

SYM POS IUM

28. + 29. NOV 2019

KLOSTER SANKT JOSEF

2. Netzwerkkongress der ZD.B-Initiativen für die Wissenschaft

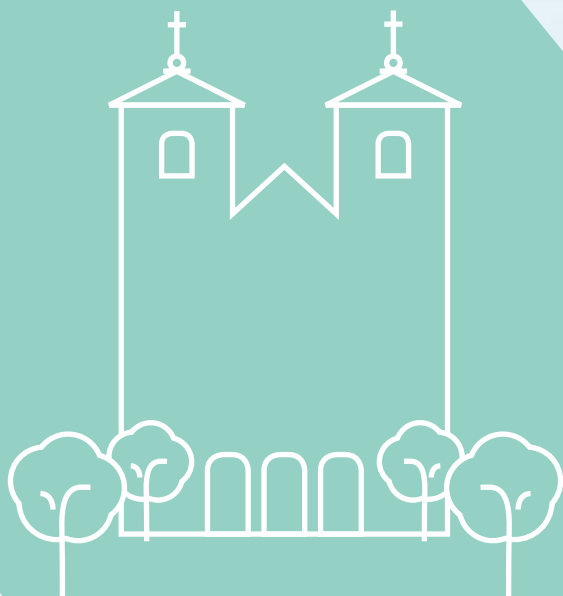
ABSTRACTBAND



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PROGRAMM

TAG 01

DO. 28. NOV. 2019

- 09:00 UHR** Ankunft im Kloster St. Josef in Neumarkt
- 10:15 UHR** Eröffnung des Symposiums
Begrüßung durch das Zentrum Digitalisierung.Bayern
- 10:45 UHR** Keynote – Multi-Inter-Trans!? Zusammenarbeiten jenseits der Disziplin
Prof. Dr. Ruth Müller
Munich Center for Technology in Society
Technische Universität München
- 11:30 UHR** LET'S TALK ABOUT: Interdisziplinarität in der wissenschaftlichen Praxis
Prof. Dr. Oliver Amft – Universität Erlangen-Nürnberg
Dr. Jörg Haßler – LMU München
Prof. Dr. Nicholas Müller – HAW Würzburg-Schweinfurth
Prof. Dr. Ruth Müller – TU München
Prof. Andreas Muxel – HAW Augsburg
Prof. Dr. Eva Rothgang – OTH Amberg-Weiden
- 12:30 UHR** Mittagspause
- 13:30 UHR** Gruppenfoto
- 13:45 UHR** Blitz-Intro für Postersession A
- 14:00 UHR** Postersession A
- A1** **A2** **A3** **A4**
- 15:00 UHR** **FELLOWS COACHING D** | **OPEN SPACE I**
- 15:45 UHR** Kaffeepause
- 16:15 UHR** Blitz-Intro für Postersession B
- 16:30 UHR** Postersession B
- B1** **B2** **B3**
- 17:30 UHR** LET'S TALK ABOUT: Mensch-Technik Interaktion. Ethik und Akzeptanz.
Dr. Daniel Buschek – Universität Bayreuth
Prof. Dr. Jens Grubert – HAW Coburg
Prof. Dr. Dominik Herrmann – Universität Bamberg
Prof. Dr. Jörg Müller – Universität Bayreuth
Dr. Matthias Uhl, vertreten durch Anja Bodenschatz – TU München
- 18:30 UHR** Abendessen

TAG 02

FR. 29. NOV. 2019

08:45 UHR

Begrüßung

09:00 UHR

Blitz-Intro für Postersession C

09:15 UHR

Postersession C



10:15 UHR

Kaffeepause

10:45 UHR

LET'S TALK ABOUT: Innovation und Impact – Welche Rolle spielt die Wissenschaft beim digitalen Fortschritt?

Prof. Dr. Andreas Festag – TH Ingolstadt

Prof. Dr. Albrecht Schmidt – LMU München

Prof. Dr. Björn Schuller – Universität Augsburg

Prof. Dr. Ramin Tavakoli Kolagari – TH Nürnberg

Prof. Dr. Verena Tiefenbeck – Universität Erlangen-Nürnberg

11:45 UHR

**TREFFEN DER
ZD.B-ARBEITSKREISE**

Austausch der
ZD.B-Professor*innen &
Nachwuchsgruppen-
leiter*innen

PHD MEET-UP

Austausch der
ZD.B-Doktorand*innen

12:30 UHR

Mittagspause

13:30 UHR

FELLOWS COACHING E

OPEN SPACE II

14:15 UHR

Keynote – Open Science – warum & wie machen wir das?

Dr. Heidi Seibold

Institut für Statistik, LMU München und Institute of
Computational Biology, Helmholtz Zentrum München

15:00 UHR

LET'S TALK ABOUT: Open Science, Open Data, Open Access.

Prof. Dr. Konrad Doll – HAW Aschaffenburg

Prof. Dr. Benedikt Elser – TH Deggendorf

Prof. Dr. Daniel Méndez – Blekinge Institute of Technology

Dr. Josch Konstantin Pauling – TU München

Prof. Dr. Heidi Seibold – LMU München

16:00 UHR

Wrap-up und Verleihung der Posterpreise

16:15 UHR

Ende des Symposiums

Moderation: Katja Nellissen

Veranstaltungsort:

■ Plenum

■ Seminarräume

■ Essens- und Gemeinschaftsräume

PROGRAMM



KEYNOTE 1: 28.11.2019, 10:45 – 11:30 UHR

Multi-Inter-Trans!? Zusammenarbeiten jenseits der Disziplin

Prof. Dr. Ruth Müller, Munich Center for Technology in Society, Technische Universität München



Zusammenarbeit jenseits der Disziplin bietet die Möglichkeit, innovatives wissenschaftliches Wissen zu generieren, das eine Disziplin allein nicht erzeugen könnte. Gleichzeitig entstehen in der Zusammenarbeit über Disziplinengrenzen hinweg aber auch neue Herausforderungen, die ernst genommen werden wollen. Der Vortrag stellt die verschiedenen Formen von Zusammenarbeit jenseits der Disziplin vor – von der Multidisziplinarität über die Interdisziplinarität zur Transdisziplinarität – und bespricht die Möglichkeiten und spezifischen Herausforderungen dieser Kollaborationsformen, sowie mögliche Schritte, Herausforderung proaktiv zu begegnen.

Ruth Müller ist Professorin für Wissenschafts- und Technologiepolitik am Munich Center for Technology in Society (MCTS) der Technischen Universität München. Sie hat Molekularbiologie (M.Sc.) und Soziologie (PhD) an der Universität Wien studiert. In ihrer Forschung beschäftigt sie sich mit den Normen und Werten, die wissenschaftliche Arbeit anleiten und prägen, sowie mit den gesellschaftlichen Dimensionen lebenswissenschaftlicher und biomedizinischer Innovationen. Sie ist Expertin für interdisziplinäre Zusammenarbeit und für Fragen von Gleichstellung und Inklusion in Wissenschaft und Forschung.

KEYNOTE 2: 29.11.2019, 14:15 – 15:00 UHR

Open Science – warum & wie machen wir das?

Dr. Heidi Seibold, Fakultät für Mathematik, Informatik und Statistik, Ludwig-Maximilians-Universität München



Die Open Science Bewegung zeigt Wege aus der Reproduzierbarkeitskrise. Heute – vielleicht mehr denn je – sind wir auf verlässliche wissenschaftliche Ergebnisse und Kollaboration angewiesen. Dies wird besonders deutlich, wenn man z.B. über die bevorstehenden Aufgaben der Wissenschaft in der Klimakrise spricht.

Die Digitalisierung spielt dabei eine bedeutende Rolle, da offene Wissenschaft auf das Internet angewiesen ist und Lösungen der Reproduzierbarkeitskrise meist technische Lösungen sind. In diesem Vortrag möchte ich auf die oben genannten Punkte eingehen, aber auch konkrete Schritte aufzeigen, die eigene Forschung offener und reproduzierbarer zu gestalten.

Heidi Seibold ist Statistikerin, Research Software Engineer und Verfechterin von offener und reproduzierbarer Wissenschaft. Als Postdoc an der LMU und dem Helmholtz Zentrum München arbeitet sie an Forschungsprojekten in Machine Learning, KI und Open Science. Außerdem unterrichtet sie in diesen Bereichen und unterstützt Forschende darin, ihre computergestützte Arbeit reproduzierbar zu machen.

GRUPPENEINTEILUNG FÜR TALKSHOWS

TAG 1, 28.11.2019 01: LET'S TALK ABOUT: Interdisziplinarität in der wissenschaftlichen Praxis 11:30 – 12:30 UHR / PLENUM

Prof. Dr. Oliver Amft – Universität Erlangen-Nürnberg: Digital Health

Dr. Jörg Haßler – LMU München: Digital Democratic Mobilization in Hybrid Media Systems (Nachwuchsforschungsgruppe)

Prof. Dr. Nicholas Müller – HAW Würzburg-Schweinfurth: Sozioinformatik und gesellschaftliche Aspekte der Digitalisierung

Prof. Dr. Ruth Müller – TU München

Prof. Andreas Muxel – HAW Augsburg: Physical Human-Machine Interfaces

Prof. Dr. Eva Rothgang – OTH Amberg-Weiden: Digitale Prozessketten in der medizinischen Versorgung und Medizintechnik

Abstract: Welche Chancen und Herausforderungen bieten die unterschiedlichen Modi von Zusammenarbeit über disziplinäre Grenzen hinweg in der eigenen Erfahrung? Welchen Einfluss hat ein solches Forschen für individuelle Karrierewege? Wird Interdisziplinarität in der wissenschaftlichen Praxis belohnt? Wie gelingt die Zusammenarbeit zwischen technischen und sozialwissenschaftlichen Disziplinen im Kontext der Digitalisierung?

02: LET'S TALK ABOUT: Mensch-Technik Interaktion: Ethik und Akzeptanz 17:30 – 18:30 UHR / PLENUM

Dr. Daniel Buschek – Universität Bayreuth: AI Tools – Continuous Interaction with Computational Intelligence Tools (Nachwuchsforschungsgruppe)

Anja Bodenschatz MSc-TU München: Ethics of Digitization (Nachwuchsforschungsgruppe)

Prof. Dr. Jens Grubert – HAW Coburg: Mensch-Maschine-Interaktion im Internet der Dinge

Prof. Dr. Dominik Herrmann – Universität Bamberg: Privatsphäre und Sicherheit in Informationssystemen

Prof. Dr. Jörg Müller – Universität Bayreuth: Serious Games/Applied Games

Abstract: Welche Chancen und Herausforderungen ergeben sich aus Daten, die bei der Interaktion anfallen, im Spannungsfeld von Datenschutz und Forschung sowie Anwendungen (z. B. Personalisierung)? Mensch-Maschine-Interaktion hat zudem weitreichende Implikationen für die Zuschreibung von Verantwortung und Schuld im Fall moralischer Übel. Dies wirft einerseits normative Fragen bezüglich der Aktualität der entsprechenden ethischen Kategorien auf. Andererseits müssen neu entstehende moralpsychologische und behavioralistische Phänomene empirisch untersucht werden, um die gesellschaftlichen Auswirkungen von Mensch-Maschine-Interaktion zu verstehen und gestalten zu können.

TAG 2, 29.11.2019 03: LET'S TALK ABOUT: Innovation und Impact: Welche Rolle spielt die Wissenschaft beim digitalen Fortschritt?

10:45 – 11:45 UHR / PLENUM

Prof. Dr. Andreas Festag – TH Ingolstadt: Fahrzeugsicherheit und Car2X-Kommunikation

Prof. Dr. Albrecht Schmidt – LMU München: Human-Centered Ubiquitous Media

Prof. Dr. Björn Schuller – Universität Augsburg: Embedded Intelligence for Health Care and Wellbeing

Prof. Dr. Ramin Tavakoli Kolagari – TH Nürnberg: Softwareentwicklung für sichere und autonome Fahrzeugsysteme

Prof. Dr. Verena Tiefenbeck – FAU Erlangen-Nürnberg: Digital technologies and human behaviour (Nachwuchsforschungsgruppe)

Abstract: Die Digitalisierung beschleunigt Innovationszyklen. Vermehrt scheinen diese digitalen Innovationen zudem von privatwirtschaftlichen Akteuren getrieben. Welche Implikationen hat das für unser Wissenschaftssystem? Wird Wissen in Zukunft stärker privatisiert, wenn Unternehmen bevorzugten Zugang zu Daten und Rechenkapazitäten haben? Wieso existieren parallel Anwendungsfelder, in denen die Digitalisierung in der Praxis trotz aller politischer Bekenntnisse nicht anzukommen scheint? Werden in diesem Innovationsumfeld die richtigen Anreize in der Wissenschaft gesetzt, um relevante Forschung zu fördern?

04: LET'S TALK ABOUT: Open Science, Open Data, Open Access.

15:00 – 16:00 UHR / PLENUM

Prof. Dr. Konrad Doll – HAW Aschaffenburg: Kooperative automatisierte Verkehrssysteme

Prof. Dr. Benedikt Elser – TH Deggendorf: Big Data Applications

Prof. Dr. Daniel Méndez – Blekinge Institute of Technology, Sweden

Dr. Josch Konstantin Pauling – TU München: LipiTUM – A Computational Platform for Lipidomics and Lipotyping in Systems Medicine (Nachwuchsforschungsgruppe)

Dr. Heidi Seibold – LMU München

Abstract: Welche Chancen und Herausforderungen ergeben sich, wenn Forschung öffentlich sichtbar durchgeführt wird, Forschungsdaten unter freien Lizenzen verfügbar sind und wissenschaftliche Publikationen für jedermann zugänglich sind? Welchen Nutzen hat das? Wieviel Aufwand für „Openness“ ist notwendig und gerechtfertigt? Wo liegen Grenzen – z.B. im Bezug auf Datenschutz und öffentliche Sicherheit? Wo liegen die praktischen Herausforderungen?

GRUPPENEINTEILUNG FÜR POSTERSESSIONS

TAG 1, 28.11.2019 SESSION A 13:45 – 15:00 UHR

- A1** **Gruppe A1 (Raum „St. Theresia“), Moderation: Dr. Daniel Buschek**
- | | |
|----------------------------|---|
| Kevin Pfeffel | Physiological and Psychological Measurements in the Perception of Virtual Reality |
| Katharina Schlosser | Political Mobilization on Social Media Sites |
| Sarah Thanner | Ethnographic Perspectives on Interactive Tabletops |
| Johanna Wald | Towards Dynamic 3D Scene Understanding |
- A2** **Gruppe A2 (Raum „Elisabeth von Thüringen“), Moderation: Dr. Raphael Wimmer**
- | | |
|----------------------------|---|
| Clemens Birkenmaier | A Novel Computational Approach for Non-Newtonian Blood Flows |
| Nina Rohrbach | "Mixed Reality" as a New Therapeutic Approach to Support Activities of Daily Living in Patients with Chronic Neurological Disease |
| Andreas Wallis | Framework for Strategy Selection of Atomic Units in Holonic Smart Grids |
| Sarah Wunderlich | Host-based Intrusion Detection in SME Company Networks |
- A3** **Gruppe A3 (Raum „Alfred Delp“), Moderation: Prof. Dr. Nicholas Müller**
- | | |
|-----------------------------|---|
| Philipp Dufter | Effective Usage of Multilingual Data in Natural Language Processing |
| Florian Fischer | An Optimal Control Approach to Human-Computer Interaction |
| Barbara Eckl-Ganser | Hierarchy in Software-Developer Communities |
| Anna-Katharina Wurst | Automated Text Content Analysis of Digital Democratic Communication |
- A4** **Gruppe A4 (Raum „St. Paulus“), Moderation: Prof. Dr. Dominik Herrmann**
- | | |
|------------------------|--|
| Alice Baird | Intelligent Audio-based Monitoring and Audio Generation for Wellbeing |
| Victoria Fast | The Value of Personal Data: Revealed Privacy Decision-Making in Controlled Laboratory Environments |
| Luke Haliburton | Human-Centered Development Process for Digital Technologies That Promote Mental Health |
| Markus Zoppelt | Automotive Security: Techniques for Modelling and Implementation |

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GRUPPENEINTEILUNG FÜR POSTERSESSIONS

TAG 1, 28.11.2019 SESSION B 16:15 – 17:30 UHR

- B1** **Gruppe B1 (Raum „St. Theresia“), Moderation: Prof. Dr. Albrecht Schmidt**
Viktor Kress Pose Based Intention Detection of Vulnerable Road Users
Christoph Molnar Interpretable Machine Learning
Tim Daniel Rose Embedding Lipidomics into the “omics” Landscape
Andreas Schmid Closing the Gap Between Physical Object and Digital Representation
- B2** **Gruppe B2 (Raum „St. Paulus“), Moderation: Prof. Dr. Oliver Amft**
Katja Auernhammer Security for Machine Learning in the Context of Autonomous Vehicles
Oliver Haas Digitalization in Clinical Contexts Using Graph Databases
Florian Lang Assistance Functions Using Augmented Reality for People with Central Vision Loss
Elias Naphausen Understanding and designing emotions in human-machine relationships
- B3** **Gruppe B3 (Raum „Alfred Delp“), Moderation: Dr. Jörg Hassler**
Anja Bodenschatz Can Artificial Intelligence be More Ethical than Humans? Experimental Evidence and Prescriptive Norms
Bastian Haberer Economic Implications of Open Government Data
Jürgen Hahn Sketchable Interaction
Andreas E. Schütz Sensitizing Employees of Small and Medium-sized Companies Individually for Information Security

TAG 2, 29.11.2019 SESSION C 9:00 – 10:15 UHR

- C1** **Gruppe C1 (Raum „St. Theresia“), Moderation: Prof. Dr. Konrad Doll**
Tobias Fertig Measuring Information Security Awareness
Jakob Karolus Proficiency-Aware Systems
Rui Zhang Dietary-Monitoring Eyeglasses
- C2** **Gruppe C2 (Raum „Elisabeth von Thüringen“), Moderation: Prof. Dr. Verena Tiefenbeck**
Florian Bockes Designing Human-centered Workflows in the Context of Digitalization in Public Administration
Jonas Schlund Modeling, Estimation and Evaluation of Electric Vehicle Charging Flexibility for Ancillary Services
Verena Stürmer Self-regulation in European Data Protection Law
David Steeven Villa Salazar nth-Sense: Providing Humans with New Artificial Sensorial Modalities Through Ubiquitous Tools
- C3** **Gruppe C3 (Raum „Alfred Delp“), Moderation: Dr. Josch Konstantin Pauling**
Apunama Hedge Open-Source Simulation Framework for Performance Analysis of Cellular V2X
Viktorija Paneva VR Prototyping Tool for Ultrasonic Levitating Interfaces
Lauren Thevin Mixed Reality for Sighted, Low Vision and Blind people

GRUPPENEINTEILUNG FÜR FELLOWS COACHING

TAG 1, 28.11.2019 SESSION D 15:00 – 15:45 UHR

Coaching D1: **Clemens Birkenmeier**

(Raum „Maria Ferdinanda“)

Coaching D2: **Sarah Wunderlich**

(Raum „Elisabeth von Thüringen“)

Coaching D3: **Verena Stürmer**

(Raum „Alfred Delp“)

Coaching D4: **Alice Baird**

(Raum „Ignatius von Loyala“)

Coaching D5: **Johanna Wald**

(Raum „Edith Stein“)

TAG 2, 29.11.2019 SESSION E 13:30 – 14:15 UHR

Coaching E1: **Jonas Schlund**

(Raum „Maria Ferdinanda“)

Coaching E2: **Christoph Molnar**

(Raum „Elisabeth von Thüringen“)

Coaching E3: **Oliver Haas**

(Raum „Alfred Delp“)

Coaching E4: **Philipp Dufter**

(Raum „Ignatius von Loyala“)

Coaching E5: **Nina Rohrbach**

(Raum „Edith Stein“)

ORGANISATIONSKOMITEE

Dr. Daniel Buschek, Universität Bayreuth

Dr. Nina Höhne, Zentrum Digitalisierung.Bayern

Dr. Susanne Schmitt, Zentrum Digitalisierung.Bayern

Dr. Daniel Schnurr, Universität Passau

Dr. Matthias Uhl, Technische Universität München

Dr. Raphael Wimmer, Universität Regensburg



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ZD.B-Professur

Prof. Dr. Oliver Amft

Digital Health

Friedrich-Alexander-Universität Erlangen-Nürnberg
<http://www.cdh.med.fau.de>

FORSCHUNGSINTERESSEN

Der Lehrstuhl für Digital Health entwickelt Methoden und untersucht den Einsatz von mobilen und körpergetragenen, alltagstauglichen Computersystemen, insbesondere „Wearables“, um individuelles, medizinisch relevantes Verhalten, Umweltfaktoren sowie Physiologie zu erfassen, gesundes Alltagsverhalten zu unterstützen bzw. zu ermöglichen. Ziel der Entwicklung ist Diagnose, Therapie und Prävention zu personalisieren. In der Datenanalyse arbeitet der Lehrstuhl

an algorithmischen Grundlagenthemen, einschließlich selektiven Abtastmethoden, Mustersuche und dynamisch adaptiv verteilten Lernmethoden. Weiterhin werden innovative Verfahren zur digitalen Entwicklung von Sensor- und Aktuatorssystemen, insbesondere mit additiven Fertigungsmethoden entwickelt und erprobt. Beispielsweise entwickelt der Lehrstuhl intelligente Brillen, die Daten über Verhalten, Umwelt und Physiologie erfassen.

AUSGEWÄHLTES PROJEKT

Unter Einsatz digitaler, mHealth-Systeme (Smartphones, -watches, Bewegungssensoren, Sensorbrillen, Blutzuckermessgeräte) wird eine Beratungsplattform entwickelt, die gesundheitsspezifische Daten zum Gesundheits-, Bewe-

gungs- und Ernährungsverhalten erfasst und darauf basierend praxisnahe, individuelle Empfehlungen „just in time“ in den regulären Alltag integriert und über verschiedene digitale ubiquitäre Systeme ausgibt.

AKTUELLE ARBEITEN

01. Derungs, A., Amft, O. (2019): Synthesising motion sensor data from biomechanical simulations to investigate sensor placement and orientation variations. Proceedings of the 41th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Berlin, Germany.
02. Wahl, F., Amft, O. (2018): Data and Expert Models for Sleep Timing and Chronotype Estimation from Smartphone Context Data and Simulations. In: Proc. ACM Interact. Mob. Wearable Ubiquitous Technol., 2 (3), 139:1–139:28.
03. Zhang, R., Amft, O. (2018): Monitoring chewing and eating in free-living using smart eyeglasses. In: IEEE Journal of Biomedical and Health Informatics, 22 (1), 23–32.

#Wearable Computing #Mustererkennung in Zeitreihen #Additive Fertigung #Digital Health Twin

ZD.B-Professur

Prof. Dr. Marco Caccamo
Cyber-Physical Systems in
Production Engineering

Technische Universität München
<https://www.mw.tum.de/cps/startseite/>



FORSCHUNGSINTERESSEN

Research interests of Prof. Dr. Marco Caccamo include: Safety-critical cyber-physical systems, real-time systems,

scheduling and schedulability analysis, and secure and safe integration of machine learning with CPS.

AUSGEWÄHLTES PROJEKT

We currently focus on the following topics: predictable high performance computing with heterogeneous SoC multi-core platforms, design of „real-time software revival“ techniques to guarantee the physical safety of a Cyber-Physical

System (CPS) in the presence of cyber attacks, secure and safe integration of machine learning algorithms with digital controllers for CPS, and development of flexible resource management policies for a broad range of CPS systems.

AKTUELLE ARBEITEN

01. Gracioli, G., Tabish, R., Mirosanlou, R., Mancuso, R., Pellizzoni, R., Caccamo, M. (2019): A virtualized scratchpad-based architecture for real-time event-triggered applications. Tech Report. Lehrstuhl für Cyber-Physical Systems in Production Engineering.
02. Gracioli, G., Tabish, R., Mancuso, R., Mirosanlou, R., Pellizzoni, R., Caccamo, M. (2019): Designing Mixed Criticality Applications on Modern Heterogeneous MPSoC Platforms. 31st Euromicro Conference on Real-Time Systems (ECRTS).
03. B. Zhong, M. Zamani, and M. Caccamo. Sandboxing controllers for stochastic cyber-physical systems. 17th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS), Lecture Notes in Computer Science, August 2019.

**#System-level Programming #Embedded System Software Design #Hardware and Software Integration on FPGAs
#Real-time Operating Systems #Real-time Reachability Analysis**

ZD.B-Professur

Prof. Dr. Benedikt Elser

Big Data Applications

Technische Hochschule Deggendorf
www.tc-grafenau.de



FORSCHUNGSINTERESSEN

In der Forschungsgruppe „Applied AI“ bringen wir die Methoden der künstlichen Intelligenz in kleine und mittelständige Unternehmen. Schwerpunkte sind Prognosen im Modehandel (Absatzvorhersage im Kataloghandel), Modellbildung bei Nahinfrarotspektroskopie und Absatzprognosen im Frischwarenhandel. Weiterhin analysieren wir Stromver-

brauchsdaten in Wohnhäusern, um den Tagesablauf der Bewohner kennenzulernen. Daraus wollen wir Frühwarnsysteme für alle dort lebenden Senioren entwickeln. Als Grundlage dient uns ein Living Lab in den sog. Digitalen Dörfern. Weitere Themenbereiche sind I4.0 Anwendungen, Cloud Computing sowie NoSQL/Big Data Technologien.

AUSGEWÄHLTES PROJEKT

Im Projekt „FreshAnalytics“ arbeiten wir mit der Universität Siegen, GS1, Tenseo und der Arconsis IT-Solutions daran, die Supply-Chain im Frischehandel vom Produzenten bis zum Konsumenten verlässlich und transparent in einer Cloud Umgebung abzubilden. Wir verarbeiten Sensordaten wie Nahinfrarotspektroskopie und kontinuierliche

Temperaturmessungen, um die Qualität eines Produktes beurteilen zu können und ein datengetriebenes Mindesthaltbarkeitsdatum zu erschaffen. Damit wollen wir allen Teilnehmern Transparenz über die Herstellung schaffen und der Lebensmittelverschwendung entgegenzutreten.

AKTUELLE ARBEITEN

01. Extracting Keywords from Publication Abstracts for an Automated Researcher Recommendation System.
02. Optimizing k-Core computation in large graphs (WIP).
03. Case Study: Predicting beer demand in a local microbrewery (WIP).

#Nahinfrarotspektroskopie #Tomaten #Big Data #Strommessungen #Cloud Computing

ZD.B-Professur

Prof. Dr.-Ing. Konrad Doll

Kooperative Automatisierte Verkehrssysteme

Technische Hochschule Aschaffenburg

<https://www.th-ab.de/ueber-die-hochschule/organisation/labor/kooperative-automatisierte-verkehrssysteme/>



FORSCHUNGSINTERESSEN

Individuelle Mobilität ist für unsere Gesellschaft von zentraler Bedeutung. Sie hat aber Verkehrsunfälle und den Verbrauch von Ressourcen zur Folge. Im Forschungsgebiet Kooperative automatisierte Verkehrssysteme geht es darum, diese Nachteile erheblich zu reduzieren. Wir konzentrieren uns auf das automatisierte Fahren im urbanen Bereich. Eine besondere Herausforderung ist dabei der Umgang mit verletzlichen Verkehrsteilnehmern wie Fußgängern und

Radfahrern. Wir erforschen Bewegungsmodelle dieser Verkehrsteilnehmer, um deren Absichten möglichst frühzeitig zu erkennen und um deren Trajektorien zu präzisieren. Für die Perzeption und Prädiktion verwenden wir u. a. sowohl analytische Methoden als auch Methoden des maschinellen Lernens, kooperative Vorgehensweisen und Sensordatenfusion.

AUSGEWÄHLTES PROJEKT

Das Projekt DeCoInt2 behandelt die Prädiktion von Trajektorien ungeschützter Verkehrsteilnehmer (UVT) beim automatisierten Fahren mit Hilfe kooperativer Technologien. Das kollektive Wissen von intelligenten Fahrzeugen, sensorgestützter Infrastruktur und Smart Device tragender UVT soll genutzt werden, um potentiell gefährliche Situationen, die die UVT betreffen, zu erkennen, bevor diese Situationen eintreten. Es ist das Ziel, Kontextinformationen (z. B. geo-

metrischer Art wie bspw. den Verlauf eines Fahrradweges oder Verkehrsregeln) zu integrieren, um den Prozess der Trajektorienprädiktion zu verbessern und genauere Vorhersagen zu ermöglichen. Die Ergebnisse der kooperativen Intentionserkennung, insbesondere probabilistische Trajektorienvorhersagen in Form von Wahrscheinlichkeitsverteilungen, dienen der Situationsanalyse und -vorhersage und damit auch der Trajektorienplanung als Grundlage.

AKTUELLE ARBEITEN

01. Zernetsch, S., Reichert, H., Kress, V., Doll, K., Sick, B. (2019): Trajectory Forecasts with Uncertainties of Vulnerable Road Users by Means of Neural Networks. In: 2019 IEEE Intelligent Vehicles Symposium (IV), Paris.
02. Kress, V., Jung, J., Zernetsch, S., Doll, K., Sick, B. (2018): Human Pose Estimation in Real Traffic Scenes. In: 2018 IEEE Symposium Series on Computational Intelligence (SSCI), Bangalore, 518–523.
03. Bieshaar, M., Zernetsch, S., Hubert, A., Doll, K., Sick, B. (2018): Cooperative Starting Movement Detection of Cyclists Using Convolutional Neural Networks and a Boosted Stacking Ensemble. In: IEEE Transactions on Intelligent Vehicles, 3, 534–544.

#Automatisiertes Fahren

#verletzliche Verkehrsteilnehmer #Perzeption

#Prädiktion #maschinelles Lernen



ZD.B-Professur

Prof. Dr. Andreas Festag

Fahrzeugsicherheit und Car2X-Kommunikation

Technische Hochschule Ingolstadt

http://bit.ly/Andreas_Festag

FORSCHUNGSINTERESSEN

Der Einsatz von Informations- und Kommunikationstechnologien verbessert die Leistungsfähigkeit und die Effizienz der Verkehrssysteme nachhaltig. Die hochgradige Vernetzung in Intelligenten Verkehrssystemen ist die Basis für eine Vielzahl von Anwendungen. Das Forschungsgebiet Fahrzeugsicherheit und Car2X Kommunikation untersucht, wie der Informationsaustausch zwischen Fahrzeugen sowie mit der Verkehrsinfrastruktur zur Erhöhung der Verkehrs-

sicherheit genutzt werden kann. Kernthemen umfassen das Design, die Leistungsbewertung und die Optimierung der Kommunikationssysteme für Car2X Use Cases. Herausforderungen sind der Einsatz von Car2X zur Unterstützung der Fahrzeugautomatisierung sowie die Integration aktiver und passiver Sicherheitsfunktionen im Fahrzeug.

AUSGEWÄHLTES PROJEKT

Im Rahmen des geplanten „Digitalen Testfelds für automatisiertes Fahren“ in Ingolstadt soll ein System entwickelt werden, das die Erprobung von automatisierten Fahrzeugen im öffentlichen Verkehr bereits in der Entwicklungsphase ermöglicht. Teilziele umfassen die Entwicklung von (i) nied-

riglatenter und hochzuverlässiger Kommunikation für den Austausch von massiven Sensordaten, (ii) leistungsfähiger Sensoren für den Einsatz in der straßenseitigen Infrastruktur sowie (iii) Methoden zur infrastrukturseitigen Absicherung des Testens von automatisierten Fahrfunktionen.

AKTUELLE ARBEITEN

01. Hegde, A., Festag, A. (2019): Mode Switching Strategies in Cellular-V2X. IFAC Symposium, Gdansk, Polen, Juli 2019.
02. Delooz Q., Festag, A. (2019): Network Load Adaptation for Collective Perception in V2X Communications. IEEE ICCVE 2019, Graz, Österreich, November 2019.
03. Kühlmorgen, S., Lu, H., Festag, A., Kenney, J., Gemsheim S., Fettweis, G. (2019): Evaluation of Congestion-Enabled Forwarding With Mixed Data Traffic in Vehicular Communication. IEEE Transactions on Intelligent Transportation Systems, Januar 2019.

#Mobilität der Zukunft #Fahrzeugsicherheit #Car2X

ZD.B-Professur

Prof. Dr. Jens Grubert

Mensch-Maschine-Interaktion im
Internet der Dinge

Hochschule für Angewandte Wissenschaften Coburg
<https://www.mixedrealitylab.de>



FORSCHUNGSINTERESSEN

Die stetig steigende Anzahl an smarten Geräten sowie überall und ständig verfügbaren digitalen Informationen verlangen nach neuen Mitteln diese für Menschen zugänglich und nutzbar zu machen. Die Gruppe um Prof. Dr. Jens Grubert erforscht Grundlagen und Anwendungen der vermischten Realität (Mixed Reality) mit seinen Ausprägungen der erweiterten Realität (Augmented Reality, AR) und der

virtuellen Realität (Virtual Reality, VR) um mittels diesen mit teils physisch – teils digitalen Produkten und Dienstleistungen interagieren zu können. Beispiele umfassen den Einsatz der AR für die Fernwartung im Maschinenbau, das effiziente Training von Handlungsabläufen mittels AR/VR in Industrieanlagen oder die Nutzung von Mixed Reality für mobile Wissensarbeiter.

AUSGEWÄHLTES PROJEKT

Das EFRE Projekt „Roadmap zur flexiblen Produktion individueller Produkte“ (Roadmap flexPro) zielt auf die Unterstützung kleiner und mittelständischer Unternehmen bei der Erarbeitung von produktspezifischen Individualisierungs-

strategien. Im Rahmen dieses Projektes untersucht die Forschungsgruppe um Prof. Dr. Jens Grubert den Einsatz der virtuellen und erweiterten Realität entlang des Produktlebenszyklus.

AKTUELLE ARBEITEN

01. Schneider, D., Otte, A., Gesslein, T., Gagel, P., Kuth, B., Damlakhi, M. S., ... & Grubert, J. (2019): ReconViguration: Reconfiguring Physical Keyboards in Virtual Reality. IEEE transactions on visualization and computer graphics.
02. Grubert, J., Ofek, E., Pahud, M., Kristensson, P. O., Steinicke, F., Sandor, C. (2018): The office of the future: Virtual, portable, and global. In: IEEE computer graphics and applications, 38(6).
03. Eiberger, A., Kristensson, P. O., Mayr, S., Kranz, M., Grubert, J. (2019): Effects of Depth Layer Switching between an Optical See-Through Head-Mounted Display and a Body-Proximate Display. In: Proc. ACM Symposium on Spatial User Interaction 2019.

#Virtual Reality #Augmented Reality #Computer Vision #Photography #The Virtual Office



ZD.B-Professur

Prof. Dr. Sascha Hauke

Intelligente Energienetze

Hochschule für Angewandte Wissenschaften Landshut

http://bit.ly/Sascha_Hauke

FORSCHUNGSINTERESSEN

Die Energiewende stellt uns vor zahlreiche Herausforderungen. Um diesen zu begegnen, müssen unsere Stromnetze intelligenter werden. Im Forschungsgebiet Intelligente Energienetze betrachten wir deshalb, wie Stromerzeugung, -speicherung und -verteilung durch Methoden der Informatik und der IT effizienter, zuverlässiger und sicherer gestaltet werden können. Hierzu nutzen wir zum Beispiel Verfahren des maschinellen Lernens zur Vorhersage von

Komponentenlebensdauern, wie der Restlebenszeit von Batterien, oder Produktions- und Verbrauchsprognosen in Netzen mit verteilter Stromerzeugung. Eine besondere Herausforderung liegt dabei darin, dass bestehende, gewachsene Infrastrukturen berücksichtigt werden müssen und diese nur in stark begrenztem Umfang verändert werden können.

AUSGEWÄHLTES PROJEKT

Wir befassen uns derzeit verstärkt mit der Prognostizierung von Energieerzeugung und Verbrauch für zukünftige Smart Grids. Dabei betrachten wir das Zusammenspiel der Erzeugung durch verteilte regenerative Quellen, die effiziente Zwischenspeicherung und den Verbrauch derart, dass wir unter verschiedenen Szenarien eine optimale Strategieaus-

wahl treffen können. Um eine Skalierung der Ergebnisse zu ermöglichen (von Haushalts- auf Gridebene), werden Methoden unter holaren Gesichtspunkten betrachtet – das heißt, unter anderem, dass eine Methodenwiederverwendbarkeit auf unterschiedlichen Skalierungsebenen gegeben sein soll.

AKTUELLE ARBEITEN

01. Wallis, A., Egert, R., Hauke, S.: A Framework for Strategy Selection of Atomic Units in the Holonic Smart Grid. 2020 IEEE Power & Energy Society Innovative Smart Grid Technologies Conference (ISGT) (Submitted).

#Smart Grid #Vorhersagemethoden #Maschinelles Lernen



ZD.B-Professur

Prof. Dr. Dominik Herrmann

Privatsphäre und Sicherheit
in Informationssystemen

Otto-Friedrich Universität Bamberg
<https://www.uni-bamberg.de/psi/>

FORSCHUNGSINTERESSEN

Im Fokus unserer Arbeit steht die Absicherung von Informationssystemen und der Schutz der Privatsphäre mit technischen Mechanismen. Dazu analysieren und evaluieren wir existierende Systeme und entwickeln Schutzmechanismen.

Wir kooperieren mit Arbeitsgruppen aus dem Bereich des maschinellen Lernens (Inferenzangriffe, Online-Tracking), Rechtswissenschaftlern (Datenschutz, Strafverfolgung) und Ethikern (werteorientierte Systemgestaltung).

AUSGEWÄHLTES PROJEKT

PrivacyScore (<https://privacyscore.org>) ist ein nicht-kommerzielles Crowdsourcing-Portal für den automatisierten Vergleich von Webseiten hinsichtlich der Einhaltung gängiger Sicherheits- und Datenschutz-Best-Practices. Auf dem Portal wird ein Ranking veröffentlicht, das einen Vergleich miteinander konkurrierender Anbieter erlaubt. An dieser Stelle setzt eine unserer Forschungsfragen an: Inwiefern entsteht

durch die von PrivacyScore erzeugte Transparenz ein Anreiz für Seitenbetreiber, ihre Sicherheits- und Datenschutzkonfiguration zu verbessern? Seit Aufnahme des Betriebs im Juni 2017 haben wir knapp 2 Mio. Scans durchgeführt (Okt. 2019). Uns sind zahlreiche Fälle bekannt, in denen Betreiber durch PrivacyScore auf Missstände aufmerksam wurden, die sie in der Folge behoben haben.

AKTUELLE ARBEITEN

01. Maass, M., Walter, N., Herrmann, D., Hollick, M. (2019): On the Difficulties of Incentivizing Online Privacy through Transparency: A Qualitative Survey of the German Health Insurance Market. Wirtschaftsinformatik 2019, 25-27.2.2019, Siegen, Germany.
02. Maass, M., Laubach, A., Herrmann, D. (2017): PrivacyScore: Analyse von Webseiten auf Sicherheits- und Privatheitsprobleme – Konzept und rechtliche Zulässigkeit. Informatik 2017, Workshop „Recht und Technik“.
03. Maass, M., Wichmann, P., Pridöhl, H., Herrmann, D. (2017): PrivacyScore: Improving Privacy and Security via Crowd-Sourced Benchmarks of Websites. In: Privacy Technologies and Policy. APF 2017. Lecture Notes in Computer Science, Vol. 10518. Springer, Cham.

#Technischer Datenschutz #Online-Tracking #Anonymität im Internet #Usable Security

ZD.B-Professur

Prof. Dr. Martin Matzner

Digital Industrial Service Systems

Friedrich-Alexander-Universität Erlangen-Nürnberg

<https://www.is.rw.fau.de>



FORSCHUNGSINTERESSEN

Der Lehrstuhl für Digital Industrial Service Systems entwickelt Theorien, Methoden und Informationssysteme für Dienstleistungen auf der Grundlage vernetzter, intelligenter Objekte und Maschinen im Kontext der Digitalisierung, womit die Analyse und Gestaltung von Geschäftsprozessen und Dienstleistungen in Unternehmen unterstützt wird. Ein

methodischer Fokus liegt auf analytischen Anwendungen der Geschäftsprozessanalyse mit Techniken des Process Mining und Machine Learning. Zusätzlich beschäftigt sich der Lehrstuhl mit IoT-Plattformen im industriellen Kontext und der damit einhergehenden zunehmenden Einbindung von Unternehmen in Ökosysteme.

AUSGEWÄHLTES PROJEKT

Ein reißender Strom an Zustandsdaten ist das Nebenprodukt moderner Industrieanlagen in der digitalen Fabrik. Dieser Datenstrom ist Antrieb für digitale industrielle Dienstleistungssysteme, die auf der Analyse von Daten in Echtzeit basieren. Die sich so ergebenden Möglichkeiten wollen wir uns im Forschungsprojekt AutoCoP für die technische Dokumentation zunutze machen. AutoCoP erkennt durch die Auswertung von Sensordaten anomales Verhalten

und Fehlerfälle von Industrieanlagen und führt diese Beobachtungen mit Kontextinformationen sowie Expertenwissen erfahrener Redakteure zusammen. So entstehen klare Handlungsanweisungen für komplexe Fehlerfälle, die an der Maschine bereitgestellt werden und Diagnosen sowie Korrekturen durch Anwender mit unterschiedlicher Erfahrung und Qualifikation ermöglichen. Mehr Infos gibt es auf <https://autocop.info/>.

AKTUELLE ARBEITEN

01. Janiesch, C., Matzner, M. (2019): BAMN: a modeling method for business activity monitoring systems. In: Journal of Decision Systems, 1–39.
02. Beverungen, D., Müller, O., Matzner, M., Mendling, J., vom Brocke, J. (2019): Conceptualizing smart service systems. In: Electronic Markets, 29(1), 7–18.
03. Breuker, D., Matzner, M., Delfmann, P., Becker, J. (2016): Comprehensible Predictive Models for Business Processes. In: MIS Quarterly, 40(4), 1009–1034.

#Process Mining #Smart Services #IIoT Platforms #Platform Ecosystems

ZD.B-Professur

Prof. Dr. Jürgen Mottok

Safe and Secure Systems

Ostbayerische Technische Hochschule Regensburg

www.las3.de, www.oth-regensburg.de



FORSCHUNGSINTERESSEN

Das Laboratory for Safe and Secure Systems (LaS³) ist ein Forschungscluster der Ostbayerischen Technischen Hochschule Regensburg. Es wurde 2005 an der damaligen Fachhochschule Regensburg gegründet und wurde initial durch die Projektförderung FHprofUnt der Bundesrepublik Deutschland sowie durch das Programm Strukturimpuls des Bayerischen Staatsministeriums für Wissenschaft, Forschung und Kunst unterstützt. Das LaS³ sieht sich als

Mediator zwischen Wissenschaft und Anwendung. Das LaS³ hat derzeit 15 Doktoranden und 10 Studierende des Masterstudiengangs „Master of Applied Research“. In der Vergangenheit wurden bereits etliche Forschungsprojekte aus öffentlichen als auch aus privaten Drittmitteln erfolgreich durchgeführt. Das LaS³ der OTH Regensburg steht als Innovator für „Safe and Secure Systems“.

AUSGEWÄHLTES PROJEKT

Energy Safe & Secure System Module (ES³M) – IT-Sichere Energienetze: Moderne Stromnetze müssen sowohl energietechnisch als auch datentechnisch nach dem Stand der Technik ausgelegt werden. Deshalb ist Ziel dieses Forschungsvorhabens die Entwicklung eines „Energie Safe and

Secure Modul“ (ES³M) als Lösungselement in Form eines Demonstrators, welcher den Einsatz von modernster Kryptographie sowohl garantierte als auch geringe Latenzzeiten in Einklang bringt.

AKTUELLE ARBEITEN

01. Renner, S., Pozzobon, E., Mottok, J. (2019): Benchmarking Software Implementations of 1st Round Candidates of the NIST LWC Project on Microcontrollers. NIST Workshop, Gaithersburg, MD, USA.
02. Osinski, L., Mottok, J. (2019): Control Flow Errors: A Discussion of Different Injection Strategies. ARCS 2019, FORMUS³IC Workshop, Kopenhagen, Denmark.
03. Weiherer, K., Osinski, L., Mottok, J. (2019): Software-Based Triple Modular Redundancy with Fault-Tolerant Replicated Voters. ARCS 2019, FORMUS³IC Workshop, Kopenhagen, Denmark.

#Software Engineering #Software Engineering Education #Functional Safety #IT-Security #Real-Time Systems

ZD.B-Professur

Prof. Dr. Jörg Müller

Serious Games

Universität Bayreuth

<http://www.ai8.uni-bayreuth.de/de/index.html>



FORSCHUNGSINTERESSEN

Der Lehrstuhl für Serious Games beschäftigt sich hauptsächlich mit der Interaktion zwischen Mensch und Computern, mit Computerspielen und Serious Games. Unsere primären Forschungsgebiete sind die Modellierung, Simulation und Optimierung der Mensch-Computer

Interaktion mithilfe von dynamischen Systemmodellen, sowie biomechanische Simulation der Mensch-Computer Interaktion, Ultraschall-Levitationsschnittstellen und erweiterte sowie virtuelle Realität.

AUSGEWÄHLTES PROJEKT

Das Ultimative Display wäre ein Computer, welcher die Existenz von Materie in einem Raum kontrollieren kann. Im Levitate Projekt entwickeln wir einen funktionierenden Prototyp dieser Vision. Mittels zwei Arrays von Ultraschalllautsprechern erzeugen wir ein Schallfeld, in welchem klei-

ne Partikel schweben können. Wir entwickeln Techniken, um dieses Schallfeld optimal und mit geringer Latenz zu steuern sowie Interaktionstechniken, mit welchen Benutzer mit dieser schwebenden Materie interagieren können.

AKTUELLE ARBEITEN

01. Bachynskyi, M., Paneva, V., Müller, J. (2018): LeviCursor: Dexterous Interaction with a Levitating Object. In: Proceedings of the 2018 ACM International Conference on Interactive Surfaces and Spaces (ISS), ACM, New York, NY, USA, 253-262.
02. Corenthy, L., Giordano, M., Hayden, R., Griffiths, D., Jeffrey, C., Limerick, H., Georgiou, O., Carter, T., Müller, J., Subramanian S. (2018): Touchless Tactile Displays for Digital Signage: Mid-air Haptics meets Large Screens. In: Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (CHI EA), ACM, New York, NY, USA, Paper D103.
03. Limerick, H., Hayden, R., Beattie, D., Georgiou, O., Müller, J. (2019): User engagement for mid-air haptic interactions with digital signage. In: Proceedings of the 8th ACM International Symposium on Pervasive Displays (PerDis), ACM, New York, NY, USA, Article 15.

#Serious Games #Mensch-Computer-Interaktion #Ultraschall-Levitation #Erweiterte und Virtuelle Realität

ZD.B-Professur

Prof. Dr. Nicholas H. Müller

Sozioinformatik und Gesellschaftliche Aspekte der Digitalisierung

Hochschule für angewandte Wissenschaften Würzburg-Schweinfurt
<https://fiw.fhws.de/fakultaet-iw/personen/details/person/prof-dr-nicholas-mueller.html>



FORSCHUNGSINTERESSEN

Die Professur Sozioinformatik beschäftigt sich anhand empirischer Methoden mit den Herausforderungen der Mensch-Computer-Interaktion sowie der Digitalisierung. Dazu werden u.a. Untersuchungen mittels der Erfassung physiologischer Parameter wie der Hautleitfähigkeit, Herzratenvariabilität oder Augenbewegungen durchgeführt und

die empirischen Fragestellungen über eine methodische Triangulation sowohl quantitativ als auch qualitativ analysiert. Darüber hinaus werden neue Lehr-Lernformate erprobt, da die Professur an drei Fakultäten angesiedelt ist und dadurch die interdisziplinäre Zusammenarbeit befördert wird.

AUSGEWÄHLTES PROJEKT

Mit der Durchführung des KONZEPTATHONS 2019 in Lohr am Main haben im vergangenen Mai diversifizierte Teams von vier bis sechs Personen unter Verwendung von Design-Thinking-Methoden Konzepte zu zehn Themen der Stadt Lohr, sozialer Einrichtungen und dortiger KMU an einem Tag entwickelt. Die beteiligten Teams setzten sich aus internationalen Studierenden der Fakultät Wirtschaftsingenieurwesen, Lohrer EinwohnerInnen sowie Studieren-

den der Fakultäten angewandte Sozialwissenschaften und Informatik & Wirtschaftsinformatik der FHWS zusammen. Im April 2020 wird die Veranstaltung eines KONZEPTATHONS auf die Region Würzburg erweitert, um eine Komponente zur nachhaltigen Weiterverwendung der entwickelten Konzepte ergänzt und innerhalb der folgenden Monate umgesetzt und im Alltag integriert.

AKTUELLE ARBEITEN

01. Rosenthal, P., Müller, N. H., Bolte, F.: Visual Analytics of Bibliographical Data for Strategic Decision Support of University Leaders: A Design Study. In: Kerren, A., Hurter, C., Jose Braz (Hg.) (2019): Proceedings of the 14th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications, Volume 3: IVAPP, 297–305, INSTICC SciTePress.
02. Müller-Wuttke, M., Müller, N.H.: Cognitive Load Levels While Learning With or Without a Pedagogical Agent. In: Zaphiris, P., Ioannou, A. (Hg.) (2019): Learning and Collaboration Technologies. Designing Learning Experiences. HCI 2019. Lecture Notes in Computer Science, Volume 11590, Springer, Cham.
03. Müller, N. H., Liebold, B., Pietschmann, D., Ohler, P., Rosenthal, P. (2017): Visualizations for Hierarchical Data: Analyzing User Behavior and Performance with Eye Tracking. In: International Journal on Advances in Software, 385–396.

#Konzeptathon #Sozioinformatik #Digitalisierung
#Physiologische Messung
#Mensch-Computer-Interaktion



ZD.B-Professur

Prof. Andreas Muxel

Physical Human-Machine Interfaces

Hochschule für Angewandte Wissenschaften Augsburg
<https://hybridthings.hs-augsburg.de>

FORSCHUNGSINTERESSEN

Wir werden zukünftig unseren Arbeitsraum, Verkehrsraum und Lebensraum mit intelligenten und autonomen Maschinen teilen. Physische Schnittstellen dienen hierbei als (be)greifbare Ein- und Ausgaben im Dialog zwischen Mensch und abstrakter Maschine. Im HYBRID THINGS LAB der Hochschule Augsburg werden zukünftige Perspektiven

der Mensch-Maschine-Interaktion exploriert und prototypisch erfahrbar gemacht. Ein weiterer Fokus liegt in der Weiterentwicklung von Formaten und Methoden, um entsprechende Zielgruppen von Beginn an mit in den Gestaltungsprozess technischer Entwicklungen einzubeziehen.

AUSGEWÄHLTES PROJEKT

MASCHINENRAUM, Symposium Mensch-Maschine-Gesellschaft am 24.05.2019 im Staatlichen Textil- und Industriemuseum Augsburg: Hatten wir früher scheinbar noch die Kontrolle, erleben wir immer mehr, dass wir mit den Maschinen „mit-funktionieren“ und diese mit und für uns handeln. Im Rahmen der Sonderausstellung „Augsburg 2040: Utopien einer vielfältigen Stadt“ sprachen Experten aus Wissenschaft, Design und Kunst über den kreativen Umgang mit Technik, moralischen Implikationen und Selbstbestim-

mung in Zeiten einer allgegenwärtigen Digitalisierung. Das öffentliche Symposium mit über 120 Besuchern wurde vom HYBRID THINGS LAB der Hochschule Augsburg organisiert und veranstaltet.

Speaker: Prof. Dr. Frieder Nake, Prof. Benedikt Groß, Prof. Dr. Lasse Scherffig, Ronit Wolf, Prof. Dr.-Ing. Friedrich Beckmann, Alexander Peterhaensel, Prof. Dr. Christian Bauer
Performances: Christian Faubel und Jürgen Branz

AKTUELLE ARBEITEN

01. MASCHINENRAUM 2019, Symposium Mensch-Maschine-Gesellschaft, <https://maschinenraum.hsaugsburg.de>.
02. Digital Encounters – Technologies of the Digital Self, Projektpartner: Milieux Institute/Concordia, University Montreal, MCTS/TU München, LMU München, Bayerisches Staatsministerium für Digitales, <https://digital.deutsches-museum.de/blog/auf-der-suche-nach-dem-digitalen-ich/>.
03. African Railway Stories, Projektpartner: Technical University of Kenya, <https://www.hsaugsburg.de/Gestaltung/Projekte/African-Railway-Stories.html>.

#Research through Design #Participatory Design #Embodied Interaction #Mensch-Maschine-Interaktion



ZD.B-Professur

Prof. Dr.-Ing. Eva Rothgang

Digitale Prozessketten in der Medizinischen Versorgung und Medizintechnik

Ostbayerische Technische Hochschule Amberg-Weiden

<https://www.oth-aw.de/informieren-und-entdecken/personen/rothgang-eva/>

FORSCHUNGSINTERESSEN

Mein Forschungsinteresse liegt im Einsatz von maschinellem Lernen in der Medizin. Aktuelle Forschungsprojekte bewegen sich im Themenfeld Automatisierung im Gesundheitswesen (z.B. Intelligente Abrechnung, Adaptives Personal), Beschleunigung des MR Workflows und

Daten unterstützte Entwicklung von Behandlungspfaden. Zudem finde ich Human-Centered Machine Intelligence höchst relevant, da maschinelle Lernsysteme nur dann erfolgreich sind, wenn sie vom menschlichen Benutzer auch angenommen werden.

AUSGEWÄHLTES PROJEKT

BIKIP – Business Intelligence und Künstliche Intelligenz im Rahmen von Pflegepersonaluntergrenzen. Ziel des Vorhabens ist, den administrativen Overhead der Pflegepersonaluntergrenzenverordnung (PpUGV) durch Digitalisierung zu minimieren und eine intelligente Pflegepersonalbedarfsplanung zu entwickeln. Aus den bestehenden Daten, die in den Kliniken schon vorhanden sind, sollen Einflussfaktoren

auf die Über- oder Unterschreitung der PpUGV durch maschinelles Lernen ermittelt werden. Diese werden in Handlungsanweisungen übersetzt, um die Planung in Zukunft zu verbessern. Mögliche Einflussfaktoren sind dabei etwa medizinische Informationen wie Einzeldiagnosen oder auch die Anzahl der Verlegungen an einem Tag, aber auch äußere Faktoren wie das Wetter oder Feiertage.

AKTUELLE ARBEITEN

01. Denck, J., Landschütz, W., Nairz, K., Heverhagen, J.T., Maier, A., Rothgang, E. (2019): Automated Billing Code Retrieval from MRI Scanner Log Data. In: Journal of Digital Imaging (Epub ahead of print).
02. Rothgang, E., Anderson, W.S., Breton, E., Gangi, A., Garnond, J., Hensen, B., Judy, B.F., Kägebein, U., Wacker, F.K.: Interventional Imaging: MR. In: Zhou, S.K., Rückert, D., Fichtinger, G. (Hg.) (2019): Handbook of Medical Image Computing and Computer Assisted Intervention (Erscheinungsdatum 8. November 2019).
03. Automatisierung und Digitalisierung klinischer Dokumentationsprozesse im Rahmen der Pflegepersonaluntergrenzenverordnung (WiP).

#Medizintechnik #Maschinelles Lernen #User Experience



ZD.B-Professur

Prof. Dr. Albrecht Schmidt

Human-Centered Ubiquitous Media

Ludwig-Maximilians-Universität München

<https://www.um.informatik.uni-muenchen.de>

FORSCHUNGSINTERESSEN

Durch die Digitalisierung vollzieht sich im Moment ein Umbruch in nahezu allen Bereichen unseres Lebens. Menschen nutzen digitale Technologien im Privaten wie im Beruflichen. Kommunikation, Wissenserwerb, Dokumentation, Nachrichten, Musik, Fotografie oder Reiseplanung basieren selbstverständlich auf digitaler Technologie. Die Schnittstelle zwischen Mensch und digitalen Medien ist allgegenwärtig, und die Einfachheit ihrer Benutzung ist die zentrale

Herausforderung, welche durch autonome Systeme noch vergrößert wird. Die übergeordnete Forschungsfrage lautet: Wie können wir menschliche Fähigkeiten durch digitale Technologien erweitern? Unser Fokus liegt auf der Bearbeitung von kritischen Fragen in der Grundlagenforschung. Im Kontext von Domänen und Anwendungen betrachten wir auch resultierende gesellschaftliche Auswirkungen.

AUSGEWÄHLTES PROJEKT

Im ERC Projekt AMPLIFY („Amplifying Human Perception Through Interactive Digital Technologies“) forschen wir interdisziplinär an digitalen Technologien, um die menschlichen Sinne und das Auffassungsvermögen zu verstärken. Das Projekt ist konstruktiv und wir konzipieren, implementieren und untersuchen neue digitale interaktive Geräte, welche einzelne menschliche Sinne verbessern. Beispiele hierfür sind Technologien welche das Spektrum und die

temporale Auflösung der visuellen Wahrnehmung verstärken oder ein System das die selektive Audiowahrnehmung unterstützt. Insbesondere betrachten wir, wie solche Geräte durch physiologische Signale implizit und explizit gesteuert werden können. Die Vision dieser Grundlagenforschung ist es, intuitive kognitiven und perzeptiven Werkzeuge zu entwickeln. Weitere Information finden Sie unter: <https://amp.ubicomp.net/>

AKTUELLE ARBEITEN

01. Kosch, T., Funk, M., Schmidt, A., Chuang, L. L. (2018): Identifying Cognitive Assistance with Mobile Electroencephalography: A Case Study with In-Situ Projections for Manual Assembly. In: Proceedings of the ACM on Human-Computer Interaction, 2(EICS), 11.
02. Feger, S. S., Dallmeier-Tiessen, S., Wozniak, P. W., Schmidt, A. (2019): Gamification in Science: A Study of Requirements in the Context of Reproducible Research. In: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems, ACM, 460.
03. Bader, P., Voit, A., Le, H. V., Henze, N., Schmidt, A. (2019): WindowWall: Towards Adaptive Buildings with Interactive Windows as Ubiquitous Displays. In: ACM Transactions on Computer-Human Interaction (TOCHI), 26(2), 11.

#Interaktive Künstliche Intelligenz #Interaktionskonzepte für automatisierte Systeme #Physiologische Signale (EEG, EMG, Blickbewegung) für die Mensch-Computer-Interaktion #Interaktion in virtueller und erweiterter Realität #Barrierefreiheit für ubiquitären Computersysteme

ZD.B-Professur

**Univ.-Prof. mult. Dr. habil.
Björn W. Schuller**

Embedded Intelligence for
Health Care and Wellbeing

Universität Augsburg, Imperial College London u.A.

<https://www.informatik.uni-augsburg.de/lehrstuehle/eihw/>



FORSCHUNGSINTERESSEN

Schullers Forschung verbindet aktuelle Methoden der Künstlichen Intelligenz mit moderner Medizin und Psychologie. Das Hauptinteresse liegt auf der Erfassung, Analyse und Interpretation von Biosignalen, wie sie etwa bei der Überwachung der Herzaktivität, des Stoffwechsels oder der neuronalen Aktivitäten anfallen. Daneben werden auch akustische und visuelle Parameter verarbeitet. Dazu werden neue Algorithmen zur robusten maschinellen Signalverarbeitung

und zum maschinellen Lernen entwickelt – insbesondere für die vielversprechenden tiefen neuronalen Netzwerke. Aus dem Einsatz im Alltagsleben ergeben sich zusätzliche Anforderungen an den Algorithmentwurf bezüglich „grünen“, vertraulichen und erklärbaren maschinellen Lernens sowie effiziente Anpassung an den Nutzer und Kontext, weitestgehend unabhängig von verwendeter Hardware.

AUSGEWÄHLTES PROJEKT

In „Remote Assessment of Disease and Relapse in Central Nervous System Disorders“ erforschen wir gemeinsam mit Projektpartnern Möglichkeiten der mobilen Gesundheitsanalyse für eine Ferndiagnose und -überwachung von Erkrankungen des zentralen Nervensystems wie Epilepsie, Multiple Sklerose und Depression. Ziel ist es, eine Infrastruktur aufzubauen, um klinisch nützliche, fern überwachte Biosignaturen zu identifizieren, die bei der frühzeitigen

Erkennung von Rückfall oder Verschlechterung behilflich sind. Hierzu kommen im Wesentlichen Wearables wie Smartphone oder Smartwatch im Alltag zum Einsatz. Verfahren Künstlicher Intelligenz erlauben die unmittelbare Auswertung beim Anwender. Ferner sollen mögliche Barrieren realer Anwendung im Gespräch mit Patienten, Ärzten, Gesetzgebern und Krankenkassen identifiziert werden.

AKTUELLE ARBEITEN

01. Grabowski, K., Rynkiewicz, A., Lassalle, A., Baron-Cohen, S., Schuller, B., Cummins, N., Baird, A. E., Podgorska-Bednarczyk, J., Pieniazek, A., Lucka, I. (2019): Emotional expression in psychiatric conditions: new technology for clinicians. In: *Psychiatry and Clinical Neurosciences*, 73(2), 50–62.
02. Qian, K., Schmitt, M., Janott, C., Zhang, Z., Heiser, C., Hohenhorst, W., Herzog, M., Hemmert, W., Schuller, B. (2019): A Bag of Wavelet Features for Snore Sound Classification. In: *Annals of Biomedical Engineering*, 47(4), 1000–1011.
03. Kollias, D., Tzirakis, P., Nicolaou, M. A., Papaioannou, A., Zhao, G., Schuller, B., Kotsia, I., Zafeiriou, S. (2019): Deep Affect Prediction in-the-Wild: Aff-Wild Database and Challenge, Deep Architectures, and Beyond. In: *International Journal of Computer Vision*, 127, 907–929.

#Medizininformatik #Mobile Health
#Künstliche Intelligenz
#Deep Learning #Ethik

ZD.B-Professur

Prof. Dr. Ramin Tavakoli Kolagari

Softwareentwicklung für Sichere und Autonome Fahrzeugsysteme

Technische Hochschule Nürnberg

<https://www.th-nuernberg.de/fakultaeten/in/forschung/automotive-software-systems-engineering/>



FORSCHUNGSINTERESSEN

Meine Forschungsinteressen umfassen den gesamten Bereich von den frühen Phasen der Softwareentwicklung und Softwarearchitektur bis zur Softwarewiederverwendung und Implementierung für die Software autonom fahrender Autos, mit speziellem Augenmerk auf Qualität im Sinne von Safety und Security. Die zunehmende Verbreitung von Ansätzen des Maschinellen Lernens (ML) bei moderner Automotive Software bietet spannende Forschungs herausfor-

derungen, um systematisch qualitativ hochwertige Systeme zu entwickeln, die vertrauenswürdig und transparent sind. Mit der Integration von Ansätzen der eXplainable Artificial Intelligence und Methoden aus der empirischen Forschung in das Automotive Software Engineering knüpfe ich dabei an entsprechende Vorarbeiten bei der Entwicklung von Automotive Informationsmodellen an.

AUSGEWÄHLTES PROJEKT

Für die Erstellung von qualitativ hochwertigem ML gilt, was für Software im Allgemeinen gilt: Qualität entsteht in den konstruktiven Phasen; daher müssen die ML Entwickler einen konstruktiven Bezug zur Spezifikation herstellen können. Dies gelingt dann, wenn die Entwickler ein Verständnis der ML-Komponenten haben: Erst durch Erklärbarkeit werden ML-Komponenten einer qualitätsorientierten Diskussion zu-

gänglich gemacht. Die Verknüpfung von XAI mit den Zielen des Software Engineering bettet das maschinelle Lernen in die für das Design komplexer Systeme unabdingbare ingenieurtechnische Herangehensweise ein. Ein interdisziplinäres Forschungs- und Entwicklungsteam erarbeitet in diesem Vorhaben eine Werkzeugunterstützung mit weiterentwickelten Ansätzen zur Erreichung von Transparenz in Automotive ML.

AKTUELLE ARBEITEN

01. van Wagenveld, R., Wägemann, T., Mader, R., Tavakoli Kolagari, R., Margull, U. (2019): Evaluation and modeling of the supercore parallelization pattern in automotive real-time systems. In: Parallel Computing, Volume 81, January 2019, 122-130.
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03. Auernhammer, K., Tavakoli Kolagari, R., Zoppelt, M. (2019): Attacks on Machine Learning: Lurking Danger for Accountability. In: Proceedings of the AAAI Workshop on Artificial Intelligence Safety, co-located with the Thirty-Third AAAI Conference on Artificial Intelligence (AAAI 2019), Honolulu, Hawaii, January 2019, 9-18.

#Autonomes Fahren
#Automotive Software Engineering
#AUTOSAR #eXplainable Artificial
Intelligence #Safety und Security

ZD.B- Nachwuchsgruppe

Dr. Daniel Buschek

AI Tools – Continuous Interaction with
Computational Intelligence Tools

Universität Bayreuth

<http://www.daniel-buschek.de/>



FORSCHUNGSINTERESSEN

Unsere Forschung wirkt an der Schnittstelle zwischen Mensch-Computer-Interaktion und computer- und daten-gestützten Methoden, wie Maschinellern und Künstliche Intelligenz. Auf der einen Seite geht es darum, neue Interaktionstechniken und Nutzerschnittstellen für intelligente Systeme zu schaffen. Insbesondere sind Interaktionskonzepte interessant und wichtig mit denen Nutzer intelligente Systeme als Werkzeuge aktiv nutzen können, anstatt

in eine passive Konsumentenrolle gedrängt zu werden. Das geht einher mit der Vision, Menschen durch KI zu befähigen anstatt sie zu ersetzen. Umgekehrt können wir daten-gestützte Modelle menschlichen Verhaltens für Mensch-Computer-Interaktion nutzen, um Nutzerschnittstellen generell zu optimieren. In diese beiden Richtungen wirkt auch die neue ZD.B Nachwuchsforschungsgruppe.

AUSGEWÄHLTES PROJEKT

Viele intelligente Systeme sind heute nur bedingt interaktiv. Oft geben sie nur Vorschläge, die man annehmen kann oder nicht. Ein Alltagsbeispiel: Wie müsste eine intelligente E-Mail-App aussehen, die nicht nur Wörter vorschlägt oder ungefragt korrigiert, sondern mich wirklich beim effizienten Verfassen von klaren Texten unterstützt? Basierend auf unseren Arbeiten zu Texteingabe und wahrscheinlicher

keitsbasierter Personalisierung von Nutzerschnittstellen explorieren wir Konzepte zur Interaktion mit intelligenten Systemen in diesem Kontext. Text ist ein ideales erstes Ziel, da es überall und von jedem verwendet wird. Parallel entwickeln wir Modelle menschlichen Verhaltens bei der Texteingabe mittels Deep Learning weiter, um Nutzerschnittstellen und Eingabegeräte zu optimieren.

AKTUELLE ARBEITEN

01. Malin Eiband, Sarah Theres Völkel, Daniel Buschek, Sophia Cook, and Heinrich Hussmann. 2019. When people and algorithms meet: user-reported problems in intelligent everyday applications. In Proceedings of the 24th International Conference on Intelligent User Interfaces (IUI '19). ACM, New York, NY, USA, 96-106.
02. Daniel Buschek and Florian Alt. 2017. ProbUI: Generalising Touch Target Representations to Enable Declarative Gesture Definition for Probabilistic GUIs. In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17). ACM, New York, NY, USA, 4640-4653.
03. Daniel Buschek, Benjamin Bisinger, and Florian Alt. 2018. ResearchIME: A Mobile Keyboard Application for Studying Free Typing Behaviour in the Wild. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18). ACM, New York, NY, USA, Paper 255, 14 pages.

#HCI #ML/KI #Nutzerstudien
#Verhaltensbiometrie
#Interdisziplinäre Forschung

ZD.B- Nachwuchsgruppe

Angela Dai, Ph.D.

Synth2Real: Domain Adaptation between Synthetic and Real Data for Understanding

Technische Universität München

<https://angeladai.github.io/>



FORSCHUNGSINTERESSEN

My research focuses on attaining a 3D understanding of the world around us, capturing and constructing semantically-informed 3D models of real-world environments. This includes 3D reconstruction and semantic understanding

from commodity RGB-D sensor data, leveraging generative 3D deep learning towards enabling understanding and interaction with 3D scenes for content creation and virtual or robotic agents.

AUSGEWÄHLTES PROJEKT

The focus of this project is an end-to-end approach to align CAD models to a 3D scan of a scene, enabling transformation of a noisy, incomplete 3D scan to a compact, CAD reconstruction with clean, complete object geometry. We

formulate a differentiable Procrustes alignment that is paired with a symmetry-aware dense object correspondence prediction. This enables new applications in both content creation as well as scene understanding and simulation.

AKTUELLE ARBEITEN

01. Avetisyan, A., Dahnert, M., Dai, A., Savva, M., Chang, A. X., Niessner, M. (2019): Scan2CAD: Learning CAD Model Alignment in RGB-D Scans. The IEEE Conference on Computer Vision and Pattern Recognition (CVPR), June 2019.
02. Avetisyan, A., Dai, A., Nießner, M. (2019): End-to-End CAD Model Retrieval and 9DoF Alignment in 3D Scans. ICCV 2019.
03. Hou, J., Dai, A., Nießner, M. (2019): 3D-SIC: 3D Semantic Instance Completion for RGB-D Scans. arXiv:1904.12012 [cs.CV].

[#Scene Understanding](#) [#Machine Learning](#) [#3D Reconstruction](#)

ZD.B- Nachwuchsgruppe

Dr. Jörg Haßler

Digital Democratic Mobilization in Hybrid Media Systems (DigiDeMo)

Ludwig-Maximilians-Universität München

<https://www.ifkw.uni-muenchen.de/lehrbereiche/hassler2/index.html>



FORSCHUNGSINTERESSEN

Die Digitalisierung hat die Kommunikation zwischen Politik und Bürger*innen strukturell verändert. Digitale Kanäle wie Facebook, Twitter oder Instagram ermöglichen einen direkten Austausch zwischen Politik und Bevölkerung und ergänzen damit die klassische medienvermittelte Top-Down-Kommunikation des Fernsehzeitalters. Gleichzeitig erleben wir einen politischen Wandel: In zahlreichen demokratischen Ländern sind neue Parteien entstanden, die Volatilität und

die Polarisierung haben zugenommen. Die Forschungsgruppe geht den Fragen nach, wie politische Mobilisierung digital umgesetzt wird (z.B. mit koordinierten Kommunikationsaktivitäten, automatisierter Verbreitung von Botschaften oder Micro-Targeting) und wie erfolgreiche Strategien demokratiefördernd eingesetzt werden können. Hierzu verbindet das Projekt automatisierte Verfahren und empirische Methoden und verfolgt einen Computational-Social-Science-Ansatz.

AUSGEWÄHLTES PROJEKT

DigiDeMo nimmt im ersten Teilprojekt die Europawahl 2019 in den Blick. Über elf Länder hinweg wird die Facebook-Kommunikation politischer Parteien analysiert. Dabei stehen sowohl generelle Trends der Kampagnenkommunikation als auch länderspezifische Besonderheiten im Mittelpunkt. Zur Analyse der Kommunikationsstrategien werden manuelle quantitative Inhaltsanalysen durch Natural-Language-Processing-Verfahren ergänzt. Dies ermöglicht, den Einfluss von Bot-

schaftsmerkmalen wie Personalisierung oder populistischen Kommunikationsstrategien auf die Verbreitung von Posts zu untersuchen. Erste Ergebnisse zeigen zum Teil deutliche Unterschiede zwischen Kommunikationsstrategien und -erfolg bei einzelnen Parteien. Länderübergreifend werden die Posts von populistischen Akteuren wie Matteo Salvini, der AfD oder Nigel Farage im Mittel am häufigsten weiterverbreitet.

AKTUELLE ARBEITEN

01. Magin, M., Podschuweit, N., Haßler, J., Rußmann, U. (2017): Campaigning in the Fourth Age of Political Communication. A Multi-Method Study on the Use of Facebook by German and Austrian Parties in the 2013 National Election Campaigns. In: Information, Communication & Society, 20(11), 1698–1719.
02. Haßler, J., Kruschinski, S.: Vernetzte Kampagne?! Die Verbindung von Offline- und Online-Wahlkampf im Wahljahr 2017 am Beispiel der Mobilisierungskampagnen von CDU und SPD. In: Holtz-Bacha, C. (Hg.) (2019): Die (Massen-)Medien im Wahlkampf. Wiesbaden: Springer Fachmedien, 73–95.
03. Porten-Cheé, P., Haßler, J., Jost, P. B., Eilders, C., Maurer, M. (2018): Popularity Cues in Online Media: Theoretical and Methodological Perspectives in Political Communication Research. In: Studies in Communication | Media, 7(2), 208–230.

#Digitale Wahlkampagnen
#(Computational) Social Science
#Politische Onlinekommunikation
#Empirische Methoden

ZD.B- Nachwuchsgruppe

Dr. Josch Konstantin Pauling

LipiTUM – A Computational Platform for
Lipidomics and Lipotyping in Systems Medicine

Technische Universität München

<http://www.lipitum.de/>



FORSCHUNGSINTERESSEN

Meine Gruppe LipiTUM entwickelt spezielle Software, um das aufstrebende Feld der Lipidomik zum Werkzeugkasten der System-Medizin hinzuzufügen. Die Etablierung der Lipidomik bzw. Metabolomik als dritte Dimension zusätzlich zur Genomik und Proteomik ist ein Schlüssel zum Erreichen von Präzisionsmedizin – dem Erkennen und zielgerichteten Behandeln von Krankheitssubtypen mit geringen Nebenwirkungen. Die Präzisionsmedizin verwendet dafür nicht nur

Daten aus der klinischen Anamnese, sondern baut auf molekulare Messungen etwaiger Biomoleküle auf, welche eine detailreichere Bestimmung einer Krankheit ermöglichen. Somit kann Patientengruppen mit ähnlichen molekularen Signaturen eine zugeschnittene Behandlung und Medikation bereitgestellt werden. Dies ist unser Beitrag zur Nutzung der vielen Möglichkeiten der Digitalisierung.

AUSGEWÄHLTES PROJEKT

Das Mittel zur Wahl in der Lipidomik ist die Massenspektrometrie, welche verschiedene Moleküle anhand ihrer Masse als Spitzen (Peaks) auf einem Spektrum darstellt. Isomere sind Moleküle derselben Masse und somit werden sie vom selben Peak repräsentiert, was zu Fehlidentifikationen führt. Die Zuordnung von Molekülen zu den beobachteten Peaks ist besonders schwierig bei „Shotgun Lipidomics“,

einer besonders schnellen Methode zur Messung von Lipid-Massenspektren, welche allerdings kein Gebrauch von chromatographischen Methoden zum Separieren von Lipidspezies macht. Daher entwickeln wir neben vielen anderen Projekten eine neue Scoring-Methode zur Identifikation von Lipidspezies für die LipiTUM-Plattform, die es ermöglicht Lipidspezies mit hoher Konfidenz zu identifizieren.

AKTUELLE ARBEITEN

01. Pauling, J.K. et al. (2016): Computational Lipidomics and Lipid Bioinformatics: Filling In the Blanks. In: Journal of Integrative Bioinformatics, 13(1), 34–51.
02. Pauling, J.K. et al. (2017): Proposal for a common nomenclature for fragment ions in mass spectra of lipids. In: PLOS ONE, 12(11).
03. Ellis, J.K. et al. (2018): Automated, parallel mass spectrometry imaging and structural identification of lipids. In: Nature Methods, 15, 515–518.

#Digitalisierung, Lipidomik, Massenspektrometrie, Bioinformatik, Biomedizin

ZD.B- Nachwuchsgruppe

Dr. Daniel Schnurr

Data Neutrality & Open Access: Coherent Economic Policies for the Digital Economy

Universität Passau
www.datapolicies.net



FORSCHUNGSINTERESSEN

Im Fokus unserer Forschung stehen Daten und deren zentrale Rolle für den Wettbewerb in digitalen Märkten. Insbesondere beschäftigen wir uns mit der Frage, wie der Zugang zu Daten ausgestaltet und geregelt werden sollte. Diese Frage stellt sich sowohl für Unternehmen, um im Wettbewerb bestehen zu können, als auch auf gesellschaftlicher Ebene mit Blick auf den gesamtwirtschaftlichen Ordnungs-

rahmen. Unser Ziel ist es Maßnahmen zu identifizieren, die geeignet sind langfristig effektiven Wettbewerb zu sichern und Innovation zu fördern. Mit Hilfe spieltheoretischer Modelle, ökonomischer Laborexperimente und Simulationen untersuchen wir (Data) Open Access Konzepte, Neutralitätsverpflichtungen für Unternehmen sowie Maßnahmen zur Stärkung der informationellen Selbstbestimmung.

AUSGEWÄHLTES PROJEKT

Mit dem neu eingeführten Recht auf Datenportabilität sind NutzerInnen in der Europäischen Union heute in der Lage personenbezogene Daten, die bei der Nutzung von Online-diensten anfallen, eigenständig zu transferieren und zu monetarisieren. In aktuellen Forschungsarbeiten beschäftigen wir uns daher mit den Fragen, welchen monetären Wert InternetnutzerInnen ihren Daten beimessen und inwieweit elektronische Handelsplattformen, sogenannte Personal

Data Markets, eine nutzerzentrierte Lösung für die Datenökonomie darstellen können. Experimentell untersuchen wir dabei in kontrollierter Umgebung, wie verschiedene Faktoren, z.B. der Datentyp oder Privatsphärepräferenzen, die individuelle Wertschätzung beeinflussen. Mittels spieltheoretischer Modelle analysieren wir komplementär dazu die strategischen Auswirkungen von Personal Data Markets auf das Internet-Ökosystem.

AKTUELLE ARBEITEN

01. Haberer, B., Krämer, J., Schnurr, D. (2019): Standing on the Shoulders of Web Giants: The Economic Effects of Personal Data Markets. Presented at 46th Annual Conference of the European Association for Research in Industrial Economics (EARIE), Barcelona, Spain.
02. Fast, V., Schnurr, D., Wohlfarth M. (2019): Data-driven Market Power: An Overview of Economic Benefits and Competitive Advantages from Big Data Use. Presented at 47th Research Conference on Communications, Information and Internet Policy (TPRC), Washington, DC, USA.
03. Krämer, J., Schnurr, D., Wohlfarth, M. (2019): Winners, Losers, and Facebook: The Role of Social Logins in the Online Advertising Ecosystem. In: Management Science, 65(4), 1678–1699.

#Data Markets
#Open Data #Datenschutz
#Economics of ICT
#Digitaler Ordnungsrahmen

ZD.B- Nachwuchsgruppe

Prof. Dr. Verena Tiefenbeck

Digital Technologies and Human Behaviour:
Transforming Consumer Behaviour in the
Energy and Mobility Sector

Friedrich-Alexander-Universität Erlangen-Nürnberg, ETH Zürich

<https://www.bitstoenergy.com/>, <https://im.ethz.ch/people/vtiefenbeck.html>



FORSCHUNGSINTERESSEN

Die Digitalisierung gewährt immer detailliertere Einblicke in das Verhalten von Individuen und ermöglicht zeitnahe und personalisierte Verhaltensinterventionen in großem Maßstab. Mein Team kombiniert die Skalierbarkeit und Flexibilität von Informationstechnologien mit Erkenntnissen und Methoden aus den Verhaltenswissenschaften. Ziel ist es,

wirksame und skalierbare Informationssysteme zu bauen, die Individuen in tagtäglichen Entscheidungsprozessen unterstützen, insbesondere im Energie- und Mobilitätskontext. Hierzu verwenden wir quantitative Methoden zur Analyse großer Datensätze und ermitteln die Wirkung digitaler Verhaltensinterventionen in der realen Welt.

AUSGEWÄHLTES PROJEKT

Das Projekt Quartierstrom ist der erste lokale Peer-to-Peer-Energiemarkt der Schweiz (quartier-strom.ch). Die Grundidee: Lokal produzierter Solarstrom soll möglichst vor Ort verbraucht werden. In einem Feldtest mit 36 Haushalten und zwei kommerziellen Gebäuden können die Teilnehmer lokal produzierten Solarstrom seit Ende 2018 dezentral in der Nachbarschaft ein- und verkaufen. Neben der techni-

schen Machbarkeit und der Untersuchung der Marktmechanismen steht dabei insbesondere das Nutzerverhalten im Fokus. Durch den lokalen Handel konnte der lokal produzierte (wie auch der lokal verbrauchte) Anteil des Stroms der Gemeinschaft in dem als Leuchtturmprojekt geförderten Pilottest fast verdoppelt werden.

AKTUELLE ARBEITEN

01. Tiefenbeck, V., Wörner, A., Schöb, S., Fleisch, E., Staake, T. (2019): Real-time feedback promotes energy conservation in the absence of volunteer selection bias and monetary incentives. In: Nature Energy 4(1), 35–41.
02. Tiefenbeck, V., Goette, L., Degen, K., Tasic, V., Fleisch, E., Lalive, R., Staake, T. (2018): Overcoming salience bias: How real-time feedback fosters resource conservation. In: Management Science, 64(3), 1458–1476.
03. Wörner, A., Ableitner, L., Meeuw, A., Wortmann, F., Tiefenbeck, V. (2019): Peer-to-Peer Energy Trading in the Real World: Market Design and Evaluation of the User Value Proposition. In: Proceedings of the International Conference on Information Systems (ICIS) (Conditionally Accepted).

#Digitale Verhaltensinterventionen #IT zur Verhaltensänderung #Energieverbrauch #Feldexperimente

ZD.B- Nachwuchsgruppe

Dr. Matthias Uhl

Ethik der Digitalisierung

Technische Universität München

<https://www.gov.tum.de/fakultaet/nachwuchsgruppen/ethics-of-digitization/>



FORSCHUNGSINTERESSEN

Die Gruppe forscht zu den ethischen Implikationen von Mensch-Maschine-Interaktionen und zu moralischen Intuitionen bezüglich digitalen Technologien in neuen Domänen. Zentrale Forschungsfragen beschäftigen sich beispielsweise mit der Diffusion von Verantwortung zwischen natürlichen und artifiziellen Agenten, dem Einfluss von Interfaces auf moralisches Verhalten und Ressentiments gegen den Einsatz von Algorithmen. Hierzu werden vorwiegend Metho-

den der empirischen Ethik eingesetzt. Die untersuchten Einstellungen sind häufig unterbewusst oder es besteht ein Anreiz zur Selbst- und Fremdtäuschung. Ein besonderer Fokus liegt daher methodisch auf der Gewinnung von Verhaltensdaten durch kontrollierte Labor- und Feldexperimente. Aus den gewonnenen empirischen Erkenntnissen werden schließlich normative Implikationen abgeleitet.

AUSGEWÄHLTES PROJEKT

Das Projekt vergleicht im Rahmen eines Laborexperiments den Einfluss artifizierlicher und menschlicher Berater auf moralisches Entscheidungsverhalten. Ein ethischer Berater schlägt (z.B. auf dem Schlachtfeld) eine bestimmte ethisch relevante Entscheidung vor, die letztlich vom Menschen umzusetzen ist, da nach verbreiteter Auffassung nur der Mensch moralische Verantwortung tragen kann. Unklar

ist jedoch, wie sich die artifizierliche Natur des Beraters auf dessen Vorbildfunktion oder die Moraldiffusion zwischen Entscheider und Berater auswirkt. Die Studie leistet einen empirischen Beitrag zur Diskussion um die ethische Neutralität von Technik sowie zur moralpsychologischen Grundlagenforschung. Die Ergebnisse haben ferner konkrete Implikationen für das Design artifizierlicher ethischer Berater.

AKTUELLE ARBEITEN

01. Krügel, S., Ostermaier, A., Uhl, M.: Artificial Vs. Human Moral Advisors: An Experimental Investigation (WiP).
02. Uhl, M.: Order Ethics for the Digital Society. In: Lütge, C., Kochupillai, N. (Hg.): Business Ethics Evolving, Springer (im Erscheinen).
03. Jauernig, J., Uhl, M. (2019): Spite and Preemptive Retaliation After Tournaments. In: Journal of Economic Behavior & Organization, 158, 328–336.

#Empirische Methoden in der Ethik #Labor- und Feldexperimente #Mensch-Maschine-Interaktion
#Technikakzeptanz #Wissenschaftstheorie

ZD.B- Nachwuchsgruppe

Dr. Christian Wachinger

Computational Population Modeling
from Big Medical Image Data

Ludwig-Maximilians-Universität München
www.ai-med.de



FORSCHUNGSINTERESSEN

Künstliche Intelligenz verändert das Gesundheitswesen. Insbesondere medizinische Bilder enthalten umfangreiche Informationen, die möglicherweise nur teilweise mit bloßem Auge erkennbar sind, aber von intelligenten Algorithmen identifiziert werden können. Für das Trainieren solcher Methoden sind allerdings große Datenmengen erforderlich. Gleichzeitig entstanden in den letzten Jahren durch groß

angelegte Forschungsstudien und jahrzehntelange Bildung in der Klinik riesige Bildarchive. Die Analyse solcher riesiger Datensätze eröffnet viele spannende Forschungsfragen, sowohl aus klinischer als auch aus technischer Sicht. In enger Zusammenarbeit mit unseren klinischen Partnern arbeiten wir an intelligenten Algorithmen, um diese Fragen zu beantworten.

AUSGEWÄHLTES PROJEKT

In einem aktuellen Projekt befassen wir uns mit der Segmentierung von 3D MRT Aufnahmen mit neuronalen Netzen. Hierbei werden anatomische Strukturen automatisch identifiziert. Anhand dieser können dann quantitative Werte wie Volumen und Dicke berechnet werden. Quantitative Werte helfen dabei die Entstehung von Krankheiten besser zu verstehen. Wir arbeiten an der Verbesserung der neuro-

nalen Netze, damit diese auch mit wenig Trainingsdaten gute Genauigkeit erzielen. Insbesondere beschäftigen wir uns mit der Rekalibrierung von neuronalen Netzen und Shot-Learning, dem Lernen neuronaler Netze mit minimalen Annotationen. Die Segmentierung kann auf <http://quicknat.ai-med.de> getestet werden.

AKTUELLE ARBEITEN

01. Guha Roy, A., Siddiqui, S., Pölsterl, S., Navab, N., Wachinger, C.: ‚Squeeze & Excite‘ Guided Few-Shot Segmentation of Volumetric Images. Medical Image Analysis (Accepted).
02. Rickmann, A., Guha Roy, A., Sarasua, I., Wachinger, C. (2019): ‚Project & Excite‘ Modules for Segmentation of Volumetric Medical Scans. Medical Image Computing and Computer Assisted Intervention (MICCAI).
03. Guha Roy, A., Conjeti, S., Navab, N., Wachinger, C. (2019): Bayesian QuickNAT: Model Uncertainty in Deep Whole-Brain Segmentation for Structure-wise Quality Control. In: NeuroImage, 195, 11–22.

#Medical Imaging #AI #Neuro #Big Data

ZD.B- Nachwuchsgruppe

Dr. Raphael Wimmer

Physical-Digital Affordances for
Digital Media and Workflow

Universität Regensburg
<https://hci.ur.de>



FORSCHUNGSINTERESSEN

Die Digitalisierung verändert, wie wir mit Dokumenten arbeiten. Digitale Systeme und Werkzeuge ersetzen Papier, Stift und Stempel. Hier müssen Entwickler, Designer und Entscheider darauf achten, dass die ganz eigenen Vorteile papierbasierter kollaborativer Prozesse auch in digitalen Lösungen erhalten bleiben. In der ZD.B-Nachwuchsgruppe „Physical-Digital Affordances“ untersuchen wir, welche inhärenten Nutzungsmöglichkeiten („Affordances“) physische und digitale Medien besitzen, und wie ihre jeweiligen

Stärken in Arbeitsprozessen sinnvoll kombiniert werden können. Neben der Forschung an geeigneten Hardware- und Software-Architekturen untersuchen wir auch in Fallstudien, wie traditionell papierbasierte Arbeitsprozesse möglichst benutzerfreundlich digital umgesetzt werden können. Ein besonderer Fokus liegt hierbei auf der Arbeit in der öffentlichen Verwaltung – einem Sektor, der stark von papierbasierten Prozessen geprägt ist.

AUSGEWÄHLTES PROJEKT

Im Juli 2019 startete das vom BMBF geförderte Projekt VIGITIA (Vernetzte Intelligente Gegenstände durch, auf und um interaktive Tische im Alltag). Zusammen mit der Bauhaus-Universität Weimar, der Extend3D GmbH (München) und der Stadt Regensburg entwickeln wir eine praxistaugliche Projektionslösung mit der existierende Tische interaktiv werden. Dabei wollen wir nicht einfach klassische digitale

Inhalte auf den Tisch projizieren, sondern alltägliche Aktionen auf und an Tischen durch eingblendete Werkzeuge unterstützen. Neben der technischen Umsetzung legen wir einen besonderen Fokus auf die benutzerzentrierte Entwicklung, bei der wir die Öffentlichkeit und insbesondere Kreativschaffende einbinden. Weitere Informationen: <http://www.vigitia.de/>.

AKTUELLE ARBEITEN

01. Wimmer, R., Echter F. (2019): VIGITIA: Unterstützung von alltäglichen Tätigkeiten an Tischen durch Projected AR. In: 2nd Workshop on VR and AR in Everyday Context (VARECo). Mensch und Computer 2019 – Workshopband. Bonn: Gesellschaft für Informatik e.V.
02. Hahn, J., Wimmer R. (2019): A Prototypical Photo Sorting Study Design for Comparing Interaction Styles. In: Proceedings of Mensch und Computer 2019 (MuC'19). ACM, New York, NY, USA, 689–693.
03. Wimmer, R., Schmid, A., Bockes, F. (2019): On the Latency of USB-Connected Input Devices. In: Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). ACM, New York, NY, USA, Paper 420.

#Digitalisierung
#Öffentliche Verwaltung #Usability
#Human-Computer Interaction
#Systems Engineering

ZD.B Fellow

Alice Baird

Ein Embedded-Soundscape-System für Personalisiertes Wohlbefinden durch Multimodale Feedbackanalyse

Universität Augsburg

<https://www.informatik.uni-augsburg.de/lehrstuehle/eihw/staff/baird/>



FORSCHUNGSINTERESSEN

Dieses Forschungsprojekt befasst sich mit der intelligenten Audioanalyse und -erzeugung, wobei die Bereiche Computer-Audition und Computer-Paralinguistik überquert werden. Insbesondere wird maschinelles Lernen neben anderen rechnerischen Ansätzen zur (multimoda-

len) nicht-invasiven Überwachung des menschlichen Wohlbefindens verwendet, um die personalisierte Erzeugung von Audioumgebungen zu informieren, die das Wohlbefinden verbessern.

AUSGEWÄHLTES PROJEKT

Eine kürzlich veröffentlichte Arbeit [1] für das Forschungsprojekt untersucht die Beziehung zwischen sprachlichen Merkmalen und sequentiellen speichelbasierten Cortisolmessungen als Anzeichen von biologischem Stress. Die Studie ergab, dass 10 bis 20 Minuten nach Stress die Korrelation zwischen Sprachmerkmalen und Cortisol zunahm. Dies steht im Einklang mit früheren Untersuchungen zur

biologischen Verzögerung von Stress und ist vielversprechend für die Verwendung von sprachlichen Merkmalen zur Vorhersage von Stresszuständen. Diese Studie wird als Grundlage für weitere Zustandsanalysen in Bezug auf das Wohlbefinden und als Aspekt der Konditionierung für Audioerzeugung dienen.

AKTUELLE ARBEITEN

01. Baird, A., Amiriparian, S., Cummins, N., Strumbauer, S., Janson, J., Messner, E.-M., Baumeister, H., Rohleder, N., Schuller, B. W. (2019): Using Speech to Predict Sequentially Measured Cortisol Levels During a Trier Social Stress Test. In: Proceedings INTERSPEECH 2019, 20th Annual Conference of the International Speech Communication Association (ISCA).
02. Baird, A., Amiriparian, S., Berschneider, M., Schmitt, M., Schuller, B. (2019): Predicting Blood Volume Pulse and Skin Conductance from Speech: Introducing a Novel Database and Results. In: Proceedings IEEE 21st International Workshop on Multimedia Signal Processing (MMSP).
03. Baird, A., Amiriparian, S., Schuller, B. (2019): Can Deep Generative Audio be Emotional? Towards an Approach for Personalised Emotional Audio Generation. In: Proceedings IEEE 21st International Workshop on Multimedia Signal Processing (MMSP).

#Computer Audition
#Computational Paralinguistics #Generative Audio
#Affective Computing

ZD.B Fellow

Clemens Birkenmaier

Realistische Modellierung von Blut in Patientenspezifischen Digitalen Modellen

Universität Regensburg / OTH Regensburg
<https://bfm.rcbe.de/>



FORSCHUNGSINTERESSEN

Warum gerinnt Blut in medizintechnischen Geräten wie Dialysatoren oder künstlichen Lungen, obwohl es nach bisherigem Verständnis nicht sollte? Ziel ist es, die komplexen Zusammenhänge hinter dieser Frage zu verstehen und ein patientenindividuelles Simulationsmodell für das kombinierte Strömungs- und Gerinnungsverhalten von Blut in künstlichen Lungen zu entwickeln. Das Projekt wird die

Entwicklung besserer Medizinprodukte mittels virtueller Prototypen ermöglichen und neue Wege bei Diagnose und Therapieplanung für die digitale Präzisionsmedizin der Zukunft eröffnen und durch den Einsatz von Machine-Learning-Methoden in der Strömungsberechnung Kompetenzen in diesem Gebiet aufbauen.

AUSGEWÄHLTES PROJEKT

Technische Strömungen zeichnen sich im Allgemeinen durch einen großen Umfang verschiedener Längen- und Zeitskalen aus, was die Berechnung aufwändig macht oder starke Vereinfachungen erfordert. Obwohl Deep-Learning-Methoden schon früher bei komplexen Strömungen angewandt wurden, ermöglichen es erst die modernen Architekturen, die etablierten Methoden zu überbieten. In einem geplanten Forschungsprojekt sollen Deep-Learning-Strategien zum Auffinden von Schließungsmodellen (Mehrphaseninteraktion,

Turbulenz) bei der klassischen Finiten-Volumen-Methode und zur Platzierung der Lösungselemente für die literarisierten Navier-Stokes-Gleichungen entwickelt und ihre Performanz mit den jeweiligen State-of-the-Art-Methoden verglichen werden. Dadurch sollen Machine-Learning-Methoden bei den beteiligten Akteuren für die Anwendung in einem konservativen Feld etabliert und grundlegende Kompetenz in diesem Bereich aufgebaut werden.

AKTUELLE ARBEITEN

01. Birkenmaier, C., Dornia, C., Lehle, K., Müller, T., Gruber, M., Philipp, A., Krenkel, L.: Analysis of thrombotic deposits in extracorporeal membrane oxygenators by high-resolution micro computed tomography: A feasibility study (Under Review).
02. Steiger, T., Foltan, M., Philipp, A., Mueller, T., Gruber, M., Bredthauer, A., Krenkel, L., Birkenmaier, C., Lehle, K.: Accumulations of von Willebrand factor within ECMO oxygenators: Potential indicator of coagulation abnormalities in critically ill patients? In: Artificial Organs 2019, 00, 1–12.
03. Birkenmaier, C., Lehle, K., Krenkel, L.: Towards a realistic model of blood viscosity and coagulation in membrane oxygenators. 7th European Conference on Computational Fluid Dynamics (ECCOMAS ECFD7), June 2018.

#Machine Learning in Fluid Dynamics
#Nonlinear Fluid Models
#Simulation-Based Decision Support

ZD.B Fellow

Philipp Dufter

Effektive Nutzung Mehrsprachiger Daten
in der Automatisierten Sprachverarbeitung

Ludwig-Maximilians-Universität München

<https://www.cis.uni-muenchen.de/>



FORSCHUNGSINTERESSEN

Natural Language Processing (NLP) hat über die letzten Jahre an Bedeutung gewonnen. Zahlreiche Industrieunternehmen – auch außerhalb von Technologiekonzernen – nutzen NLP, um zum Beispiel internes Wissen besser zugänglich zu machen, oder Kundenanfragen schneller zu verarbeiten. Unter anderem mit der Veröffentlichung des BERT Modells (Bidirectional Encoder Representations from Transformers) wurde ein tiefes neuronales Netz vorgestellt, das zahlreiche und vielfältige Aufgaben mit nie vorhergesehener Genau-

igkeit lösen kann. Dieses Modell hat große Anforderungen bezüglich der Speicher- und Rechenkapazität. Da meist ein Modell pro Sprache benötigt wird und es auf der Welt ca. 700 ökonomisch relevante Sprachen gibt, ist es herausfordernd, BERT effizient über mehrere Sprachen hinweg anzuwenden. Das Hauptinteresse dieses Projekts liegt deshalb in multilingualen Modellen: Wie können mehrere Sprachen gleichzeitig mit einem einzigen Modell wie BERT bedient werden?

AUSGEWÄHLTES PROJEKT

BERT liefert wie die meisten Neuronalen Netze hervorragende Genauigkeit, jedoch ohne Einblick, wie das Modell im Detail funktioniert. Deshalb beschäftigt sich ein aktuelles Projekt mit der Frage der Interpretierbarkeit von Wortrepräsentationen. Wir erweiterten und vereinfachten eine

existierende Methode, die es ermöglicht interpretierbare Richtungen in Wortvektorräumen mit Hilfe von Lexika zu identifizieren. Diese Methode soll nun benutzt werden, um die Multilingualität von BERT genauer zu verstehen und Verbesserungspotenzial aufzudecken.

AKTUELLE ARBEITEN

01. Dufter, P., Zhao, M., Schmitt, M., Fraser, A., Schütze, H. (2018): Embedding Learning Through Multilingual Concept Induction. In: Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics.
02. Dufter, P., Schütze, H. (2018): A Stronger Baseline for Multilingual Word Embeddings. arXiv preprint arXiv:1811.00586.
03. Dufter, P., Schütze, H. (2019): Analytical Methods for Interpretable Ultradense Word Embeddings. arXiv preprint arXiv:1904.08654.

[#Natural Language Processing](#) [#Machine Learning](#) [#Deep Learning](#) [#Multilinguality](#)

ZD.B Fellow

Oliver Haas

Digitalisierung im Klinischen Umfeld
mittels Graphdatenbanken

FAU Erlangen-Nürnberg, OTH Amberg-Weiden
<https://www.oth-aw.de/informieren-und-entdecken/personen/haas-oliver/>



FORSCHUNGSINTERESSEN

Im klinischen Umfeld werden an verschiedenen Stellen Daten erhoben und gesammelt. Diese sind stark heterogen, aber dennoch hochgradig verknüpft. Graphdatenbanken eignen sich gut für solche Daten: sie beinhalten heterogene „Datenpunkte“, die miteinander verknüpft werden können. Die grundlegende Fragestellung ist nun, ob und wie diese klinischen Daten in einer Graphdatenbank sinnvoll genutzt

werden können, vor allem wie die Mitarbeiter der Klinik davon profitieren können. Denkbare Szenarien sind eine graphische Oberfläche, damit Mitarbeiter einfacher an benötigte Informationen kommen oder eine Schnittstelle für Auswertungen, um komplexere Fragen beantworten zu können. (z.B. „Gab es zu einem Patienten bereits ähnliche Patienten? Wie wurden sie behandelt?“)

AUSGEWÄHLTES PROJEKT

Indem klinische Daten aus verschiedenen Systemen mittels Graphdatenbanken kombiniert werden, können Krankenhaushäufigkeiten als Einkaufskörbe betrachtet werden und alles, was diesen Fall beschreibt (Diagnosen, Prozeduren, Medikamente, demographische Daten...) kann als Ware in diesem Einkaufskorb betrachtet werden. Ähnlich wie bei Amazon

können nun anhand vergangener Fälle Regeln oder Muster erkannt werden, die gehäuft auftreten aber normalerweise unter der großen Menge an verschiedenen Patienten nicht sichtbar sind. Diese Regeln können von Klinikmitarbeitern sowie Forschern genutzt werden, um neue Informationen aus bestehenden Daten zu gewinnen.

AKTUELLE ARBEITEN

01. MIMIC graph: clinical records as graph databases (WiP).
02. General cross-domain association rule mining from clinical records (WiP).
03. Digitalization of clinical documentation processes with respect to nurse-patient ratios (WiP).

[#Graphdatenbanken](#) [#Behandlungspfade](#) [#Pflegermanagement](#) [#klinische Daten](#)
[#Gesundheitssystem in Deutschland](#)

ZD.B Fellow

Christoph Molnar

Interpretable Machine Learning

Ludwig-Maximilians-Universität München

<http://www.compstat.statistik.uni-muenchen.de/>



FORSCHUNGSINTERESSEN

Ich beschäftige mich mit der Interpretierbarkeit von Modellen des maschinellen Lernens. Mein Fokus liegt auf Methoden, die für verschiedene Typen von Modellen funktionieren. Ich habe viele der existierenden Methoden in einem R Softwarepaket (iml) implementiert und in dem Buch „Interpretable Machine Learning“ zusammengefasst. In unserer

Arbeitsgruppe beschäftigen wir uns auch mit Limitationen von Methoden wie Permutation Feature Importance, Accumulated Local Effects und Partial Dependence Plots. Ein weiterer Schwerpunkt ist Automated Machine Learning und wie man Machine Learning Modelle gleichzeitig für Performance und Interpretierbarkeit optimiert.

AUSGEWÄHLTES PROJEKT

Es gibt bereits viele Methoden, die die „Black Box“-Modelle des maschinellen Lernens erklärbar machen können. Die kritische Analyse dieser Methoden kommt unserer Meinung nach zu kurz. Wir erforschen daher, in welchen Situationen diese Methoden der Interpretierbarkeit an ihre Grenzen stoßen und Interpretationen sogar zu irreführenden Schlussfolgerungen führen können. Vor allem Interaktionen und abhängige Verteilung der Features führen zu Pro-

blemen in der Interpretation. Zum Beispiel können Partial Dependence Plots bei Interaktionen irreführende Interpretationen liefern. In unserem aktuellen Forschungsprojekt entwickeln wir Indikatoren für Interpretationsprobleme. Diese Indikatoren können genutzt werden um Anwender auf Probleme aufmerksam zu machen und besser geeignete Interpretationsmethoden vorzuschlagen.

AKTUELLE ARBEITEN

01. Molnar, C. (2019): Interpretable machine learning. A Guide for Making Black Box Models Explainable". <https://christophm.github.io/interpretable-ml-book/>.
02. Molnar, C., Casalicchio, G., Bischl, B. (2019): Quantifying Interpretability of Arbitrary Machine Learning Models Through Functional Decomposition. arXiv preprint arXiv:1904.03867.
03. Scholbeck, C. A. et al. (2019): Sampling, Intervention, Prediction, Aggregation: A Generalized Framework for Model Agnostic Interpretations." arXiv preprint arXiv: 1904.03959.

[#KI](#) [#Klimakrise](#) [#Klosterführung](#)

ZD.B Fellow

Nina Rohrbach

„Mixed Reality“ als ein neuer rehabilitativer Ansatz bei Störungen von Alltagshandlungen nach chronisch neurologischer Erkrankung

Technische Universität München

<https://www.sg.tum.de/bewegungswissenschaft>



FORSCHUNGSINTERESSEN

Aufgrund der steigenden Anzahl an Patienten mit neurologischen Erkrankungen und den daraus resultierenden Alltags Einschränkungen interessieren mich sowohl alternative Therapieansätze zur Förderung des motorischen Lernens, wie dem Training in virtueller Umgebung, als auch Assistenzsysteme zur Unterstützung der Selbstständigkeit, z.B. durch Einblen-

dung holografischer Zusatzinformationen. Mein Ziel ist es, die effektivsten Hinweisquellen auf motorischer und kognitiver Ebene zu ermitteln sowie den potentiellen Einfluss affektiver Konstrukte (z.B. Steigerung der Trainingsmotivation) und des technischen Immersionsniveaus auf die Therapieergebnisse zu erforschen.

AUSGEWÄHLTES PROJEKT

In einer Reihe an Griffkraft-Experimenten erforschen wir den Einfluss holografischer Stimuli auf das motorische Lernen bei Objektmanipulation während einer Greif-Hub-Aufgabe mittels Griffkraftmanipulandum. Das „Color Holo Learning“ Experiment untersucht, ob das Einblenden holografischer Farbinweise, die das jeweilige Objektgewicht kodieren, zu einer Farb-Gewichts-Assoziation führen. Das „Size-Weight-Holo

Illusion“ Experiment ermittelt, ob durch holografische Größen-Reize das Phänomen der Size-Weight Illusion, eine in der Regel stabile Wahrnehmungstäuschung, aufgehoben werden kann. Die gewonnenen Erkenntnisse können zur Entwicklung von Therapieansätzen oder Assistenzsystemen mit Mixed Reality Technologie beitragen.

AKTUELLE ARBEITEN

01. Rohrbach, N., Gulde, P., Armstrong, A. R., Hartig, L., Abdelrazeq, A., Schröder, S., Neuse, J., Grimmer, T., Diehl-Schmid, J., Hermsdörfer, J. (2019): An augmented reality approach for ADL support in Alzheimer's disease: a crossover trial. In: Journal of Neuroengineering and Rehabilitation, 16(1), 66.
02. Rohrbach, N., Chicklis, E., Levac, D. E. (2019): What is the impact of user affect on motor learning in virtual environments after stroke? A scoping review. In: Journal of Neuroengineering and Rehabilitation, 16(1), 79.
03. Baur, K., Rohrbach, N., Hermsdörfer, J., Riener, R., Klamroth-Marganska, V. (2019): The "Beam-Me-In Strategy"-remote haptic therapist-patient interaction with two exoskeletons for stroke therapy. In: Journal of Neuroengineering and Rehabilitation, 16(1), 85.

[#Neurorehabilitation](#) [#Mixed Reality Technologie](#) [#Alltagshandlung](#) [#Assistenzsysteme](#) [#Motorisches Lernen](#)

ZD.B Fellow

Jonas Schlund

Dezentrale Bereitstellung von Systemdienstleistungen mit Elektrofahrzeugen

Friedrich-Alexander-Universität Erlangen-Nürnberg
https://www.cs7.tf.fau.de/forschung/smart_energy/



FORSCHUNGSINTERESSEN

Ich simuliere und analysiere komplexe Energiesysteme unter Unsicherheit mittels ereignisorientierter Simulation. Dabei interessiere ich mich insbesondere für vorausschauende Steuerungsalgorithmen und Strategien zur Erbringung von Systemdienstleistungen mit verteilten Assets eingeschränkter Verfügbarkeit, wie Elektrofahrzeuge oder stationäre Speicher. Mein Schwerpunkt liegt auf der Mo-

dellierung und Abschätzung verfügbarer (Lade-)Flexibilität unter Berücksichtigung des Mobilitätsverhaltens und technischen Randbedingungen. Ziel sind technoökonomischen Analysen auf Basis kombinierter Betrachtung des Energie- und Mobilitätssektors. Weitere Interessen sind Optimierung, maschinelles Lernen, Distributed-Ledgers und Datenanalyse im Energiesektor.

AUSGEWÄHLTES PROJEKT

Im Projekt „Dezentrale Bereitstellung von Systemdienstleistungen mit Elektrofahrzeugen“ modelliere, schätze und steuere ich die Ladeflexibilität von Elektrofahrzeugen in einer Simulation Deutschlands für verschiedene Ausbauszenarien und evaluiere Systemdienstleistungen wie Redispatch oder Regelleistung aus technischem und wirtschaftlichem Blickwinkel. Im Kern des Projekts steht

eine gemeinsame Betrachtung und Modellierung der Einschränkungen aus dem Energie- und Mobilitätssektor im erforderlichen Detailgrad. Im Rahmen von EXIST arbeite ich zudem mit dem Startup ChargingLedger zusammen, um entwickelte Konzepte und Algorithmen im Feld anzuwenden.

AKTUELLE ARBEITEN

01. J. Schlund, M. Pruckner, R. German, "Modeling mobility characteristics of electric vehicles as stochastic trip chains" (work in progress)
02. J. Schlund, R. German, "A distributed ledger based platform for community-driven flexibility provision," in *Energy Informatics*, 2(1), 2019.
03. J. Schlund, R. Steinert and M. Pruckner, "Coordinating E-Mobility Charging for Frequency Containment Reserve Power provision," *Proceedings of the Ninth International Conference on Future Energy Systems*, 556-563, 2018.

#Nachhaltigkeit #Energiewende #Startups #Entwicklungszusammenarbeit #Mountainbiking

ZD.B Fellow

Verena Stürmer

Selbstregulierung im
Europäischen Datenschutzrecht

Universität Bayreuth



FORSCHUNGSINTERESSEN

Die Digitalisierung stellt den Datenschutz vor neue Herausforderungen. Wie kann angemessen auf die veränderte Gefährdungslage reagiert werden? Als Antwort auf die beobachteten Defizite des herkömmlichen Datenschutzrechts wird das Steuerungskonzept der „Regulierten Selbstregulierung“ diskutiert. Nach diesem Konzept soll die Wirtschaft dazu veranlasst werden, branchen- oder unternehmensbezogene Regelungen zu entwerfen und mithilfe privater Kontrollins-

tanzen durchzusetzen. Es verspricht unter anderem, die Akzeptanz bei den Datenschutzverpflichteten zu erhöhen. Die Datenschutzgrundverordnung sieht mit Verhaltensregeln, Zertifizierungen und verbindlichen internen Datenschutzvorschriften (Art. 40f., 42f., 47 DS-GVO) entsprechende Instrumente vor. Inwieweit der europäische Datenschutz durch diese Instrumente tatsächlich weiterentwickelt werden kann, wird im Rahmen des Projektes untersucht.

AUSGEWÄHLTES PROJEKT

Die in der DS-GVO vorgesehenen Instrumente der regulierten Selbstregulierung werden vom Europäischen Datenschutzausschuss auch als „Accountability Instrumente“ bezeichnet. Es liegt daher nahe, dass sie in einem engeren Zusammenhang mit dem neu eingeführten Grundsatz der Accountability stehen (Art. 5 Abs. 2 DS-GVO). Was unter diesem Grundsatz allerdings genau zu verstehen ist, ist zumindest in der deutschen Literatur bislang noch nicht umfassend herausgearbeitet worden. Im Rahmen des Pro-

jektes soll daher auch dieser Grundsatz entfaltet und sein Verhältnis zu den Instrumenten der regulierten Selbstregulierung untersucht werden. Dabei wird auf das allgemeine Begriffsverständnis der Accountability im angelsächsischen Sprachraum, das spezifische Verständnis im Zusammenhang mit dem Datenschutz sowie auf die Stellungnahmen der Art. 29-Datenschutzgruppe zur Einführung eines solchen Grundsatzes eingegangen.

[#DS-GVO](#) [#Accountability](#) [#verstärkte Eigenverantwortung](#)

ZD.B Fellow

Dipl.-Ing. Johanna Wald

Towards Dynamic 3D Scene Understanding

Technische Universität München

<https://waldjohannau.github.io/RIO/>



FORSCHUNGSINTERESSEN

Das Scannen und Verstehen von 3D Räumen ist eine wichtige Forschungsrichtung in Computer Vision, die die Grundlage für eine Vielzahl von Anwendungen in Robotik sowie in erweiterter und virtueller Realität bildet. In meiner Arbeit konzentriere ich mich auf Umgebungen, die sich auf natürliche Art und Weise mit der Zeit verändern. Auch wenn ein

hoher Bedarf an dynamischem Szenenverständnis besteht, ist dieser Schwerpunkt bis dato immer noch relativ unerforscht. Offene Forschungsfragen beschäftigen sich mit der 3D Lokalisierung von Objekten sowie der Kamera, einer beständigen 3D Rekonstruktion sowie der Erkennung von Veränderungen und dessen Erfassung.

AUSGEWÄHLTES PROJEKT

In unserem aktuellen Projekt „3D object instance relocation in changing indoor environments“ arbeiten wir an 3RScan, einem umfangreichen Datensatz der Momentaufnahmen von Räumen enthält, die sich auf natürliche Art und Weise verändern. Darauf basierend veröffentlichen wir ein öffentliches Benchmark zur Re-Lokalisierung von 3D Objektinstanzen: Auf Basis einer segmentierten Szene sind die 6DoF-Posen in einem zweiten Scan derselben Umgebung

gesucht, der zu einem späteren Zeitpunkt aufgenommen wurde. Wir evaluieren unsere Methode, ein Fully-Convolutional Multiscale-Netzwerk, auf dem erstellten Benchmark und veröffentlichten unseren Datensatz mit einem standardisierten Test-, Validierungs- und Trainingsset sowie umfangreichen Annotationen, um einen fairen Vergleich mit anderen Methoden zu ermöglichen.

AKTUELLE ARBEITEN

01. Wald, J., Avetisyan, A., Navab, N., Tombari, F., Niessner, M. (2019): RIO: 3D Object Instance Re-Localization in Changing Indoor Environments. ICCV 2019 (Oral).
02. Rethage, D., Wald, J., Sturm, J., Navab, N., Tombari, F. (2018): Fully-Convolutional Point Networks for Large-Scale Point Clouds, ECCV.
03. Wald, J., Tateno, K., Sturm, J., Navab, N., Tombari, F. (2018): Real-Time Fully Incremental Scene Understanding on Mobile Platforms, RA-L/IROS.

#Computer Vision #Deep Learning

ZD.B Fellow

Sarah Wunderlich

Selbstadaptierende Online-Analyse Host-basierter Sicherheitskritischer Ereignisse in Unternehmensnetzen Kleiner und Mittlerer Unternehmen

Hochschule Coburg, Universität Würzburg
<https://www.hs-coburg.de/CIDDS>



FORSCHUNGSINTERESSEN

Kleine und mittlere Unternehmen (KMU) haben durch ihre Innovationskraft an Bedeutung gewonnen. Dies macht KMUs zu einem attraktiven Ziel für Hackerangriffe. Bestehende Sicherheitslösungen finden jedoch in KMUs aufgrund von mangelnden personellen und finanziellen Ressourcen häufig keine Anwendung. Forschungsinteresse ist deshalb, ein benutzerfreundliches Sicherheitssystem zu entwerfen, welches auf die Bedürfnisse von KMUs angepasst ist. Dieses

soll Mitarbeitern über eine detaillierte Problembeschreibung helfen, Angriffe zu erkennen und Sicherheitslücken zu schließen. Die Analyse soll auf einer feingranularen Ebene eines Computersystems unter Nutzung von Systemaufrufen durchgeführt werden. Ansatzpunkt ist hierbei die Modellierung von Normalverhalten mittels neuronaler Netze, um die Detektion von Anomalien zu ermöglichen.

AUSGEWÄHLTES PROJEKT

Eine große Herausforderung in der Arbeit mit künstlichen neuronalen Netzen ist die Tatsache, dass diese nur numerische Daten verarbeiten können. In vielen Anwendungsgebieten liegen die zu verarbeitenden Daten jedoch nicht in numerischer Form vor. Ein Forschungsfeld ist deshalb die sinnvolle Transformation von kategorischen Werten in numerische Repräsentationen. Im Bereich der host-basierten IT-Sicherheit müssen ebenfalls Systemaufrufe zur

Verarbeitung transformiert werden. Ein aktuelles Projekt ist die Analyse verschiedener Methoden aus dem Bereich des Natural Language Processing wie word2vec, Glove und fastText, um Systemaufrufe in numerische Repräsentationen zu transformieren. Hierbei ist vor allem sicherzustellen, dass durch die Transformation kein Informationsverlust stattfindet.

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#Machine Learning #IT-Security
#Anomaly Detection #System Calls



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01

Security for Machine Learning in the Context of Autonomous Vehicles

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The Effects of XAI on the Creation of Attacks

Motivation:
eXplainable AI (XAI) algorithms are used to explain models. While this helps the developer to understand the model, XAI can also be used to provide adversaries with useful information.

Evaluation:
The attack with XAI will be applied to comma.ai openpilot, an add-on for cars to enable autonomous driving.


Novel Contributions:
The effect of XAI algorithms on the creation of attacks has not yet been evaluated.



Original Image



ATTACK

No XAI
algorithm perturbs pixels anywhere in the image



Duration: ~ 11 min.
Reddish tone around the area of the beak

XAI
(here: LIME)
algorithm perturbs pixels only in areas highlighted in the mask



Duration: ~ 5 min.
Reddish tone around the area of the shoulders

INTRODUCTION

In view of the advent of (semi-)autonomous vehicles in people's everyday lives, machine learning (ML) must be reliable and trustworthy. However, ML algorithms are often black box components, such as deep neural networks. To increase trustworthiness in ML, researchers are developing eXplain-able Artificial Intelligence (XAI) algorithms to explain why a particular output was made by the ML component. This gives the user and the

developer a useful insight into the ML reasoning; at the same time, an attacker can also benefit from the explanations of XAI, for example, to design custom attacks exploiting the vulnerabilities explored by XAI. This project examines the impact of XAI methods on attacks on ML models.

RESEARCH APPROACH AND METHODOLOGY

In order to examine the impact of XAI algorithms on attacks, different XAI methods and attacks are evaluated. An attack that most likely profits from XAI methods is an attack called "Adversarial Example". An adversary creates Adversarial Examples by perturbing the input data, e.g., manipulating some pixels in an image. As a result the target ML model creates a false output.

Our algorithm used to create adversarial examples is a black box algorithm, which means it only needs access to input and output of the target model. Black box adversarial example algorithms are slower compared to whitebox algorithms. However, they require only minimal knowledge of the target model which makes them applicable to any model. In every iteration

the algorithm creates a number of images, each with some perturbed pixels and has them classified by the target model. The algorithm calculates the impact to the predictions of the model and applies the perturbations, which increased the probability of the target label (i.e., what the image should be classified as according to the adversary) most, to the image. In the next iteration it uses the perturbed pixels to start its search for other pixels to perturb. This continues until an adversarial example is found [1].

PRELIMINARY RESULTS

The target model used to test the algorithm is ResNet50, a pre-trained neural network for image recognition [3]. Our Adversarial Example algorithm perturbs pixels only slightly and stops after 100 iterations even when no adversarial example was found. We define the second predicted label of the original image as target label.

The algorithm found an adversarial example for our test images in 50% of cases with LIME and in 78% of cases without LIME

PLANNED NEXT STEPS

We will continue our research and try our algorithm with different parameters, XAI algorithms, attacks and target models to see how the attack chain will perform in such cases.

For further research we are looking for experts in security or

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To analyze the effect of knowledge derived from the model by XAI algorithms, LIME (Local Interpretable Model-agnostic Explanations) [2] was chosen to explain the model. LIME is a black box XAI algorithm that explains a prediction based on a locally faithful interpretable representation. We use LIME to explain the predictions of our object detection ML model. LIME finds superpixels in the image that are relevant to a specific output class and creates a mask for the most relevant pixels. The mask created by LIME for the target class are used as an input to the adversarial example algorithm, which now only perturbs pixels that are relevant for the target class according to LIME.

(another 17% were close to finding an adversarial example with LIME, another 11% were close without LIME). The algorithm needed about 6 minutes on average with LIME and 7 minutes on average without LIME using a computer with an Asus GeForce RTX 2080 graphics card. The algorithm with LIME did not find an adversarial example as often which was probably because the algorithm had significantly less pixels to temper with and did also often get stuck within a patch of pixels due to the LIME mask.

machine learning (especially in the area of XAI). Furthermore, for further research we require input on how machine learning is implemented in cars.

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02

Intelligent Audio-Based Monitoring and Audio Generation for Wellbeing

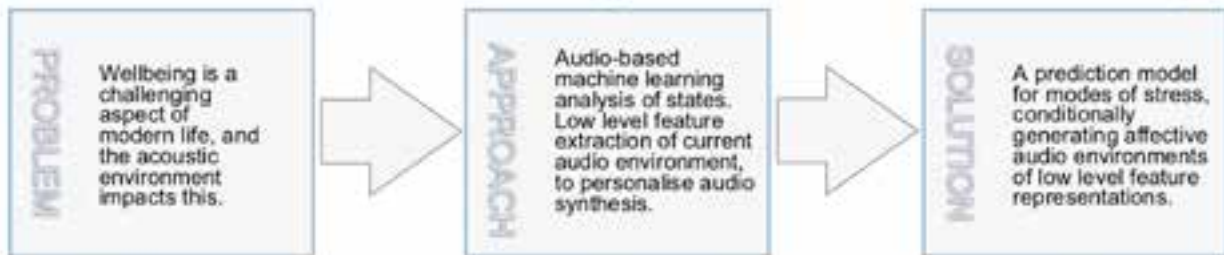
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To generate soundscapes which improve individual wellbeing, use machine learning to monitor individuals affective state, and conditionally generate audio based on learnt emotionality.



Motivation: Studies show that the audio environment impacts wellbeing, both positively and negatively. Diagnosis of acute-stress is growing in prevalence in modern-life, and the noise-floor of urban living is increasing. Audio-based approaches for monitoring are non-invasive, and implementation is less costly.

Methods: Machine learning to monitor biological stress, predicting fluid-based cortisol, skin conductance, heart rate and the big 5 emotions. Conditioning generative networks by affective human state, synthesising audio input based on feature level representations of a current soundscape.

Contributions: Emotion-based audio conditioning, and sonification for machine learning interpretability. Computationally generated soundscapes with personalised individual benefit. Low-level prediction of novel attributes associated with states of stress from non-invasive speech monitoring.

INTRODUCTION

Individual wellbeing is an ever present and challenging aspect of modern life, and the impact of conditions including stress are gaining in global prevalence. Additionally, research shows that uncontrolled audio environments with excessive sound levels

impact human states of wellbeing (particularly in the workplace). With this in mind, this project is exploring intelligent computational audio-based monitoring approaches, to inform conditional audio generation to improve wellbeing.

RESEARCH QUESTION

This project has avenues of exploration; state-of-the-art audio-based methods to monitor affective human states, and generative approaches to personalise listening experiences, both aspects focusing on improving human states of wellbeing (i.e., under stress). Key research questions that this project explores include: (1) Which methods for audio synthesis, and which combination of audio can be used to improve wellbeing? (2) Which data modality and representations are most valuable as a means

of monitoring wellbeing? To this end, some of the expected contributions of this work include; (1) Prediction models for novel attributes associated with states of wellbeing (particularly 'stress') through non-invasive monitoring, (2) computational methods for generating soundscapes with personalised individual benefit, (3) real-time emotion-based audio conditioning, and feature sonification.

RESEARCH APPROACH

This research project takes an empirical approach, with observations from initial experiments informing the end-goal. Ultimately, it is expected that the resulting system will be evaluat-

RELATED WORK

There are numerous studies which guide core aspects of this project, including: multimodal stress monitoring [5], audio conditioning of emotional speech [6], and soundscape emotion based alteration [7]. An extensive overview of properties important to reliable stress monitoring is given in [5], and the authors propose best practices for selection of population, and choice of stress stimuli. This survey assists this project during data considerations, to engage in empirical and reliable analysis. For emotional audio generation, a state-of-the-art approach

PRELIMINARY RESULTS

A number of publications have been accepted to date in direct relation to this project [1-4,8-12]. Most recently in regards to audio-based monitoring of multimodal signals, the use of audio features to predict states of stress have been analysed [1-2]. Of note, the relationship of speech-based features and sequential saliva-based cortisol measurements, as a marker of biological stress was explored [2]. The study found that 10 to 20 minutes after stress the correlation increased between speech features and cortisol, which is in line with prior research on the biological delay of stress, and shows strong promise for the use of speech-based features to predict states of stress. This study will be used as a grounding to inform further state analysis in relation to wellbeing, and as an aspect of conditioning for audio gener-

PLANNED NEXT STEPS

Next steps for this project include further feature level analysis of states of stress from the acquired datasets. With the need for large quantities of data prevalent for deep approaches, transfer learning and data augmentation will also be implemented to expand these datasets. This will lead to the development of a prediction model specifically for stress-based prediction from audio. Additionally, such state prediction will inform audio generation,

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

In the near future user studies will be applicable for significant outcome. With this in mind, it would be of great interest to coop-

ed through user-studies of individuals interacting with various aspects of the personalised audio generation framework.

for speech emotion conversion is given in [6]. Audio conversion is of interest as this may reduce computational processing for emotionally generated soundscapes. Additionally, an approach for monitoring the emotions which are altered by audio (specifically, music) signals is given in [7]. This study explores four emotional states – contentment, depression, anxiety, and exuberance – offering a foundation for attributes of general audio which are connected to specific emotions.

ation. With this said, in regards to audio generation, we found that emotionality can be retained via deep generative networks (specifically, WaveNet), and generated data can be used for augmentation of emotional training data [4]. Additionally, we found that generated audible environments, both from acoustic and synthetic sources, have a slightly positive impact on stress reduction [11]. A number of datasets have also been collected and/or processed for analysis, including BIOS-DB [1] (55 speakers, speaking in a public speaking scenario), FAU-TSST [2] (40 individuals undergoing the renowned Trier Social Stress Test), AWS-DB [8] (88+hrs of 5 classes of audio data known for improving wellbeing), and EmoSynth [12], (synthetic audio instances, labelled by 40 individuals for dimensions of valence and arousal).

and feature level extraction and filtering of real-word soundscapes is currently being explored for real-time augmentation. For example, features related to musicality are extracted from audio environments, and harmonic filtering directly enhances (augments) the audio environment to generate a personalised soundscape with emotional attributes.

erate with researchers working with populations that are a focus to this project (i.e., individuals under stress).

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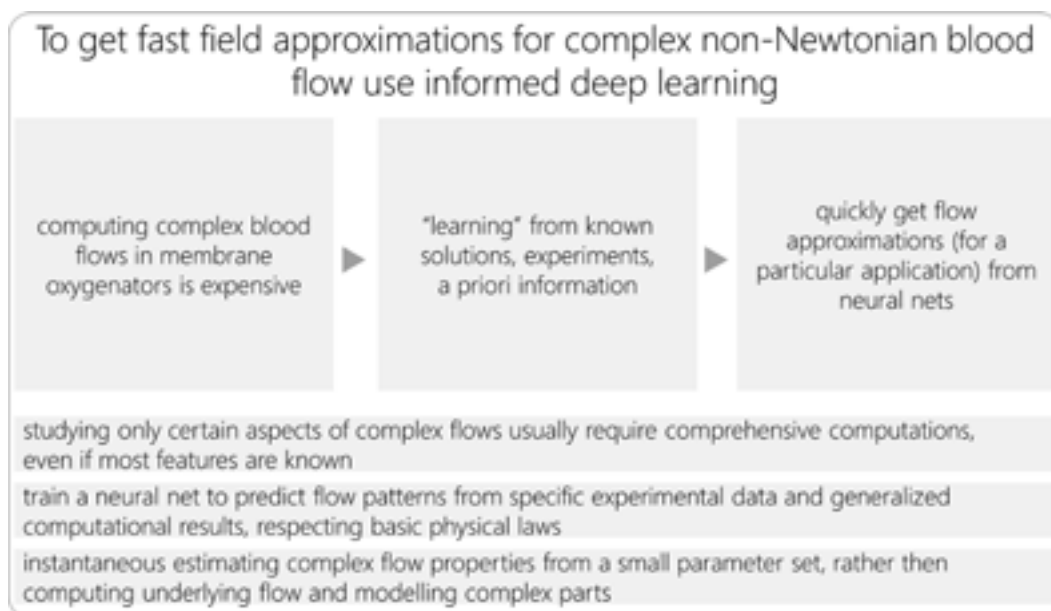
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03

A Novel Computational Approach for Non-Newtonian Blood Flows

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INTRODUCTION

Extracorporeal membrane oxygenation can so far only be a rescue therapy in critically ill patients and bear a high risk of complications. This work is based on the hypothesis that there is a blood coagulation pathway that is triggered or mediated by flow. The understanding of complex blood flows and its interaction

with coagulation even lacks a precise and efficient blood viscosity description. A suitable computational model is necessary to make the underlying complex phenomena more accessible for physicians making therapy decisions as well as for engineers developing artificial organs.

PROBLEM STATEMENT AND RESEARCH QUESTION

Blood flow mechanics are still not fully understood, especially when it comes to interaction with coagulation. The multiscale nature of technically relevant flows makes detailed computations necessary but also very expensive and time consuming. A commonly accepted workaround is replacing the computationally costly part by simple models, capturing only the most relevant behavior. Instead of modeling flow phenomena using classical transport equations, it is possible to use machine learning strategies in order to achieve instantaneous approximations of the

relevant flow field properties. By training a neural network on experimental data it should be possible to create an approximator for a specific class of flows. The aim of the present project is to demonstrate the feasibility of this approximation approach for blood flows in discontinuous geometries. The key question is if the training on a very limited set of experimental data in combination with some knowledge on conservation laws is sufficient to give satisfactory precision in flow prediction.

RESEARCH APPROACH AND METHODOLOGY

To acquire the learning data, parametric experiments with blood in microchannels of different geometries are performed. The statistical movement of the blood components under varying conditions are imaged and analyzed using concepts usually applied in particle imaging velocimetry (PIV) and particle tracking velocimetry. Additionally, a prediction-correction approach using optical flow, improving image correlation quality, is developed. The optical properties of blood are adjusted by making

red blood cells transparent and adding fluorescence dye. From this data, a neural network is trained to instantly predict a flow field based on some generalized input parameters. Since the training data is limited in amount and variety, some additional constraints known from fundamental physical laws (conservation of mass and energy) are implemented in the cost function. A key question is how to assign the weights of these constraints.

RELATED WORK

Theoretical considerations show the power of deep networks in approximating a vast variety of functions [1]. In several applications, Karniadakis and his group show this extensively. They also proposed the idea of physics informed deep learning [2-5]. However, they try to approximate solutions for existing sets of partial differential equations. In the case of blood flow, there is no generally applicable model describing the viscosity.

Thus, the presented approach circumvents the modeling step and gets the solution directly from the neural network, without identifying an underlying model first. In a further step, incorporating interpretation mechanisms, the underlying model is identified. Another idea is to divide the flow field into subsets of recurring features and apply linearized solutions [6].

PRELIMINARY RESULTS

The final experimental setup is in production and pretests of the image acquisition and analysis algorithms have performed well against an industrial PIV setup.

PLANNED NEXT STEPS

The experimental phase will be followed by extensive analysis and processing of the data. Having the data ready, the design, training and evaluation of the neural network will be a main challenge.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

The application of machine learning in fluid dynamics is not very common yet and there are still a lot of open questions. In contrast to image classification, there are no pre-trained networks

available. Thus, expertise, feedback, hints and tips on machine learning in approximating flow fields is highly welcome.

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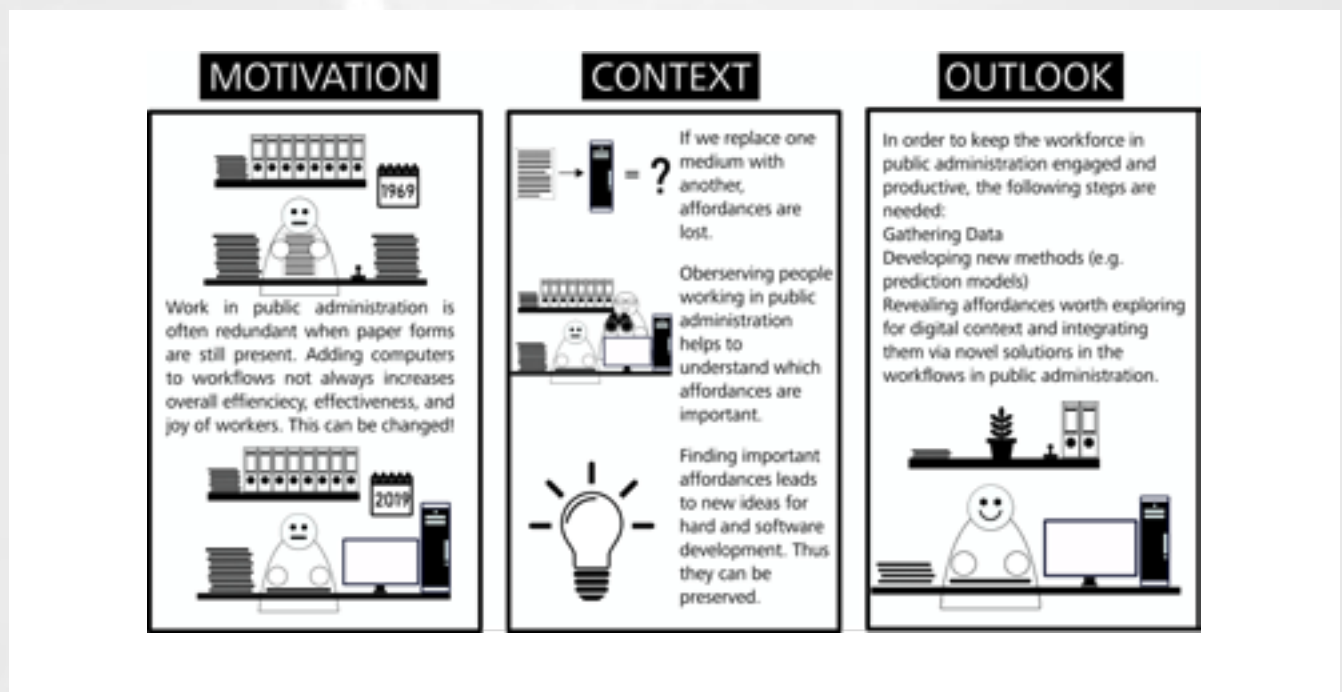
Designing Human-Centered Workflows in the Context of Digitalization in Public Administration

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INTRODUCTION

In Germany, the state is the biggest employer [1]. Working for the government always involves bureaucratic processes, which need to be documented. Historically this was done on paper. Thus, offices are full of physical tools for working with paper - such as stamps, ring binders, or staplers. Looking back at the last fifty years a lot has changed. Today, staff is working with computers, and while there are still some paper forms and paper is used as a storage medium, the government goes to great lengths in order to make administration digital [2]. There might be reason to be worried when looking at this development. Its worth to call to attention that software makes peoples life easier and many

problems could be solved, but some new ones might emerge. We might lose important affordances of the manifold physical artifacts in public administration. Affordances are the properties of an object, which determine how it can be used (e.g., books can be read or browsed, annotated with pens or various other uses). One could ask if staplers, stamps and (physical) forms will disappear in the near future. We might lose productivity and flexibility. The goal of this PhD project is to contribute to our knowledge of affordances and shed a light on those worth preserving.

PROBLEM STATEMENT AND RESEARCH QUESTION

Any state has an interest in an efficient and effective administration. Developing or providing user centered and ergonomic solutions for its workforce accompanies this interest. One pillar of this thesis will be the development of methods for measuring efficiency and effectivity of typical tasks done by administrative staff and, to a lesser extent, their satisfaction when performing these tasks. Those dimensions can be interpreted as a bridge be-

tween human-computer interaction and administrative science (see [3]). Therefore, this overlap and the field of administration informatics inspired the starting point. Another core aspect of my research is the question of how we can reliably quantify efficiency, effectiveness and joy of use of novel (software-) systems in the context of public administration.

RESEARCH APPROACH AND METHODOLOGY

One first contribution will be a comprehensive manifest summarizing the most important aspects for this specific user group. Since HCI researchers and software developers alike will profit from these findings, critical elements in Interaction Design can be identified early and therefore be properly evaluated. Consequently, this will have a high impact since novel hard- and software can be developed with the specific necessities. Those systems affect not only administrative staff but also everyone encountering public administration. In order to develop new methods to compare and evaluate current and novel processes, it is necessary to gather exhaustive data from different authorities. This will be done via different qualitative methods, like field-observation, interviews, shadowing, questionnaires

and contextual-inquiries. Data-logging could contribute to the general understanding but is difficult to justify when thinking about labor law or privacy. If first results are promising it can be considered to fall back on more automated methods. With the gathered information it is possible to quantify and categorize physical and digital affordances, and ideally a prediction model similar to the Keystroke Level Model (KLM) of Card et al. [4] can be built. With generic approaches like this, consisting of a combination of qualitative and quantitative analysis, different prototypes are made comparable and thus identification of deterioration and improvements regarding physical affordances for digital media are simplified.

COOPERATION AND NEXT STEPS

Currently being in the observation stage of this thesis, alliances for first projects have been forged. For example partnerships with some departments of the self-administrative body of the university of Regensburg, like the procurement-division or the human resources department. Further observations will take place in different bureaus of the city of Regensburg (November

2019). Additionally it is planned to reach out to other departments and public offices of the city of Regensburg for possible cooperation. When enough data is collected (approximately in March 2020) model building will begin and first predictions can be evaluated.

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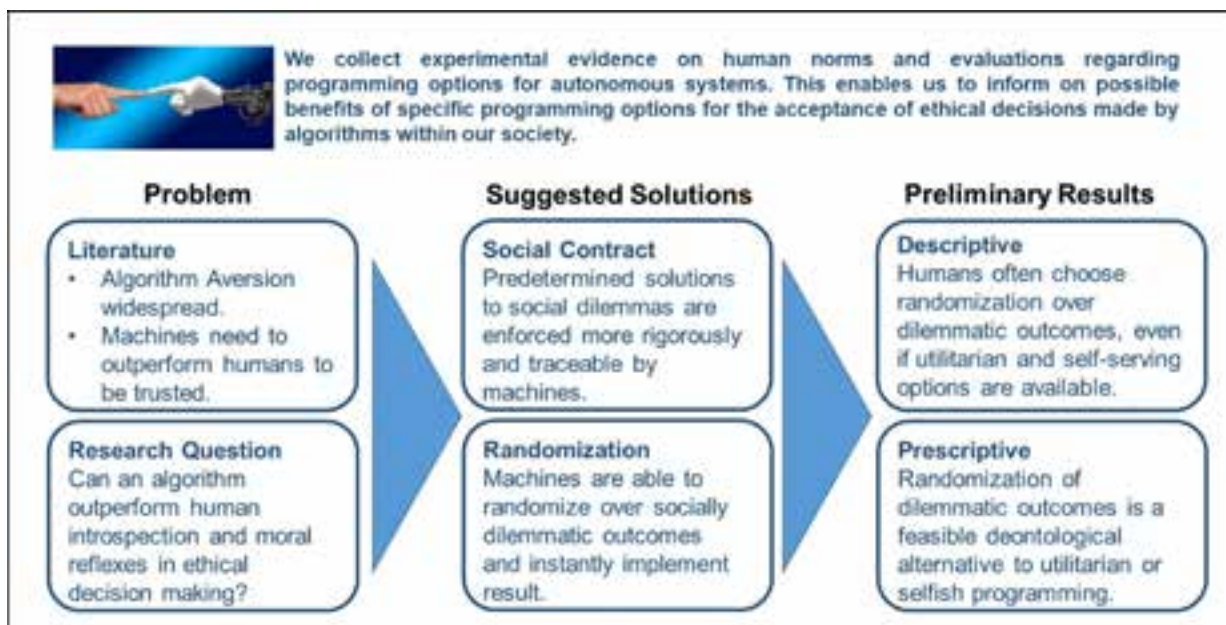
Can Artificial Intelligence Be More Ethical than Humans? Experimental Evidence and Prescriptive Norms

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INTRODUCTION

Artificial intelligence (AI) raises hopes for efficiency and improved moral standards in ethical decision making. If society trusts machines to take ethically relevant actions, it may be able to benefit further from the implementation of autonomous systems in addition to the promise of time saving and unbiased decisions. For example, autonomous cars may lead to safer and fuel-saving street traffic. However, AI, as of today, consists mostly of predetermined decision rules and statistical predictions, which

often stem from machine learning systems, i.e. from unmonitored “black box” systems. These statistical evaluations often mirror the biases present in their underlying data. Scandals arising from biased predictions through AI have caused tremendous trust issues with the layman, concerning the implementation of autonomous systems into our society (Bertelsmann Stiftung, 2018).

PROBLEM STATEMENT AND RESEARCH QUESTION

Machines are normally held to higher standards than human agents. In case a machine only meets the human performance standard, people are intuitively algorithm averse and too untrusting of automated systems to agree to their implementation (Gogoll & Uhl, 2018).

This raises the question how a machine can outperform human reasoning and moral reflexes in the ethical domain. We argue that this can in some cases be achieved by a more rigorous implementation of the ethical standards that society may agree upon than this would be feasible for a human agent. For exam-

ple, an algorithm can be programmed to utterly disregard the gender of applicants. However, to enable rigorous norm implementations, society has to be able to agree upon a clearly defined ethical solution.

For many social dilemmas this will prove impossible. One example is the risk allocation to people involved in autonomous

car accidents. This exemplary case is met with great interest by scientists and society and data of individual programming preferences exists (Awad et al., 2018; Bonnefon et al., 2016). These preferences are inconclusive concerning a possible contractual solution. Deontologists suggest a randomization of dilemmatic outcomes in these kinds of cases, for which society cannot agree upon an ethical solution (e.g. Hirose, 2017).

RESEARCH APPROACH AND METHODOLOGY

We study human behavior and decisions in social dilemmas representative of situations autonomous systems may encounter in the future. Through laboratory experiments, in which subjects face monetary incentives determined by their actions, we study revealed preferences in actual dilemma situations which we vary in a controlled manner. We thus record in which cases people implement a certain outcome directly and in which cas-

es they delegate the decision to an autonomous system (e.g., predefine a rule for later allocations or use a randomization device). By doing so, we are able to understand which machine behaviors are considered ethically valid and improve our ability to lower society's contempt toward the implementation of autonomous systems.

PRELIMINARY RESULTS

We find that many people, even if they are able to implement a utilitarian outcome, randomize allocations in social dilemmas concerning others. If a decision maker does not have own stakes in a dilemma situation, randomization is even as popular as the utilitarian solution.

When their own material interest is at stake, most people decide for the selfish solution and save their own material interest over that of several others. However, in these situations with self-interest, a substantial amount of participants also randomizes over the outcomes. Additionally, randomization is chosen at a

significantly higher frequency than the utilitarian solution. Since selfish programming options will not be sustainable in democracies (Gogoll & Müller, 2017), randomization of dilemmatic outcomes in socially dilemmatic situations may pave the way for a higher frequency than the utilitarian solution. Since selfish programming options will not be sustainable in democracies (Gogoll & Müller, 2017), randomization of dilemmatic outcomes in socially dilemmatic situations may pave the way for a higher acceptance of autonomous systems.

PLANNED NEXT STEPS

Internationalization: We will conduct our experiments in different nations. Awad et al. 2018 elicited strongly diverging norms in different cultures for programming preferences concerning autonomous cars. This promises an international comparison for the case of outcome randomization to prove interesting.

Normativity: Based on normative arguments in combination with our empirical data, we will carve out the possible underlying mechanisms of ethicality ascriptions to certain machine behaviors. The goal is to provide a normative argumentation for and against certain machine behaviors (e.g. randomization).

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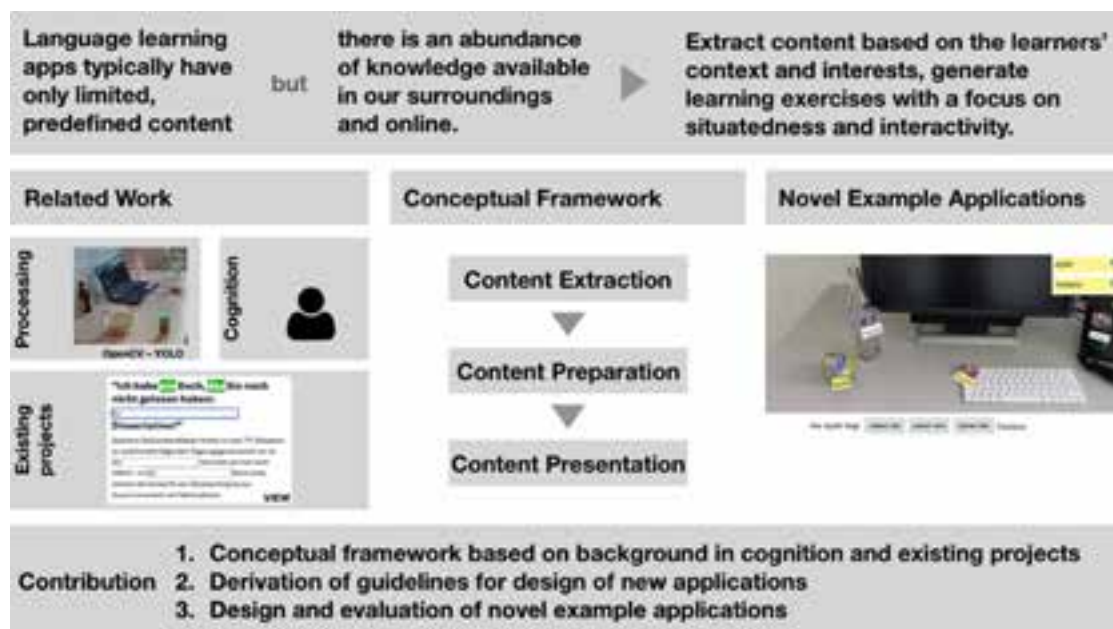
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06

Enhancing (AR) Learning Apps with Auto-Generated Content

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INTRODUCTION

Learning apps are widely used for, e.g., mobile language learning. The content of these apps is usually limited to predefined lessons or flashcards, which, over time, leads to decreased engagement and motivation.

At the same time, there is an abundance of information and knowledge available in our surroundings and online that could be used to generate almost infinite content for learning. For instance, the objects in a room could be used to learn new vocabulary on demand. In addition, context-relevancy has actually been shown to improve vocabulary recall [1]. Thus, the goal of our research is to create a link between available information and learning applications. In the long run, we hope to increase long-term engagement and broaden the area of topics that learning applications can teach without creating additional overhead in topic preparation.

In our work, we analyse existing work on content generation for learning. We review this work in the light of cognitive principles and derive a conceptual framework exploring content extraction, content preparation, and content presentation.

Moreover, we design and evaluate novel example applications with a focus on usability, user engagement, and learning structural concepts in context.

We aim to answer the following questions:

- (1) What content types and sources are suitable to be used for generating learning content?
- (2) How can extracted knowledge be integrated into learning applications to maximise engagement, understanding, and recall?

RESEARCH APPROACH AND METHODOLOGY

The process of content generation for learning entails several steps from extraction to presentation. As HCI researchers, we do not focus on developing advanced information extraction systems, but on researching the application of existing systems (e.g. object recognition) for learning. For our conceptual framework, we analyse such systems and their potential for learning, considering also cognitive principles of learning. Moreover, we explore gaps and potential areas of future developments.

RELATED WORK

Word Sense, an AR app that uses Google Vision to augment real-life objects with translations and multimedia content [2]. Twasebook collects tweets as example sentences for language learning [3] and Meurers et al. developed a browser extension that creates clozes by removing articles/determiners etc. on arbitrary websites [4]. These projects show that it is indeed possi-

We derive guidelines for content extraction and presentation, which we then apply to develop different prototypes of dynamic learning applications. We empirically evaluate these in terms of learning performance and usability. Based on our findings, we refine and extend our development guidelines.

ble to adequately extract suitable content. However, so far, the focus has been on the algorithmic side, i.e. the accuracy and performance of content generation, rather than interaction design and catering to the needs of learners.

PRELIMINARY RESULTS

In addition to literature research, so far, we have developed a first prototypical application that uses AR to teach vocabulary and the description of spatial relationships in German based on real-life objects in the learner's surroundings (see teaser figure). The evaluation was very promising from a usability point of view,

but AR did not lead to better learning performance than a non-contextual app using photographs of similar situations. Moreover, so far, we only computed spatial relationships, the objects themselves still required markers for recognition.

PLANNED NEXT STEPS

As a next step, we will continue our literature research and provide a structured overview to be used as a basis for our conceptual framework. We will extend our existing AR prototype with

automatic object recognition and explore further application domains, in particular also structural concepts outside of language learning.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

Have you worked on an algorithm that extracts information from various sources and would like to investigate potential use cases? We rely on algorithms developed by other researchers, but

can, in turn, contribute with an analysis of practical applications. Please also let us know if you have ideas for potential topics or areas where auto-generated content could be beneficial.

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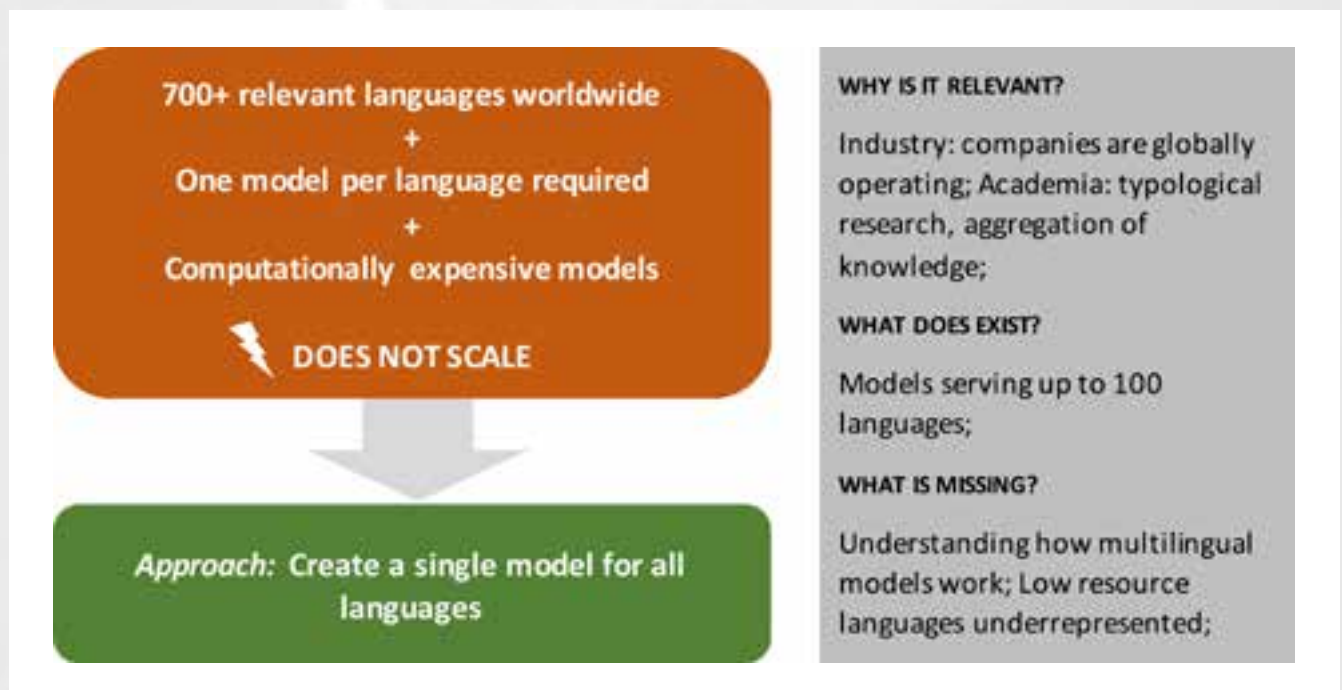
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07

Effective Usage of Multilingual Data in Natural Language Processing

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INTRODUCTION

Natural Language Processing (NLP) showed tremendous momentum over the past years culminating in the publication of several large pretrained language models such as ELMo [1] or BERT [2]. These models achieve high performance in a wide range of tasks, such as named entity recognition or natural language inference. They are deep neural networks with tens of millions of parameters and thus computationally very expensive. With more than 7000 natural languages globally and around 700 economically relevant languages it becomes prohibitive to ob-

tain and maintain one model per language. Yet, due to permanent personalization of services globally operating firms have a need of serving as many languages as possible. Thus, the focus of this research project is on understanding multilingual models, improving multilingual transfer and ultimately contribute towards the goal of having one single model which is capable of processing hundreds of languages.

PROBLEM STATEMENT AND RESEARCH QUESTION

This research project aims at identifying neural network based models and training strategies to obtain models that can solve

a single task, such as named entity recognition, for a large number of input languages. These language invariant models are

useful for several reasons. First, compared to having one model per language fewer models need to be trained and maintained. This reduces the resources required both in terms of human and computational effort. Second, we expect multilingual models to have higher performance by leveraging knowledge across languages and thus more data overall. Imagine having access to all Wikipedias at once, versus only to the German Wikipedia. Key

PRELIMINARY RESULTS

During the first phase of the research project we refined and proposed methods to obtain multilingual representations across 1000+ languages [3,4]. With the raise of contextualized embeddings [1,2] the boundary between multilingual representations and algorithms became fuzzy. In the turmoil of these new approaches the second phase started with several failed approaches: such as extending attention mechanism to process more than 2 inputs (languages) at the same time or improving the mul-

PLANNED NEXT STEPS

The immediate next step is to investigate models such as BERT with word embedding interpretability methods. We use potential insights from interpretability methods to determine the strengths of multilingual signals (e.g., dictionaries, parallel texts).

RELATED WORK

There is a wide range of work regarding multilingual word representations which we discuss our prior work [3,4]. Recently, pretrained multilingual language models have been successfully tested on a variety of tasks [2,6,7]. Some of them use linear transformations to strengthen the multilinguality of these sys-

research questions are: 1) How does crosslingual transfer work. 2) Which multilingual signals are effective. 3) Which modeling decisions need to be made to achieve multilingual models. The research project is structured into three phases: 1) Obtain multilingual presentations 2) Refine multilingual algorithms 3) Establish connections between multilingual and multi-domain processing.

tilinguality of pretrained language models using dictionary based linear transformations. This led to the conclusion that in order to improve the multilinguality of pretrained language models, it is essential to understand more closely how the internals of these models work. To this end we worked on interpretability methods of word representations [5] which we plan to apply to contextualized representations in future work.

We expect that this leads to new multilingual signals that enable more effective transfer. Special considerations are given to identifying effective multilingual signals for low resource languages, as the performance in this case is still unsatisfactory.

tems [8] – an approach that we followed as well. Generally these systems are found to work well and provide a high degree of multilinguality [9]. However, insights why and how the multilingual transfer works are missing.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

1) Recent models in NLP became prohibitively demanding with respect to computation resources. Most state of the art models cannot be handled on university infrastructure. This restricts the research approach we are pursuing. 2) Annotated multilingual data is only available for few tasks such as part-of-speech tag-

ging. Identifying and/or creating new datasets is of high interest. 3) Evaluation of systems for low resource languages is challenging as speakers for rare languages are hard to find. Cooperating with groups which have access to rare natural language capabilities would be great.

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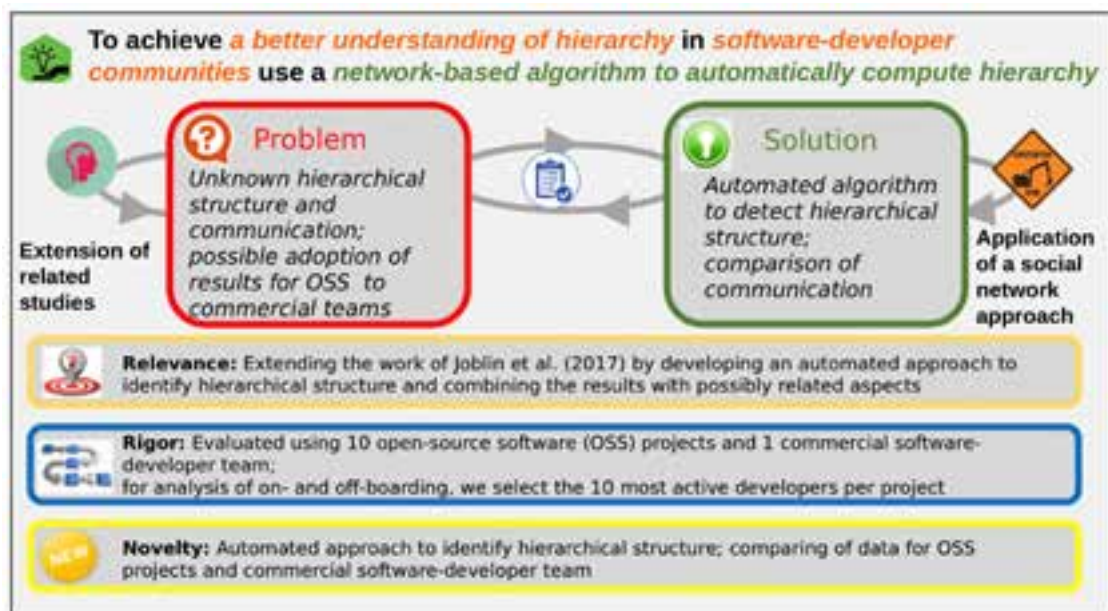
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08

Hierarchy in Software-Developer Communities

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INTRODUCTION

Most of the software around us is developed as open-source software (OSS), or is based on libraries or frameworks that are developed as OSS. It was long believed that OSS communities are chaotic, but different studies suggest an organizational struc-

ture, e.g., hierarchy, and identify this structure as a driver of innovation [3]. Our goal is to analyze the structure of developer communities regarding hierarchy automatically to identify typical patterns of evolution in the OSS communities.

PROBLEM STATEMENT AND RESEARCH QUESTION

Knowing how organizational structures evolve helps us to identify unhealthy patterns, community smells, and also to suggest counter measures. Thus, the main driving research question is: *How does the hierarchical structure in an OSS community evolve typically?*

Based on the analysis of the hierarchy we analyze the career cycle of developers. Critical points in time are on- and off-boarding, because this affects the flow of knowledge. Experienced

developers can help with the on- and offboarding process, as they can answer questions and give hints, thereby directing the knowledge flow. During the off-boarding process of an experienced developer, knowledge preservation is important to avoid the loss of knowledge. A well structured knowledge management helps to keep innovation in OSS projects.

In a further step, we compare OSS projects with commercial projects. To this end, we are observing how a team of a company

communicates. We analyze whether it is possible to adopt our results from the OSS projects to commercial software development teams. It is often not possible to directly analyze commercial software, because the necessary data is not available (contrary to OSS projects with publicly available commit histories and mailing lists). Thus, we formulate the research questions: *Are software developer teams in OSS communities and companies comparable? Can we adapt the results of our research from OSS communities to commercial development teams?*

Our research complements the wide field of mining software repositories and creates new insights by transferring results from OSS projects to commercial software development. Our analysis helps practitioners to evaluate the organizational structure of their teams and judge the organizational structure of OSS projects.

RESEARCH APPROACH AND METHODOLOGY

For the first part of our work, we mine software repositories to obtain the data for repositories and mailing lists. Then, we construct developer networks from this data and determine each developer's hierarchical position in the project's organizational structure based on the developer's number of contacts and the amount of communication among the contacts. This way, we can identify sub-groups of developers and define the position of developers in the hierarchy and their neighborhood. This part is based on the work of Joblin et al. [1] and Ravasz and Barabasi [2].

For the second part, we visit software development companies and observe the developers of software development teams. Besides analyzing the evolution of software and the mail communication, we observe the communication in meetings and through direct speech because most of the communication happens face-to-face.

PRELIMINARY RESULTS

We detected a hierarchical structure in ten randomly selected OSS projects that exists most of the time of the project histories. Most active contributors start at a low level of hierarchy and move over time to a top level, at which they remain. Some of the most active developers leave the projects by moving down the hierarchy again. To become one of the highly active developers, a developer's contacts should be

very active, too. Communication is very important and central in software development for both commercial and OSS projects because developers organize the development process by themselves and share knowledge with each other. The difference between commercial and OSS development is the choice of the communication channel: OSS communities use digital mediums, while commercial, local teams talk directly with each other.

PLANNED NEXT STEPS

So far we visit one commercial team. As a next step, we plan to visit more commercial teams to increase the generalizability of our results.

Furthermore, we are currently combining the detection of hierarchy with the detection of aggressive wording (e.g., in mails) in

OSS projects (e.g. Linux kernel), to evaluate a potential relationship. This way, we can answer questions such as: Do developers in a higher level of hierarchy use more (or less) aggressive speech during communication?

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

We are looking for companies that would like to provide their data for our analysis. Furthermore, we plan to include more OSS projects in our analysis.

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09

The Value of Personal Data: Revealed Privacy Decision-Making in Controlled Laboratory Environments

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WHAT IS THE IMPACT OF DIFFERENT DESIGN PARAMETERS ON CONSUMERS' DATA VALUATION?			
	STUDY 1 <i>Data Type</i>	STUDY 2 <i>Elicitation Method</i>	STUDY 3 <i>Uncertainty</i>
• Opinion on controversial topics [1]	✓	✓	
• Performance in logic test [2]	✓		✓
• Sensitive, personal statements [3]	✓		
• Becker-DeGroot-Marschak [4]	✓	✓	✓
• Reverse Vickrey Auction [5]		✓	
• Hypothetical		✓	
• Ex-post valuation (base)	✓	✓	✓
• Ex-ante valuation (high uncertainty)			✓
• Feedback (low uncertainty)			✓

1	Privacy consent and comprehension questions
2	Data collection <ul style="list-style-type: none"> • 14 statements on socially controversial topics [1] • 16 questions of a logic test [2] • 15 statements on sensitive, personal topics [3]
3	Data valuation (willingness-to-accept disclosure)
4	Additional questionnaires
5	Implementation of experimental outcome <ul style="list-style-type: none"> • Becker-DeGroot-Marschak (BDM)-mechanism [4] • Reverse Vickrey Auction [5] • Hypothetical

Overview of experimental studies.

General experimental procedure.

INTRODUCTION

Due to the continuing digitalization of our social interactions and economic transactions, individuals are now confronted with judgments and decisions regarding their personal data on an almost daily basis. Thus, in a digital environment, individuals have to continually make privacy trade-offs by identifying, assessing and weighing the benefits and risks of disclosing their data. In this context, individual privacy decision-making is likely to be influenced by numerous additional behavioral determinants beyond a purely rational privacy calculus which makes consumers' privacy decision-making a relevant and interesting research

topic. However, up to now, privacy decision-making has mostly been investigated with surveys and field studies. These methods entail some disadvantages as they are based on hypothetical scenarios, elicit stated preferences as well as intentions and may involve confounding effects and low control. In contrast, controlled laboratory experiments would allow to evaluate revealed decisions beyond stated preferences and enable to scrutinize the underlying mechanisms that determine individuals' privacy decision-making.

PROBLEM STATEMENT AND RESEARCH QUESTION

A major hurdle for the development of such experimental investigations is the challenge to induce value for personal data in an artificial laboratory environment and still maintain inter-

nal validity through experimental control. Additionally, it remains unclear which data is suitable to be used in laboratory experiments. To this end, some prior studies have suggested

different data creation procedures as well as different elicitation mechanisms as a basis for investigating privacy decision-making [e.g., 6]. Despite their crucial role, the impact of these different design decisions has not yet been systematically investigated. To address this issue, we develop an experimental testbed that compares participants' (monetary) valuation of different types of personal data and benchmarks different

design parameters. Overall, the empirical findings of this paper aim at providing guidance for future experimental designs that investigate consumers' privacy decision-making and at informing new business models such as Personal Data Markets which enable consumers to actively sell their data and participate in the monetization of personal data.

RESEARCH APPROACH AND METHODOLOGY

We conduct three experimental studies in a laboratory environment (see Figure). In all studies, we elicit subjects' monetary valuation of their personal data, by asking them for their willingness-to-accept (WTA) the disclosure of this data in the experimental session. In Study 1, we vary the type of personal data which is collected and disclosed. In Study 2, we compare different mechanisms for eliciting subjects' monetary valuation. In Study 3, subjects face different degrees of uncertainty regarding their collected personal data. The general experimental procedure is as follows (see Figure): After signing consent forms, participants have to answer several comprehension questions. Next, personal data about the participants is collected and their monetary valuation (i.e., WTA) is elicited. Then, participants have to fill out a questionnaire with questions on the experimental procedure, privacy as well as risk attitudes and demographics. At the end of each session, one participant is selected (randomly in

the case of the BDM treatments) and the experimental outcome is implemented. In the case of data disclosure, the selected participant has to come to the front and say her name which is verified by means of her student card. Additionally, a photo of the selected participant is taken. Her data, her name and photo are then disclosed in the laboratory by displaying them on the participants' screens. The selected participant receives an additional payment of up to 50€ for data disclosure. All participants are paid a fixed payment of 12€ for participation. Participants will be recruited from the student subject pool of the University of Passau using the experimental software ORSEE. Each subject participates in only one of the three studies and in only one treatment (between-subject design). In all three studies, subjects are fully informed about the timeline of the experiment and the consequences of their actions. Additionally, each participant may exit the experiment at any time.

PLANNED NEXT STEPS

Feedback from conference presentations and test sessions is currently incorporated into the experimental design. Experimental sessions will then be run during the winter term 2019/2020. Besides investigating consumers' data valuation, my dissertation

will contain a literature review on data-driven market power and a proposal for an experimental design on the effect of transparency in the context of privacy decision-making.

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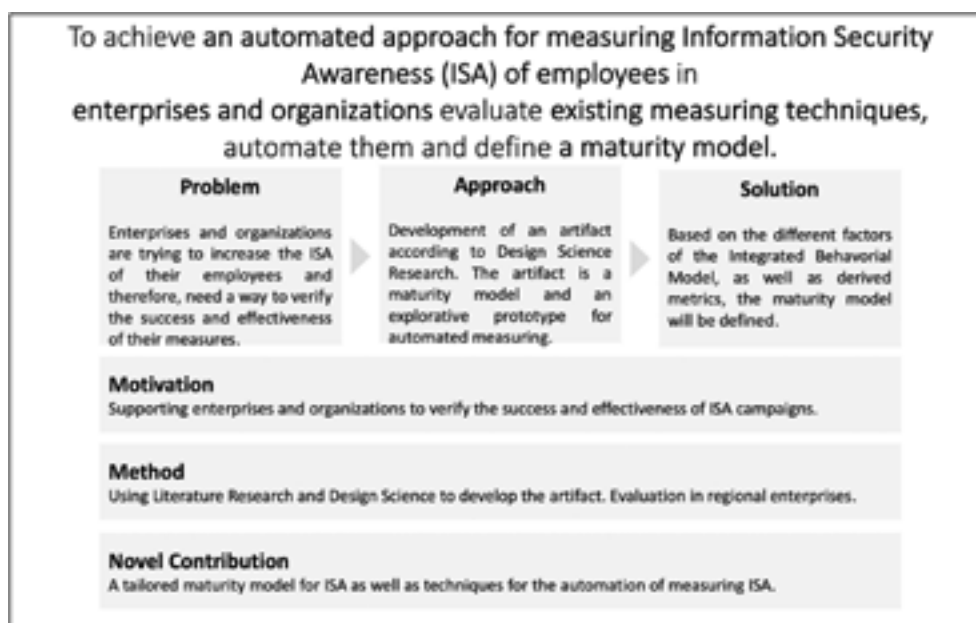
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10

Measuring Information Security Awareness

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INTRODUCTION

In information security, humans play a central role. The behavior of employees affects the confidentiality, integrity, and availability of sensitive corporate information. Risks can occur by criminals exploiting the “human factor” as a weak point with techniques such as phishing, malware, and social engineering [1]. Former social engineer Kevin Mitnick puts it this way: “Cracking the human firewall is often easy, requires no investment beyond the cost of a phone call, and involves minimal risk” [2]. To make em-

ployees aware of their important role, companies typically carry out security awareness campaigns. To verify that the awareness has increased, a suitable measurement method for security awareness is required. The awareness level measured before the campaign has to be compared with the awareness level measured after the campaign. In general, measurement results are required to assess whether actions have been effective.

PROBLEM STATEMENT AND RESEARCH QUESTION

Employees need to be sensitized in order to behave securely and to make them aware of their important role in information security [3]. However, in order to create an individualized approach for sensitizing, measuring is required. Moreover, the measuring

of success and effectiveness is important to justify budget allocation and validate the used methods. Therefore, the main research question is: How can ISA be measured and what is the possible degree of automation.

RESEARCH APPROACH AND METHODOLOGY

The doctoral project follows the artifact-creating research paradigm "Design Science Research". We are examining possibilities for measuring the degree of sensitization of a company and how ISA-increasing techniques can purposefully influence the behavior of employees. We follow the approach of action research,

where researchers and the cooperating institution jointly develop a problem solution. The evaluation with partner companies includes an analysis of the usability and effectiveness of the maturity model. Subsequently, the findings are arranged and summarized in a method.

RELATED WORK

The Integrated Behavioral Model (IBM) [4] is used as a fundamental theory of human behavior. The IBM originates in the field of health psychology and is interpreted in the context of information security. The different factors describe the categories required to cover every aspect of ISA during the measuring. Therefore, I use the IBM to derive metrics and key performance

indicators. Those metrics can be used to determine the maturity of a company and their employees. Moreover, each factor of the IBM leads to another sensitizing approach. Therefore, the maturity model can easily give some recommendations on what factor to focus the campaigns.

PRELIMINARY RESULTS

For my first paper, I carried out a systematic literature review as well as interviews to examine both, theory and practice. The literature as well as the interviewed enterprises revealed that measuring knowledge is not sufficient. The behavior has to be measured in order to verify the ISA of employees. However, en-

terprises state that it is very difficult to quantify human behavior. Moreover, the literature mostly focuses on measuring staff behavior with questionnaires. However, the literature does not offer many approaches with respect to actual behavior.

PLANNED NEXT STEPS

A systematic literature review for existing metrics and key performance indicators is required. Afterwards, the gathered information has to be used to create a metric system. The system

can then be used to define a maturity model for ISA in small and medium-sized enterprises.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

In order to verify and evaluate the results of the dissertation, cooperation partners from industry are required. The resulting maturity model as well as the measuring techniques have to be

tested and optimized since the techniques should be automated as much as possible. In addition, we are looking for opportunities to fund our conference publications.

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11

An Optimal Control Approach to Human-Computer Interaction

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In recent years, the number of mouse clicks and screen touches used to interact with PCs, smartphones, tablets, etc. increased immensely. Even though such interactions have become self-evident to many of us, a scientific understanding of the complex processes of the nervous muscular systems is essential. However, the understanding of movement in the human-computer interaction (HCI) research area is still dominated by Fitts' law, a model of motor control from the 1950's and 60's, which does not allow conclusions to be drawn about the generation of movement.

In the field of human motor control, however, there has been tremendous progress in the understanding of human movement since then. In particular, the theory of optimal feedback control (OFC) has contributed considerably to this. This theory assumes that users can condition their movements on observed input signals and behave optimally with respect to some cost function that represents their internal objectives.

The aim of this thesis is to introduce modern optimal feedback control theory to Human-Computer Interaction (HCI). This can strengthen the field of HCI through a deeper insight into the

basic constituents of interaction, including tasks like pointing, steering, tracking, scrolling and zooming as well as user interaction with PCs, mobile devices, in AR/VR, etc.

For a start, however, the focus will be on mouse pointer movements. Although this seems to be a very simple and straightforward action at the first glance, it is still only partially understood complexity of the human body that makes it extremely difficult to predict the behavior of computer users.

All models that attempt to capture human movements therefore work with simplifications, which, depending on the field of research, either concern the biomechanical apparatus [1], the neuro-muscular system [2], or the intentions and objectives of the users [3]. The main idea is thus to bring these different approaches together in a general framework which, hopefully, leads to a better understanding of the generation of human movements.

The LQR scheme, which already has been applied to pointing tasks including multiple targets by Todorov [4], albeit in a substantially extended variant, seems to be suitable for this purpose:

Here, we can implement both an arbitrary weighted combination of objectives that the users are assumed to optimize given a specific task and linear system dynamics which model the underlying biomechanical apparatus.

As a first step, we used linear second-order dynamics and assumed the following objectives of users in pointing tasks: accuracy maximization, time minimization, and jerk minimization. Moreover, we decided to include three easily interpretable system parameters: the spring stiffness k , the damping factor d , and the jerk weight r . In order to check the suitability of our model, we then fitted these parameters in an additional optimization process to different user trajectories that originate from a one-dimensional pointing task experiment [5]. As it appears, the resulting model approximates the observed user behavior significantly better than the conventional minimum-jerk [3] and second-order lag models [5]. This shows that it is possible to replicate complete movements under the assumption of reasonable objectives and constraints. In addition, the optimal parameters allow us to characterize users by properties and strategies and provide a deeper insight into the variability of mouse movements.

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However, there are still many outstanding issues: Despite the small number and easy interpretability of our parameters we suspect that there is still some correlation between them, leading to unclear effects of the individual parameters. A principal component analysis (PCA) could provide decisive insights in this respect.

Moreover, it would be of interest to apply this model to user trajectories that do not originate from a reciprocal pointing task. Most importantly, the deterministic approach does not allow for a meaningful consideration of visual or proprioceptive perception. The next step is thus to extend the proposed model to include stochastic error terms and distinguish between observed output and actual state of the system.

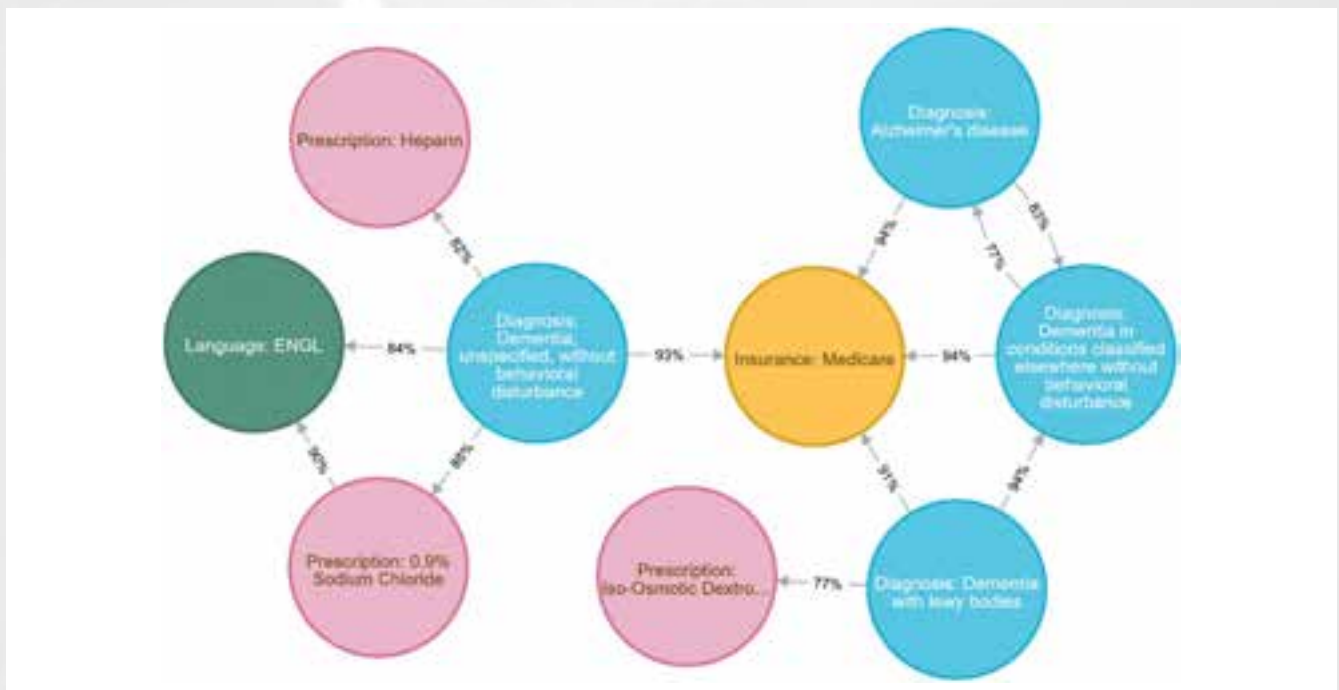
Furthermore, it also seems promising to take the recently developed Cost of Time theory into account, which assumes that humans value time with a certain (e.g., hyperbolic or sigmoidal) cost function [6].

12

Digitalization in Clinical Contexts Using Graph Databases

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INTRODUCTION

Hospitals all over the world have more and more clinical records available which were gathered over the years. This data can be used to improve the treatment of future patients by enabling decision support and may be used to uncover previously unknown connections between different aspects of clinical cases.

New approaches for data integration and analysis are needed. We used a publicly available database [1] consisting of clinical records. We transformed it into a graph and applied association rule mining. This creates a more condensed view of the original data, simplifying analysis.

PROBLEM STATEMENT AND RESEARCH QUESTION

Information from previously documented admissions from different data domains like diagnoses, procedures, prescriptions, demographic data must be integrated. By storing this information in a graph as data nodes, different types of data can be stored in a unified way. Every admission node is then linked to all other nodes that describe the clinical case. As an example, a male patient with sepsis creates an admission node with links

to the 'male' node and to the 'sepsis' node, as well as a patient node that describes the person itself. One patient node can be linked to multiple admission nodes. This format makes it easy to explore all data belonging to an admission, irrespective of its source and type, as they are just the neighbors of the admission node.

While this approach makes the data easier to analyze, a method which automatically detects patterns in the data is still needed. This helps clinicians and researchers understand the data,

which would not be possible without computer support due to its size and heterogeneous formats.

RESEARCH APPROACH AND METHODOLOGY

Treating admissions as baskets and the neighbor nodes as items in the basket, we can mine association rules in the data, i.e. rules of the form $A \rightarrow B$ indicating that the existence of item A in an admission likely hints at the coexistence of item B in the same admission. This is backed by statistical quality measures in the original clinical records. These rules can then be used by clinical staff and researchers to discover new relations between nodes of different types and to use the documented evidence for decision-making for new admissions by learning from similar admissions.

Using data from the MIMIC-III project [1], a graph consisting of a large part of the data has been created, making the database

more approachable for the analysis of single patients and the contents of their admissions. Then, after applying association rule mining to the admissions as transactions and their neighbors as items, we created a new graph, called the rules graph (see figure), by linking the items using the discovered one-to-one rules, i.e. a rule $A \rightarrow B$ becomes a link from the node A to the node B. In the figure, nodes are shown as circles with the type and the content written inside the circle. Arrows of the form $A \rightarrow B$ are rules. The confidence of the rule, i.e. the certainty that if A is connected to an admission then B is connected to the same admission as well, written on the arrow. These links between items can then be analyzed in an interactive way.

RELATED WORK

In comparison to other work, e.g. [2], the presented approach is not restricted to certain domains: all information can be used, and rules can include any type of data and are not restricted to diagnosis \rightarrow diagnosis rules. Additionally, our approach can be applied to general hospital settings – not only to intensive

care data, as in other work [3]. The presented method can also produce all rules and store them in a database. This enables researchers to look at clusters of rules without the need to re-learn rules over and over again.

PRELIMINARY RESULTS

The learned rules could partially be validated using scientific literature. As an example, our approach automatically generated the rule that the sickle-cell trait is mostly found in the African-American population. This finding is consistent with previous research

[4]. Other rules have been found that need scientific validation, mostly on the impact of social factors on the prevalence of various diseases, a field for which scientific evidence is hard to find.

PLANNED NEXT STEPS

Two next steps are planned. First, we will include the temporal information to additionally discover rules of the form “two months after diagnosis A, diagnosis B occurs in 80% of the cases”. Secondly, we plan to implement the proposed method in a

German hospital for a usability evaluation as well as a study on the transferability of rules between hospitals, potentially even between countries.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

Clinical cooperation is very welcome, as more hospitals mean more insight into differences between learned rules. Another

interesting aspect would be to specifically analyze rules around certain diseases like Alzheimer's, cancer, or infectious diseases.

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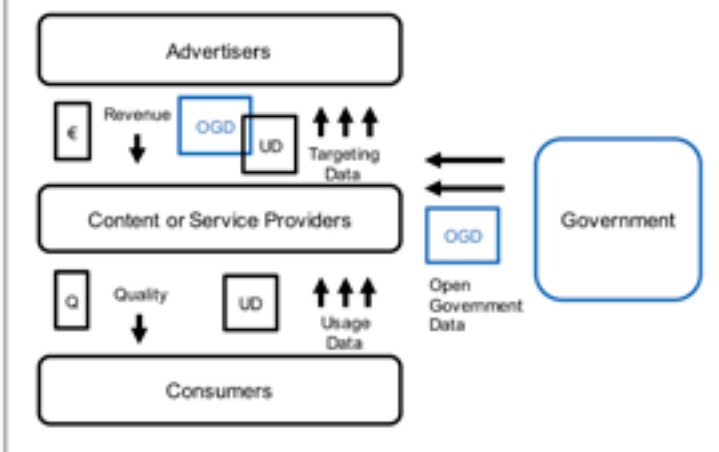
Economic Implications of Open Government Data

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What are the Effects of Open Government Data on the Online Ecosystem?

Stylized Model of the Online Ecosystem



Problem Statement:

More and more, open government data is made accessible for companies. Yet, the effects on the online ecosystem are understudied.

Research Questions:

What are the effects on:

- content or service providers' quality and revenues
- consumers' data provision and welfare

INTRODUCTION

Data is an essential input for value creation in today's digital economy as it enables companies to personalize services, products, advertisement and prices. Thus, it is no surprise that online content or service providers (CSPs) whose business models rely heavily on data exploitation are among the most valuable companies worldwide.

For such CSPs, a common source for data acquisition are their consumers. But there are also other sources from which data can be acquired. One such source is government, which provides access to open government data.

Open government data can be characterized as data and information produced or commissioned by public bodies that is freely useable, re-useable and distributable by anyone, being only subject to attribution and re-sharing requirements [1]. This data may contain, e.g., information regarding businesses, registers, geography, legal content, meteorology, transport and society [1].

In many countries, there is political will to increase the scope and accessibility of such open government data by means of legal reforms. However, studies on the impact of open government data on the online ecosystem are scarce.

PROBLEM STATEMENT AND RESEARCH QUESTION

CSPs often generate revenues by targeting advertisements. To target advertisement, they gather data from their consumers. Open government data might complement or substitute this usage data. In order to get access to usage data, CSPs offer content or services of a specific quality to their consumers. Having access to open government data might, thus, affect the incentive to invest in the quality of a content or service. In consequence, consumers might be harmed by decreasing quality or benefit from better quality. Besides changing the quality investments of a specific CSP, open government data might also

facilitate entry of new companies in the market as it potentially counteracts competitive advantages of larger incumbents. In consequence, consumers might also profit from a wider variety of content or services in the market. My research questions are therefore: How does open government data affect the qualities and revenues of CSPs? How does it influence data creation? And, under which conditions does open government data benefit and when does it harm consumers? The findings bear several important implications for policy makers and managers.

RESEARCH APPROACH AND METHODOLOGY

In order to answer the aforementioned research questions, I deploy a game-theoretic model.

Applying game theory is a well-established research-method in environments where real world data is hard to come by (such as the composition of the concrete datasets underlying a company's targeting algorithms) or hard to measure (such as the quality of content or a service).

The model consists of CSPs offering content or services of a specific quality to their consumers. The CSPs gain revenue from tar-

geted advertisements based on data analytics from the gathered usage data. CSPs invest in quality because consumers adjust their usage intensity to this quality. Having access to open government data might affect the relative value of consumer data and, thus, investment incentives. I will investigate the effects of several types and levels of open government data in the market on quality, provided usage data, welfare (i.e. profits and consumer surplus) and on a new CSP's entry decision.

PRELIMINARY RESULTS

If there is no market entry of new CSPs and open government data can be used to substitute (complement) usage data in data

analytics, companies invest less (more) in content or service quality, which likely harms (benefits) consumers.

PLANNED NEXT STEPS

In the near future, I will investigate the effects of different types of open government data on a CSP's decision to enter the market and the implications for consumer welfare. Thereafter, I will test the model's robustness in several extensions with different

market settings. Besides studying the economic effects of open government data, my dissertation will contain research on personal data markets, which is currently in preparation for journal submission.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

Information from practitioners regarding the granularity of open government data and the conditions of real-time access to this data would be helpful to get a deeper understanding of current

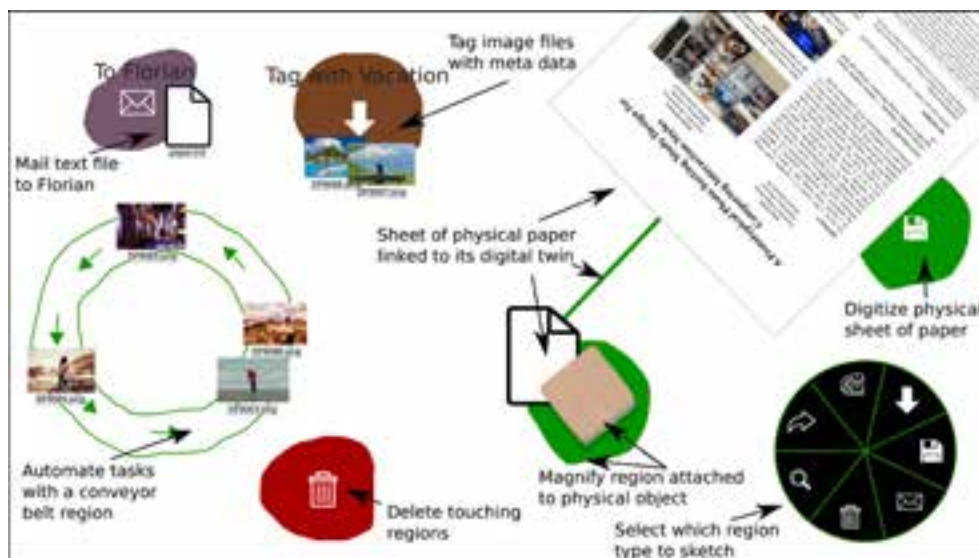
usability barriers. Thus, feedback from open government data providers as well as from data scientists of CSPs would be very much appreciated.

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Core Idea : Users draw regions on a desktop, preferably an interactive table (hinted at by the black border) which apply effects to documents or objects touching them.

INTRODUCTION

In my research, I aim to develop, implement and evaluate Sketchable Interaction (SI), a novel concept for visual end-user programming. It allows end-users to model their digital workspaces and workflows, according to their preferences. Primarily, SI is intended to run on interactive surfaces such as digitally augmented physical desks. Within a SI context, users sketch interactive regions with their fingers, mouse or pen. Such regions apply specific effects to any object touching them, thereby the object's properties such as their visual representation or underlying data are modified. For example, a file icon can be dragged

onto a region and its contents are then shown in a preview on the desktop or sent via email as shown in the visual abstract. Effects apply to a multitude of object types such as digital artifacts and their graphical representation ("file icons"), windows of the operating system, pointers (e.g. mouse cursor), and physical artifacts e.g. paper documents. Users can build complex setups, tools and toolchains for their office work tasks by combining the necessary regions and objects within an SI context. Also, users are able to automate processes via a conveyor belt region.

PROBLEM STATEMENT AND RESEARCH QUESTION

The status quo in public administration office work shows a distinct gap between the digital and physical worlds with regard to workflows or processes. Typically, this work requires the use

of both physical records or paper in general and several important implications for policy makers and managers. digital files. Usually, digital systems for workflows are very limited in

terms of customization and do not integrate physical artifacts. However, people can easily customize their physical desktop and adapt physical workflows with documents to their needs. Therefore, users tend to lose control of their workflows when using current digital systems. Solving this problem allows users to regain lost flexibility and also potentially efficiency. My primary research question is how to build a software system that allows users to design custom workflows or workspaces. Which

properties does it need to have? Which interaction techniques work? How well does the system scale to complex workflows and multiple users. Therefore, this work contributes the ability for researchers and practitioners to explore and expand the concept and reference implementation of SI. Also, it contributes a notation for workflows, which allows users to formalize personal and collaborative processes. Additionally, I plan to deploy implementation versions in actual office environments.

RESEARCH APPROACH AND METHODOLOGY

My research is conducted in five phases. First, I developed an SI prototype for exploration. Next, I fully defined the theoretical concept of SI based on the prototype. Then, I began working on the reference implementation. After that, I will build applications (models of workflows or workspaces) with SI, according to

real processes. Lastly, I evaluate these applications and SI. I will use focus groups and interviews to gather requirements for the most required SI applications. In user studies, I use those applications, in order to measure the participants' performance and to compare SI with the status quo.

RELATED WORK

SI was inspired by the Buffer Framework [1]. However, SI allows arbitrarily sketchable regions which apply effects to both, visuals and data, being more dynamic than static buffers. The idea that everything is a window [3] inspires that SI also works with win-

dows of file managers. Substrates [2] inspire the use of regions as tools and their ability to be linked to physical or digital artifacts.

PRELIMINARY RESULTS

Informal testing revealed new angles for ideas on how to use and expand SI. I developed a notation for expressing SI contexts. I conducted a user study from which I got a better idea on how to evaluate SI applications. While working on the reference imple-

mentation, I determined and solved technical challenges. Most notable here is the problem of the collision check for arbitrary shapes of regions.

PLANNED NEXT STEPS

Currently, I primarily work on the reference implementation. The requirements of the SI applications are evaluated in parallel. After that, the applications will be built and evaluated.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

I am interested in discussing the general concept of SI, especially with regard to potential pitfalls or problems I might have missed. Also, I am keen on suggestions for other areas of application of

the SI concept. Additionally, I look forward to discuss concrete study designs for evaluating SI applications.

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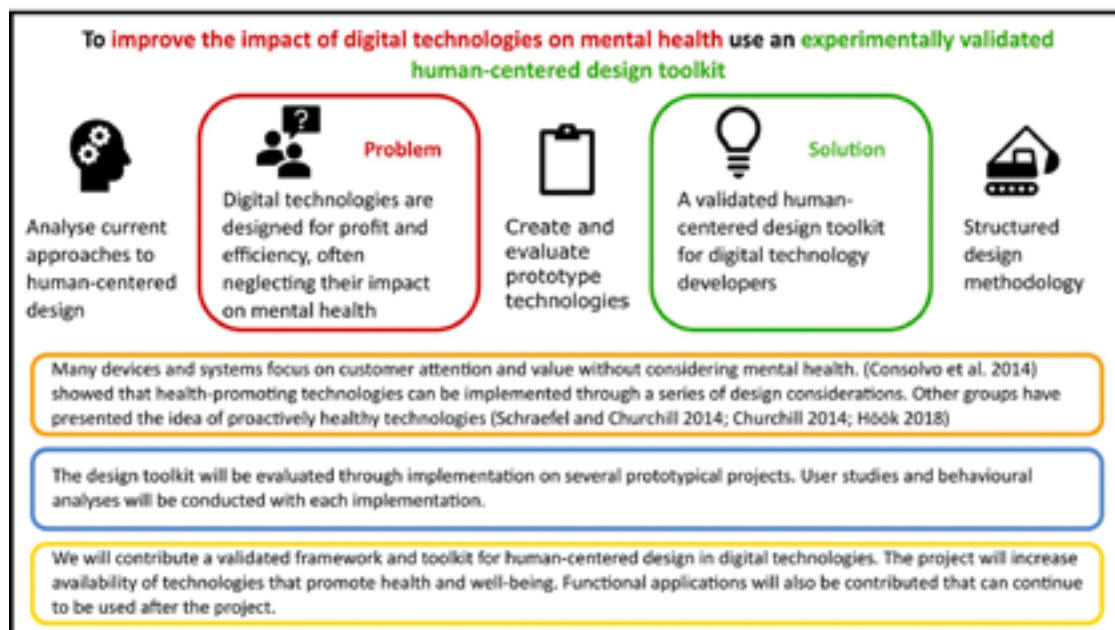
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Human-Centered Development Process for Digital Technologies that Promote Mental Health

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INTRODUCTION

Digital technologies are deeply woven into our professional and personal lives. Many devices and systems are created with a focus on productivity and customer value without considering their impact on human health. This focus is often economically motivated by the 'attention economy' [1], where companies

profit by keeping users on their sites as long as possible. There is a definitive need for an explicit human-centered approach to designing digital technologies that considers the mental health and well-being of end-users.

PROBLEM STATEMENT AND RESEARCH QUESTION

This project aims to develop a structured approach to implementing human-centered design for digital technologies. Developers are currently driven by a focus on cost efficiency and consumer value and lack an effective method to incorporate well-being into the design process. Our research question is

therefore: Can we create a developer toolkit that improves the health-impact of resulting digital technologies?

Altogether the project seeks to increase the availability of technologies that promote mental health and well-being..

RESEARCH APPROACH AND METHODOLOGY

This project is newly formed, and our approach to addressing this research problem can be broadly divided into two aspects: (1) design tool development and (2) prototypical experimentation. We will develop a theoretical human-centered design methodology based on current research and established approaches and use this methodology to iteratively create and test functional prototype applications. Following each prototype, we will analyze experiential data from end-users and empirically strengthen the design methodology.

Example applications include products that promote physical activity or encourage appropriate breaks during work. Our design

framework will encourage developers to weave these aspects into products without sacrificing their intended purpose.

This iterative approach is rigorous and will lead to an experimentally validated human-centered design toolkit that will be practically useful in the development of digital technologies. The toolkit will enable developers to incorporate human-centered design practices into the development process. Creating prototypes ensures that we can integrate user data into the design process and demonstrates the effectiveness of the methodology.

RELATED WORK

Several groups have presented the idea of technologies that proactively have a positive impact on health [2,3,4]. It has also been shown that health-promoting technologies can result from design considerations [5]. No structured approach currently ex-

ists for incorporating well-being considerations into the design of digital technologies.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

This project is part of the ForDigitHealth research network within the Bavarian Research Alliance. Through this network we will recruit input from researchers in psychology, business, and media

science. The end goal of the project is a methodology that generalizes to technologies across multiple fields, so input from external expertise is very valuable.

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Open-Source Simulation Framework for Performance Analysis of Cellular V2X

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Cellular V2X has two modes for vehicle-to-vehicle communication



Performance assessment of modes under realistic conditions



Simulator with accurate models for protocols, communication characteristics, mobility patterns

- Switching of communication mode causes communication outage and packet loss
- Algorithm design for mode switching: 1. forced, 2. signal strength-based, 3. load-based
- Mode switching decision for each algorithm specified by cost functions.
- Decomposition of overall mode switching procedure into subsequent phases (detection, synchronization, resource allocation and configuration).

INTRODUCTION

Cellular-V2X is a cellular network-based communication technology that aims to facilitate communication between vehicles and roadside infrastructure in order to improve traffic safety and

efficiency. It enables vehicles to share a common perception and awareness of other traffic participants, thereby improving traffic efficiency and road safety.

PROBLEM STATEMENT AND RESEARCH QUESTION

Cellular-V2X provides two resource allocation modes: when the vehicle is located in the coverage of the cellular network, the corresponding base station manages the transmission resources for the direct message exchange. In the out-of-coverage mode, the vehicle does not require cellular coverage and allocates its resources autonomously. The scope of the doctoral research involves an in-depth study of radio resource

allocation procedures for Cellular V2X communication over the LTE sidelink PC5 interface. The key requirement of sidelink resource allocation is to facilitate uninterrupted exchange of messages between vehicle user equipment (UEs) irrespective of their geographical location (inside or outside the base station coverage region). In addition to configuration, allocation and scheduling of time-frequency resources, we have identified

that a vehicle should be able to seamlessly switch between the resource allocation modes based on the availability of network

coverage, quality of received signal strength and time taken for synchronization.

RESEARCH APPROACH AND METHODOLOGY

In the first step, we have developed a discrete-event based simulator of the Cellular V2X protocol stack that aims to evaluate the resource allocation concept under realistic conditions as described in the figure. The simulator is based on the OMNET++ simulation framework and uses the data plane of the SimuLTE simulation library. In order to understand the impact of mode switching on the message exchange, the duration of the mode switching procedure is divided into four sub-stages –

detection of cellular coverage, time synchronization, resource allocation and configuration. By setting up different application scenarios of V2X communication, i.e. vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-network (V2N) using the SUMO traffic simulator model, we aim to calculate the latencies incurred at subsequent stages of the mode switch procedure.

RELATED WORK

A scientific study related to the performance assessment of mode 4 with the help of analytical models is carried out by Gonzales-Martin et al. [2]. The system level performance of sensing-based semi persistent scheduling (SB-SPS) is assessed

by Molina-Masegosa and J. Gonzalez [3]. The performance of WLAN-V2X (IEEE 802.11p) and Cellular V2X in the context of platooning is studied by Jornod et al. [4].

OPEN RESEARCH QUESTIONS

Management of resources such as spectrum, transmission power, storage and computational efficiency is critical for the proper functioning of vehicular networks. A mainstream approach to radio resource allocation involves the formulation of an optimization problem based on certain constraints. Most of the existing optimization techniques take into consideration that the channel environment is relatively stable. For resource allocation, obtaining a precise timing synchronization is important and becomes critical

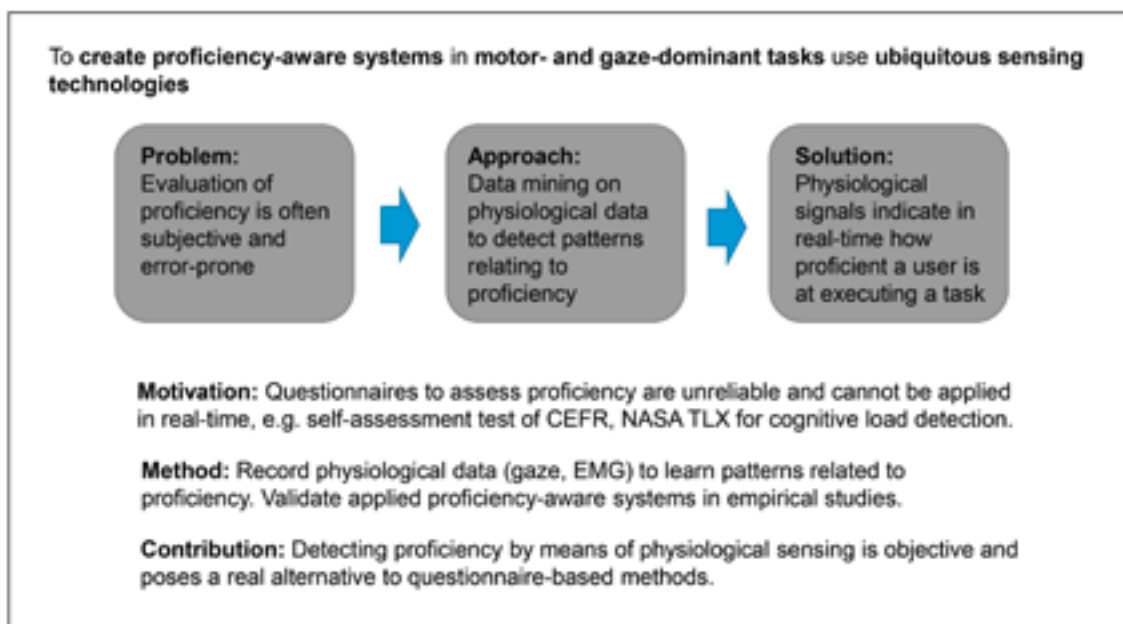
when the traffic load on the cell increases. When a vehicle UE has to switch between the resource allocation modes, it fails to acquire radio resources if synchronization has not taken place. In order to tackle the problems of synchronization during mode switching, we intend to employ reinforcement learning techniques to effectively distribute the vehicular traffic load which will subsequently ensure fast synchronization.

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INTRODUCTION

Mastering skillful tasks is something we all strive for. Be it a hobby – like playing an instrument – or work-related tasks, such as operating machinery. Yet, measuring proficiency for these tasks often relies on subjective measurements, e.g. self-assessment or expert supervision. These are often error-prone, hence accurately measuring proficiency is unreliable.

Physiologically-based interaction has proposed a means to remedy this problem. For selected tasks, one can easily distinguish

an expert from a novice using the right modality. In our work, we focus on tasks that deal with a human’s ability to recognize information and interact with objects. Therefore, we focus on employing gaze tracking to record a user’s eye movements as well as electromyography (EMG) to record their muscle activity. This allows us to tailor the necessary proficiency detection to the task at hand.

PROBLEM STATEMENT AND RESEARCH QUESTION

Subjective evaluations are error-prone and unreliable. Leveraging physiological sensing, one can infer objective metrics that relate to a person’s proficiency when executing a task.

Additionally, realizing proficiency-aware systems highly depends on the availability of real-time detection, favoring physiological sensing. Our key research questions focus on how these modalities can be used to their maximum potential. This

is highly task-dependent as one modality may be suitable for ad hoc proficiency detection while others are more suited for prolonged tasks and continuous proficiency estimation.

We aim to provide guidelines on how to create proficiency-aware system, mainly focusing on gaze and EMG as input modalities, that foster research and enables developers to utilize these modalities in adaptive systems.

RESEARCH APPROACH AND METHODOLOGY

We define proficiency-aware systems as follows: systems that can sense a user's proficiency and adapt the content, the presentation, and the interaction. Hence, every system is comprised of two modules: proficiency detection and adaptation.

For the latter, we focus primarily on adapting the presentation aspect. This allows us to keep the content the same, while adjusting to the user's need, e.g. presenting content in another language [1].

When it comes to proficiency detection, we favor ubiquitous sensing technologies, allowing for easy integration into existing system. Here, gaze is a very expressive indicator for a person's

focus and interest. Furthermore, EMG helps us to identify dexterity, indicating novice or expert handiwork. It is important to note that any proficiency-aware system should consider the context of interaction as well. This decides whether coarse estimation of proficiency is sufficient [1] or fine-grained estimation is needed [2].

To evaluate and validate our results, we use empirical studies that compare recorded physiological measurements to state-of-the-art questionnaires. Since this comparison is not possible for live systems, we use task metrics, such as play accuracy in EM-Guitar [2] to validate the usefulness of the system.

RELATED WORK

For gaze-related work, we mainly focus on detecting patterns in eye movement data [5]. Here, we proposed a method [1] that realizes near real-time feedback for the user. On the EMG side

we look at the technical feasibility [4] and also how to design interfaces for EMG interaction.

PRELIMINARY RESULTS

We addressed the user's language proficiency and leveraged robust gaze features to detect whether users were able to read the displayed language [1]. We further evaluated a user's skills in programming [3], but could not identify patterns relating to proficiency.

In EMGuitar [2], we opted for a fine-grained proficiency detection by leveraging electromyography to infer a user's skills when playing the guitar. Here, we adapted the playback speed of our tutoring system, when the user is struggling to play correctly.

PLANNED NEXT STEPS

In future research, we plan to combine both modalities into one system that allows for coarse- and fine-grained estimation when needed. For this purpose, we look into tasks that require hand dexterity.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

Measuring physiological signals is usually highly person-dependent. It is thus essential to minimize the impact of necessary calibration procedures. Other domains are facing this issue as well and we envision adapting their solutions and concepts for our

approach. Here it might also be beneficial to identify tasks in need for live proficiency detection.

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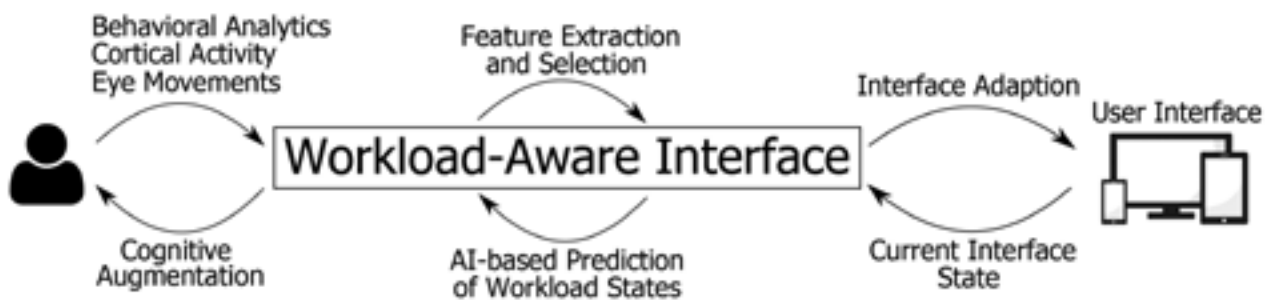
Mind the Load: Workload-Aware Interfaces for Cognitive Assistance

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Example of a workload-aware interface pipeline. Users provide individual physiological data for real-time analysis. Analyzing the data is used to provide cognitive augmentation through (a) task distribution, (b) interface adaption, and (c) cognitive self-reflection.

INTRODUCTION

The analysis of user states for context-aware applications has been extensively explored. Thereby, context-aware computing has proliferated the integration of sensors in stationary and wearable technologies. These take factors, such as physical activity or current location, into account to provide a user-tailored experience.

One, yet scarcely, explored topic is the real-time quantification of cognitive workload. Since numerous factors contribute to cognitive effort, we define cognitive workload as mental demand which is exerted through the recall and processing of information in the long and short-term memory. High cognitive workload can elicit frustration during a current action while low cognitive workload may rise boredom. Thus, the “sweet spot” between cognitive over- and underload has to be found to maximize the overall task engagement.

Memory and cognitive performance are known to decline with aging, a matter of fact which is supported by an older becoming

society. One aim in the domain of Human-Computer Interaction (HCI) is the minimization of cognitive workload while keeping the task engagement high. Questionnaires, interviews, and think-aloud studies provide meaningful insights into the experienced workload of users while interacting with computers. However, these methods are difficult to apply in practical settings as they are susceptible to subjective perception, require users to rate their experience, and require users to remember their past performance.

The proposed thesis closes this gap by introducing workload-aware interfaces into the domain of HCI. Cognitive workload is envisioned as an additional dimension in the paradigm of context-aware computing which is reactive or reflective towards the user. We (a) propose the use of physiological sensing as a real-time measure for cognitive workload that overcomes the need for subjective assessments, (b) evaluate applications that reduce cognitive workload in work and home settings, and (c) discuss the ethical implications of

using devices which are ubiquitously aware of cognitive states. This thesis envisions computer systems as ubiquitous companions that

sense the cognition of user interface intervention and self-reflection.

PROBLEM STATEMENT AND RESEARCH QUESTION

Three pivotal research questions have emerged when comes to support users in their diurnal chores. First, augmentation strategies for concurrent tasks need to be researched. Cognitive aiding which does not foster engagement is detrimental for the overall user performance. The first research question deals with the design of workload-aware interfaces:

RQ1: What are the design guidelines of workload-aware interfaces?

Second, cognitive workload must be quantified in real-time by a system. Behavioral patterns and physiological measures can be employed to accomplish this:

RQ2: What are suitable strategies and measures to quantify cognitive workload?

Finally, both concepts can be applied to generate applications that adapt to the current level of cognitive workload. This includes a design that provides awareness about the data collection and processing policy as well as self-reflection strategies which inform users about the experienced workload:

RQ3: How can workload-aware interfaces in applications be used to provide in-situ assistance and reflective feedback?

RESEARCH APPROACH AND METHODOLOGY

A user-centric approach was applied to answer **RQ1**. Interviews and observations were conducted during diurnal chores to initially detect cues for cognitive assistance in home and work environments [1, 2], resulting in design implications for the future design of workload-aware interfaces. A literature review of sensing modalities was the reason to focus on the three sensing modalities eye tracking [4], electroencephalography [5], and electrodermal activity [6] to answer **RQ2**. Significant changes in eye

movements, pupil dilation, and cortical activity were found for different levels of cognitive workload. Applying machine learning techniques showed high practicability of the selected physiological measures.

Finally, **RQ3** is answered by providing reference implementations which evaluate the researched concepts [6, 7].

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Pose Based Intention Detection of Vulnerable Road Users

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 To achieve precise forecasts of trajectories of vulnerable road users (VRUs) consider all previous body motions, such as arm, leg, or upper body movements.

Problem



Error-prone forecasting of the intentions of VRUs solely based on their past trajectories.

Solution



Use of machine learning methods to improve forecasts by using the entire body poses estimated based on camera data from a moving vehicle.

Motivation	VRUs are exposed to a considerable danger in road traffic. To increase their safety, accurate forecasts of their future trajectories are necessary.
Dataset	Evaluated on data gathered in real traffic with a sensor-equipped vehicle, covering pedestrians and cyclists.
Novel contribution	Use of body poses for trajectory forecasting of pedestrians and cyclists.

INTRODUCTION

In today's worldwide traffic, more than half of the fatalities occur to pedestrians, cyclists, and motorcyclists [1]. In order to increase their safety, Driver Assistance Systems and automated driving functions must be able to forecast their future trajectories. The body pose of these so-called vulnerable road users (VRUs) is of great importance for intention detection and trajectory forecasting. For example,

starting motions of cyclists are often preceded by arm movements [2]. Therefore, the objective of this work is to improve trajectory forecasting by using 3D poses, which describe the posture of arms, legs and torsos. This requires an estimation of the 3D poses from a moving vehicle in the first place.

PROBLEM STATEMENT AND RESEARCH QUESTION

In order to be able to use 3D poses for trajectory forecasting, they need to be estimated in real road traffic from a moving vehicle equipped with suitable sensors. This is a challenging task due to large distances, occlusions caused by objects or by the body of the respective VRU itself, and varying environmental conditions.

To improve the trajectory forecasting of VRUs, appropriate methods need to be developed that are capable of taking 3D poses into account. In principle, two different approaches are possible: modeling of the behavior of, e.g., pedestrians in a single model or use of specific models for different motion primitives, such as starting of a pedestrian or turning of a cyclist,

which are selected according to the respective intention. This requires a preceding motion primitive classification, which can

also be done using 3D poses.

RESEARCH APPROACH AND METHODOLOGY

This research uses a quantitative, data-driven approach. It tries to gain new insights from the collected data. Therefore, statistical methods and machine learning techniques are used. All findings are evaluated based on data gathered with a sensor-equipped vehicle in real traffic.

Research concerning the use of poses for motion primitive classification and trajectory forecasting is currently limited. Image based 2D poses were used by Fang and López [3] in combination

with a Random Forest and a Support Vector Machine for intention detection of pedestrians from a moving vehicle. Quintero et al. [4] used balanced Gaussian Process Dynamical Models for intention detection and trajectory forecasting of pedestrians based on 3D poses. However, the method was trained and evaluated under ideal conditions using a high sampling rate and low noise dataset, which was recorded indoors.

PRELIMINARY RESULTS

With the help of a vehicle equipped with appropriate sensors and state-of-the-art methods for 2D and 3D pose estimation [5, 6], trajectories of pedestrians and cyclists including their 2D and 3D poses could be extracted from real scenes in road traffic. The accuracy of the 2D and 3D poses was evaluated using manually labeled poses [7]. The obtained errors are sufficiently small in relation to body size to characterize respective body poses. However, the errors for cyclists are greater compared to pedestrians and increase with growing distance to the recording vehicle.

With regard to motion primitive classification, the use of poses has improved the early detection of start intentions of cyclists compared to a solely trajectory based classification [8]. Furthermore, the trajectory forecasting of pedestrians as well as cyclists has been enhanced. The biggest improvements have been achieved for starting and stopping VRUs. These movements are difficult to forecast and of particular importance for the safety of VRUs in road traffic.

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Assistance Functions Using Augmented Reality for People with Central Vision Loss

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Help people with central vision loss in everyday tasks using AR



Central vision loss, i.e. scotoma, results in problems with tasks requiring high acuity.

Augmenting the world leads to faster task completion times and lower workload.

Different designs for augmentations provide help in different scenarios.

* Wikimedia Commons [3]

INTRODUCTION

Diseases like age-related macular degeneration (AMD) and genetic conditions like Stargardt disease affect a large portion of the population. In Germany, 7.5 million people show symptoms of AMD. These diseases lead to central vision loss (CVL). This results in a lower acuity compromising daily activities, such as reading, mobility and social interactions. Most of these require the interaction with interfaces. Current assistive technologies use handheld and head mounted electric or analogue magnifiers.

We want to go beyond simple image enhancements. In our approach, we add task-dependent augmentations to the real world. These substitute the missing information by either guiding an action of the user or displaying the information in a condensed and visually simple design. This enables people with visual impairments to complete tasks, which they would otherwise not be able to complete without help. For other tasks, the required task completion time and the workload are reduced. This significantly improves the quality of life for affected persons.

PROBLEM STATEMENT AND RESEARCH QUESTION

There is an increasing number of people with CVL. As most of the diseases have no medical treatment which can reverse the progression and restore full vision, these people have to rely on assistive technology for many everyday tasks. Using augment-

ed reality (AR) glasses as assistive device for persons with visual impairments seems promising. AR has advantages over auditory devices designed for fully blind people in loud situations and when conveying private information.

We want to investigate situations in which AR can provide better assistance compared to existing devices. In addition, we want to evaluate the augmentations designed for each task and find suitable augmentations.

We envision, a finished system together with more advanced hardware (as current AR glasses are heavy and big) will lead to a ubiquitous and versatile assistance application. This will improve the quality of life for millions of people with visual impairment.

RESEARCH APPROACH AND METHODOLOGY

We investigate problems of people with CVL by conducting an extensive literature research and in addition ask patients in semi-structured interviews about their personal experiences and difficulties in their everyday life. We use this information to develop and design systems that assist them.

We design multiple variants for each task and evaluate the different augmentations compared to each other and to current state of the art technology. Doing so, we can find optimal solutions and apply a human-centered design process by involving patients directly.

RELATED WORK

There are many problems for people with visual impairments, which even cause depression and influence social activities. [4]

Research with head mounted systems using video see-through have been around for a while. While this technique offers more options, such as to undistort images [2], AR is more fitting for everyday use.

Zhao et al. proposed CueSee, an AR systems for users with low vision for shopping, in 2016 [3]. Our designs focus on the peripheral vision to target users with CVL.

PRELIMINARY RESULTS

Patient feedback for early prototypes has been very good. Patients generally are amazed about the possibilities and easily find more situations to augment. Our ongoing work shows significant improvements in accuracy, faster task completion times and a reduced workload.

The preferred, as well as the best, augmentation varies widely between participants and is highly dependent on their medical condition and already adapted strategy for coping with CVL, e.g. eccentric fixation. Our parametric augmentations are adjustable in size, line width, color, intensity, orientation, etc. This enables patients to customize the system to their needs.

PLANNED NEXT STEPS

In the future, we plan to integrate more functionality into our system. Further, we want to use virtual reality to simulate CVL. This serves as a demonstration for family or medical staff to visualize the effects of CVL.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

Our main concern now is getting in contact with persons with CVL. We are planning to cooperate with multiple doctors or professors from the field of ophthalmology to increase our range.

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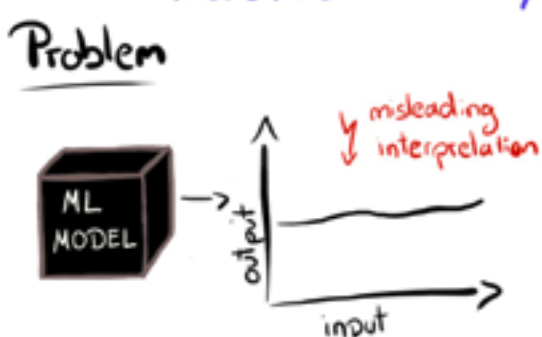
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To correctly interpret machine learning models use indicators that warn you of interpretation issues.

Problem



Interpretation methods such as partial dependence plots and feature importance can be misleading when features depend on each other or when the machine learning model covers feature interactions.

Solution



We develop indicators for possible interpretation issues such as feature interaction. These indicators can help practitioners to avoid wrong machine learning model interpretations.

INTRODUCTION

Machine learning models do not come with explanations of how they derive their predictions. Fortunately, there are many model-agnostic methods for interpreting machine learning models, for example permutation

feature importance and partial dependence plots. Feature importance ranks the inputs by how important they were for making predictions and feature effects plots show how a feature affects the predictions on average.

PROBLEM STATEMENT AND RESEARCH QUESTION

Technically, model-agnostic interpretation methods can be applied to any machine learning model. But the resulting feature effect plot or importance value can be misleading or even wrong when the model is complex (e.g. strong feature interactions) or when the features are not independent of each other. For example, a partial dependence plot might show that a feature has no effect on the prediction. In truth the feature might have a strong effect, but groups in the data with opposite ef-

fects can cancel each other out when averaged. The presence of interactions or dependence alone is not sufficient to imply problematic interpretations. Thus we want to quantify – dependent on model and data – how feature interaction and dependence affect a given model interpretation. Such indicators could warn the user of interpretation issues or suggest alternative interpretation methods.

RESEARCH APPROACH AND METHODOLOGY

As a first step, we identified two frequent sources of misleading or wrong interpretations: 1) Many interpretation methods such as permutation feature importance assume an independent distribution of features. 2) Since feature effect plots are averaged over the data, the plots can hide heterogeneity of the effects when feature interactions are present. For these two cases, we aim to develop indicators that quantify how much they affect a certain interpretation.

For the indicator of feature interaction we plan to make use of the decomposition of the prediction function into lower-dimensional components. For the feature dependence indicator, we are still investigating different ways to express how much the distribution of a feature depends on the other features. The dependence indicator has to reflect that dependence alone does

not cause problems, but the machine learning model predictions must differ between conditional and marginal distributions of the features.

The project is in an early stage. We plan to simulate various datasets with different levels of correlation and interaction and compare whether our indicators reflect the simulation settings. Furthermore, we plan to apply these indicators to a machine learning model for real data to highlight their use. We expect that interpretation issue indicators improve the interpretation of machine learning models amongst researchers and practitioners. We plan to incorporate the interpretation issue indicators into the R package *iml*, which already implements various interpretation methods.

RELATED WORK

An alternative to indicators would be to develop new methods that avoid the problems (e.g. Accumulated Local Effect Plots [1] can replace Partial Dependence Plots in case of feature dependence). Other publications have suggested solutions for feature dependence [1,2] and feature interactions [3]. The suggested solutions are more complex than the methods they replace (partial dependence plots and permutation feature importance) and

as such only recommended to be used when necessary. We take a different but complementary approach by quantifying how strong the negative impact of dependence and interactions is. Based on these indicators, it is possible to suggest when to use a more complicated method.

PRELIMINARY RESULTS

In a first publication [1], we suggested an interaction strength measure (and other model complexity measures) based on functional decomposition and illustrated that more complex models are harder to interpret. We also held a student seminar in which students investigated limitations of machine learning model in-

terpretations. From this seminar we got valuable insights, e.g., that the dependence issue only occurs for certain models and situations.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

Since the project is in an early stage, discussions about the best way to measure dependence and interactions can be helpful. We want to demonstrate the measures with real data, so we are in-

terested in collaborating with someone who works on a machine learning application with need for interpretability.

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VR Prototyping Tool for Ultrasonic Levitating Interfaces

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INTRODUCTION

Ultrasonic Levitation Interfaces promise a future in which the computer can control the existence of matter in our environment, truly merging physical and virtual worlds. This is similar to Programmable Matter [1], which proposes to create environments out of tiny robots. However, with Ultrasonic Levitation, power supply, actuation, and computation are placed in the environment, making the individual atoms simpler and cheaper. In addition, the user can interact with the interface without any devices; the same hardware that is used for levitation, apart from the visual, can be employed

to produce audio and haptic feedback; and the content is real and visible from many angles, hence supporting collaboration and multi-user interaction. Finally, the novelty of the technology and its 'magic-like' appearance triggers people's curiosity and encourages users to engage with the display. Due to the benefits stated above, *Ultrasonic Levitation Interfaces* are becoming a promising and growing subfield in Human-Computer Interaction [2,3]. However, the majority of current research focuses on the technical aspects of acoustic levitation, as a new technology.

PROBLEM STATEMENT AND RESEARCH QUESTION

To our knowledge, there has not been any content created especially for this type of novel medium, so far. Hence, even though the technology exists, we are scratching the surface

in terms of its full potential in application. The main problem is that interaction designers, game developers and most researchers do not have access to a levitating interface and/or

are not equipped with the required skillset, that would allow them to design exciting, interactive experiences for Levitating Interfaces. To bridge this gap, we propose the *Levitation Simulator*, a prototyping tool in Virtual Reality (VR), that can accurately and interactively simulate a Levitating Interface. Instead of having to build an ultrasonic levitation apparatus, designers simply need a Head-Mounted Display and basic knowledge of the Unity game engine. They can then develop custom applica-

tions and games, test interaction techniques etc. specifically for levitating displays. Moreover, they can iterate on the design, by performing evaluations and collecting feedback, based on users' experience with the interface in VR. With the *Levitation Simulator*, we aim to democratize ultrasonic levitation research and facilitate content creation.

RESEARCH APPROACH AND METHODOLOGY

We validate the *Levitation Simulator* experimentally. The objective of the user study was to compare interaction with the *Levitation Simulator* and the physical prototype. We were interested in how far interaction with physical and virtual levitation prototypes delivers similar performance, and if not, what the differences are. Further, we wanted to investigate whether interaction with physical and virtual prototypes was perceived similarly by participants. We decided to investigate the performance achieved by interacting with each prototype in a Fitts'-Law-type

repetitive pointing study. To this end, we employ LeviCursor [4], a method for interactively moving a levitating, physical cursor in 3D with high agility, where the user controls the levitating cursor with finger gestures. Participants were also asked to compare how demanding the pointing task was using each interface, by filling in a NASA TLX questionnaire. At the end, a semi-structured interview was conducted.

PRELIMINARY RESULTS

Overall, the results of the most recent user study show that the virtual prototype provides a very good approximation of the performance of users with a physical prototype. Using the Friedman test, we did not find significant differences between the movement times in both conditions. The computed Fitts' Law models state that participants achieved an average throughput of 3.08 bits/s with the *Levitation Simulator*, while in the physical condition, the throughput was 3.41 bits/s. In the TLX questionnaire, the workload in VR was evaluated as higher, on average, however, no significant difference was found.

Even though in the semi-structured interview, almost all participants reported that the interaction felt very similar in both conditions, one prominent difference did arise. Namely, the "wow effect" was missing in the virtual prototype. The thrilling experience of interacting with a levitation interface, for the first time, cannot be replicated in VR. Possibly because we simply expect everything to work and to be possible in the virtual world. This effect needs to be considered when estimating the user experience of a physical user interface from a virtual prototype.

PLANNED NEXT STEPS

The Fitts' Law pointing study was a first in a series of studies evaluating the predictive power of the *Levitation Simulator*, with respect to user interaction with physical levitating interfaces. The user study validated that participants have similar performance

and sense of control in both conditions. In the future user studies, we plan to look deeper into the level of user engagement and immersivity, that the *Levitation Simulator* can provide.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

There is still a lot of research to be done in order to understand how people experience certain phenomena, e.g. levitation, in VR and to what extent a virtual simulator can be used for iterative content development and evaluation of user experience with a

given interface in the context of HCI research. To what degree, virtual prototyping practices of other fields (e.g. engineering, automotive etc.), are transferable to HCI?

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Physiological and Psychological Measurements in the Perception of Virtual Reality

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INTRODUCTION

Virtual Reality has drawn much attention in the last few years. In addition to economic applications or medical applications, the medium is also increasingly finding its way into the living room and thus it is getting more interesting for private users. For example, Hollywood has already started to shoot the first films with 360°cameras or at least produced some 360°environments, as seen in "Gnomes & Goblins" from Jon Favreau. Even for the actual creation of the movies, Virtual Reality is becoming more and more interesting, as many sets, scenes and characters are created digitally as 3D models. These models can then be viewed with Virtual Reality glasses.

A director gets the opportunity to choose the optimal perspective in a digital scene with a virtual camera. This technique was used in movies like "Ready Player One", "John Wick 3" or "The Lion King". In addition, many interesting VR video games have already been created such as "Beat Saber" or "Super Hot VR". These offer a completely new and exciting feel compared to classic video games. Nevertheless, the virtual reality experience is not fully explored, and therefore it is of particular interest to determine how people react to virtual realities and how to enhance this experience.

PROBLEM STATEMENT AND RESEARCH QUESTION

In summary, the research project should determine what happens to the user in a virtual reality. Above all, perception and presence

are of great interest. The goal is to enable the best possible virtual reality experience. In order to determine the best VR experience,

physiological data should be collected and compared in different VR settings. In addition, questionnaires about subjective feelings can also be used.

A good virtual reality experience is of interest to all applications. For example, new markets can be opened up in the economic sector and new types of surgical options can be created in the medical sector.

RESEARCH APPROACH AND METHODOLOGY

The research approach will mainly pursue a quantitative approach. By doing so, we can test theoretical predictions by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures.

RELATED WORK

The book State of the Art Virtual Reality and Augmented Reality Knowhow [1] has been a good starting point, because it is a compilation of recent advancements in digital technologies embracing a wide arena of disciplines. In particular, the book highlights the scientific use of VR/AR in healthcare, building industry and education.

Another influential work is from Mazuryk & Gervautz [2] because their paper gives a comprehensive review of the history and evolution of Virtual Reality. In addition, essential terms such as telepresence or simulation sickness are explained here.

PRELIMINARY RESULTS

In a first experiment, a 360° video was made of the city beach in Würzburg. Thereafter, subjects were placed on said city beach and their pulse rate and skin conductivity were recorded. In the laboratory, this was repeated with new subjects; however, these subjects used VR glasses to watch the scenery. Again, the pulse

PLANNED NEXT STEPS

Next, more basic scientific research will follow to help understanding the impact virtual reality have on the human. For this purpose, we want to research the area of temperature perception in more detail. In this next experiment, we want to test how temperature

The key research questions ask how virtual realities affect the physiological features of the user, how the greatest possible presence can be achieved and above all how the user experience can be improved.

Therefore, the research project should contribute to a fundamental understanding of virtual reality. This can be used in developing virtual reality experiences.

Specifically, physiological measurements such as heart rate, skin conductance and cognitive load measurements are used. These have the advantage that they run unconsciously and therefore can hardly be changed by the user.

At last, the work of Coelho, Tichon, Hine & Wallis [3] should be mentioned, because they propose presence as the key concept to be considered in any research involving human interaction with Virtual Reality. For Coelho et al. it seems evident, that the main determinant factors in presence are the use of multiple sensory channels, immersion, egocentric location and the possibility of action in the environment. Therefore, they draw together current research on presence to provide an up to date overview of the most widely accepted approaches to its understanding and measurement.

rate and skin conductivity were recorded. Currently we have not yet finished the data analysis. Nevertheless, it should be determined whether subjects in both conditions can relax, and when a relaxation effect occurs.

changes within virtual reality as well as temperature changes in the laboratory space during a VR session affect humans' physiological values.

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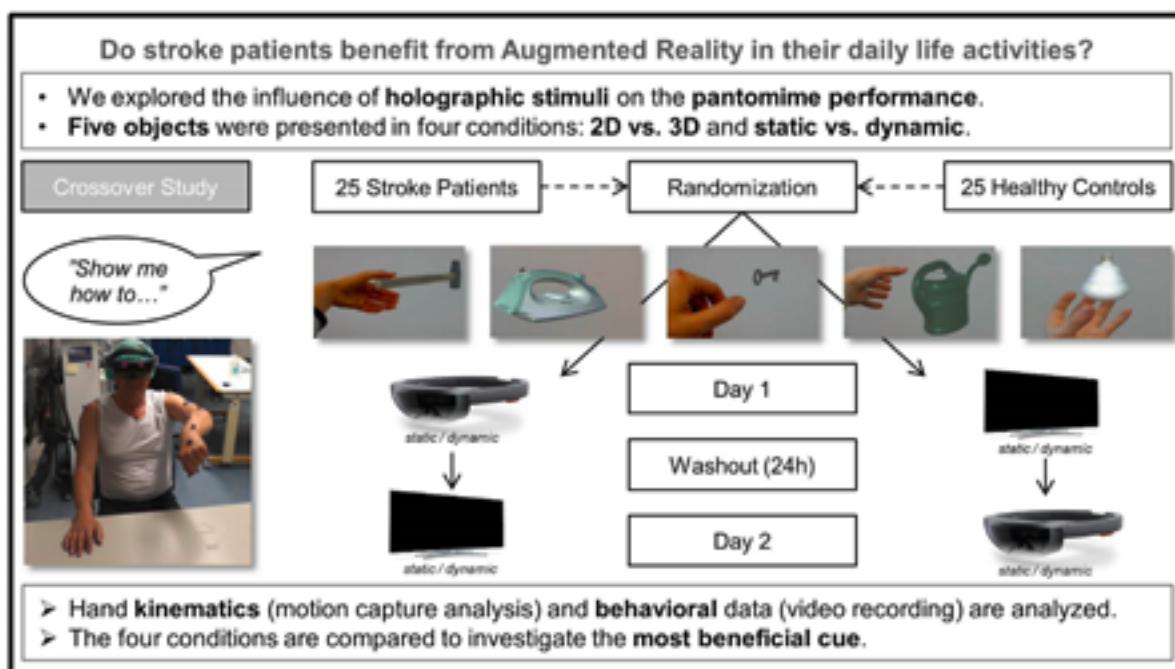
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"Mixed Reality" as a New Therapeutic Approach to Support Activities of Daily Living in Patients with Chronic Neurological Disease

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INTRODUCTION

Stroke is one of the leading causes of disability worldwide, and one of the most costly diseases in the German healthcare system. In 30-50% of left brain damage patients (LBD) the disorder of apraxia occurs, an often underestimated cognitive-motor disorder that impairs the ability to carry out activities of daily living (ADL) [1,2,3]. Patients rely on assistance from caregivers who guide them through everyday tasks. The load and the cost of time and money are substantial for the patients and their relatives. Consequently, finding

solutions to maintain independency is of highest importance. Mixed Reality technology allows for the pursuit of new pathways to study new approaches for the treatment of apraxia. In a pilot study on ten patients with Alzheimer's Disease and signs of apraxia we demonstrated that augmenting information to a real ADL task using the Microsoft HoloLens proved feasible and well accepted. To optimize our approach, the given cues have to be investigated in more detail to provide the most beneficial way of support [4].

PROBLEM STATEMENT AND RESEARCH QUESTION

Hitting a nail with a hammer, watering plants with a watering can, screwing in a light bulb, opening a lock with a key, or ironing a blouse with a flat iron – these are just examples of tool use actions patients after stroke might struggle with. The underlying reason can

be "limb apraxia". Patients with apraxia of tool use select the wrong tools to use the presented objects (e.g. soap instead of toothpaste) perform a wrong movement with the tool (e.g. pressing a nail instead of hitting with a hammer) or make no movement at all [1,2,3].

Pantomime of tool use

The pantomime test is a well-recognized clinical screening tool for apraxia. Patients are asked to demonstrate an action without taking the object in their hand, e.g. "how to hit a nail with a hammer". Making a correct grip (cylinder or lateral) and a correct movement (hitting) requires cognitive processes, i.e. representative and abstract thinking. Manipulation knowledge as well as the successful retrieval of the matching movement representation and its integration into a movement plan is needed to fulfill this task [1]. Research shows, that the pantomime performance of apraxia patients is dependent on the given quality of the stimuli. We therefore assume that patients can be supported in their cognitive

processes using Augmented Reality (AR) technology. Due to the salient character of three-dimensional holographic objects into a real environment, we hypothesize that the desired motor plan can be triggered by AR-cues. Key research questions are:

- Can we influence the pantomime performance by holographic stimuli?
- Which is the most beneficial (holographic) cue to reinforce the appropriate motor plan?

If holographic cues influenced a patients pantomime performance, future assistive technology could be implemented upon this knowledge and thus, positively impact the rehabilitation process and a patient's autonomy.

RESEARCH APPROACH AND METHODOLOGY

We translated the pantomime test into a holographic set-up using the Microsoft HoloLens device. In a randomized controlled trial, 50 subjects (25 LBD patients, 25 healthy controls) are tested in four different conditions over two days (testing time = 2hours/participant). A crossover study design (washout time > 24 hours) was chosen to minimize carry over effects and fatigue. The subjects are requested to pantomime the use of five objects

(lightbulb, hammer, watering can, key, iron) presented in two different modes (static vs. dynamic) and two different dimensions (2D vs. 3D). Performance data are quantitatively (using motion capture analysis) and qualitatively (behavioral observation using video recordings) analyzed (figure 1). The study protocol was prospectively registered with the German Clinical Trials Register on 22 September 2018 (DRKS00015464).

PRELIMINARY RESULTS

A scoring system to qualitatively evaluate the pantomime performance was adapted and applied by two independent scorer to ensure representative data. The refined system allows detecting even small changes within various conditions. First results on ten patients (70.4 ± 16.2 years, six men, 68.4 ± 59.2 days post stroke)

and ten healthy controls (69.2 ± 7.8 years, two men) indicate that the dimension (3D) and the mode (dynamic) have a significant effect on the pantomime performance in patients. Further, participants interacted with the 3D objects as they tried grabbing and following the holograms.

PLANNED NEXT STEPS

We will further analyze kinematic data to support our qualitative findings. A correlation between quantitative and qualitative

results will help to identify the strength of holographic cues.

OPEN ISSUES AND COOPERATION

The analysis of severely affected patients is challenging due to irregular and untypical movement patterns. Support with data pro-

cessing and analysis of the hand kinematics would be appreciated.

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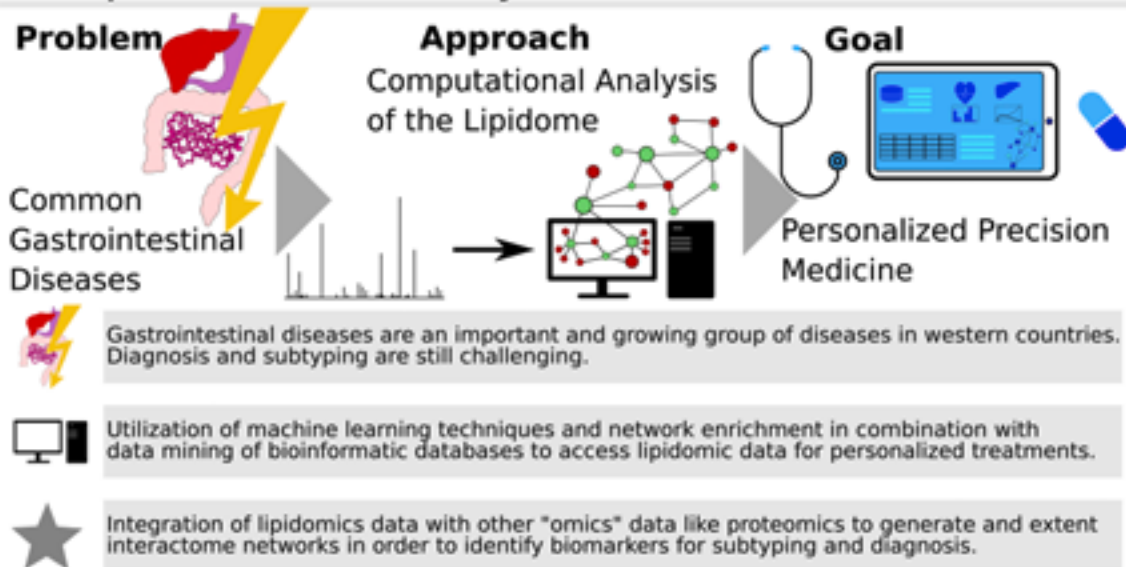
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Embedding Lipidomics into the “omics” Landscape

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Lipidomics as a Key for Metabolic Diseases



INTRODUCTION

Metabolic diseases are common in modern industrialized societies. They are often associated with unhealthy lifestyles and are a huge burden for the health care system. Especially chronic diseases cause great suffering for the affected patients. Many of the defects can be related to lipid metabolism. Wellknown representatives are

Crohn’s disease or the non-alcoholic liver disease (NAFLD). Globally, ~55% of type 2 diabetes mellitus patients are affected by NAFLD [1] and a total prevalence is estimated at 24% [2]. Since a variety of diseases exists, an easy classification is not possible and a reliable diagnosis of e.g. NAFLD still requires an invasive liver biopsy.

PROBLEM STATEMENT AND RESEARCH QUESTION

The goal of precision medicine is to provide optimal personalized treatments for patients. To achieve this, detailed knowledge about the phenotype of a disease for every patient is necessary. Not only in a qualitative, but also in a quantitative fashion. A basis for this are automated quantitative analysis tools of patient data, which classify patient’s diseases into subtypes and therefore allow predictions for

appropriate treatment strategies.

Analysis of lipid data is a crucial step for improving diagnoses for patients. Current challenges for the analysis of such data in the bioinformatics pipeline are standardized statistical routines for quality control and a functional analysis combined with integration into “omics” fields [3]. The goal of this project is to develop automated solutions and standards for subtyping

of patients based on lipidomic data from mass spectrometry measurements. This includes analysis tools to integrate lipidomic with proteomic data, to extract important features in the data and get a mechanistic understanding of the diseases and make prognosis predictions for patients. This is a step towards

digitized medicine, where complete molecular profiles of patients can be analyzed and evaluated automatically, to support physicians.

RESEARCH APPROACH AND METHODOLOGY

Subtyping of patients and extraction of parts of the cellular metabolic/signaling machinery that play an important role for the disease will be based on machine learning approaches in combination with network enrichment tools like the KeyPathwayMiner [4]. Adaptations and development of new tools will be necessary to make our lipidomic data accessible. Additionally, lipid

information will be integrated with other “omics” data such as proteomics to get an indepth understanding of mechanisms of diseases and extent existing bioinformatics resources. Development of mechanistic mathematical models can further help to understand diseases.

RELATED WORK

The goal of our group is to develop the LipiTUM platform for identification and quantification of lipidome mass spectra from standard experimental procedures to novel high throughput methods with additional dimensions [5]. The platform will also feature the developed

tools of this project to enable a straight forward and standardized workflow for the analysis of patient lipidome data. Various online lipid databases [6, 7, 8] will be utilized to profit from their knowledge for analysis and predictions.

PLANNED NEXT STEPS

As a first step, patient lipidomic data will be analyzed to extract similarities between patients and detect potential subtypes of diseases, which an potentially later be predicted from specific biomarkers. This will be followed by the development and imple-

mentation of data mining tools to establish a link between lipidomics and other “omics” data and connect them to patientspecific clinical anamneses.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

We are in close collaboration with various clinicians and experimentalists, who not only provide patient data, but are able to validate computational results and predictions. Further, we can adapt our software tools to their specific needs to make precision

medicine accessible. Furthermore, our group is embedded in the Chair for Experimental Bioinformatics at the Technical University of Munich, which has successfully developed various “omics” analysis tools.

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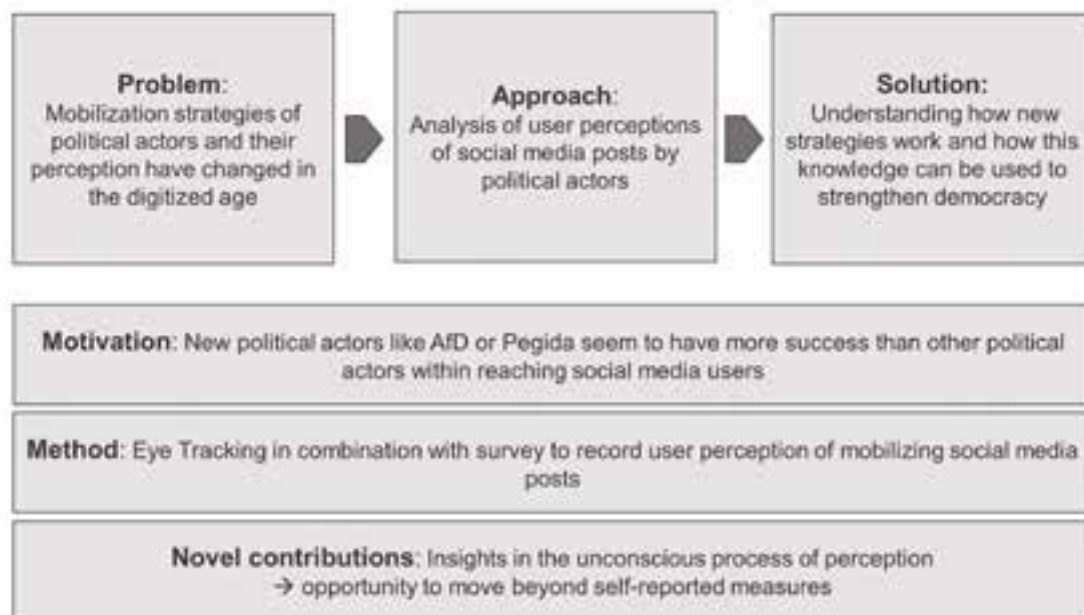
Political Mobilization on Social Media Sites

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INTRODUCTION

Digitalization has had a massive impact on democratic processes across the world in recent years. Especially social network sites – like Facebook or Twitter – which take up an increasing part of people's lives, are supposed to have an influence on voters. In general, social media offer many opportunities to access and disseminate (political) information which mean a lower expenditure of time and money for potential voters [1]. This is the reason why also many

political actors and parties use social media as a campaign tool and thereby want to mobilize voters in a targeted and comprehensive way.

There are different research results in this area but the majority of research points to a positive impact of Internet use on participation [2].

PROBLEM STATEMENT AND RESEARCH QUESTION

Nevertheless, the question remains what makes online political messages effective. Previous research on political mobilization shows that voter turnout increases when parties intensively campaign for votes [3]. Furthermore, mobilization is most effective when sympathizers are addressed directly which is more or less common in times of micro-targeting. Related to

the post level, researchers do not yet agree on this area. On the one hand, there are results which show that mobilizing posts facilitate virality [4]. On the other hand, mobilization cues themselves have negative effects on user engagement. Instead, reasoning, post length and references to competitive political actors, negative tonality, positive emotional expressions and

humor can increase user engagement [5]. Apart from these inconsistent results, there is little known about the success of new political actors like AfD or Pegida within reaching social media users. Besides the possible use of bots, the explanation could also be their mobilization strategies. These mobilization strategies are in focus of this thesis. The overall research question is: How do users of social media perceive mobilization

strategies of political actors?

Answering this question is important because it gives insights in the behavior of potential voters and their thinking of social media appearances of political actors. With this knowledge it should be easier to develop efficient mobilization strategies – also for other political actors.

RESEARCH APPROACH AND METHODOLOGY

The research approach assumes that users focus their (visual) attention on certain elements of a social media post and in this way perceive it and its message in a certain way. This particular perception then affects whether or not a user is mobilized to take action. In order to capture the perception of users of polit-

ical posts, the goal of this thesis is to use eye-tracking methodology in combination with a survey. Eye Tracking is a method in which the eye movements of the test persons are distinguished.

RELATED WORK

It had already become clear that the state of research on this topic is not coherent. It is also common to answer questions in this area by using surveys. The problem here is that the participants first have to be aware of their perception and in addition be able and have the will to share this knowledge. Especially in the case of embarrassing or very personal information, the desire for social desirability occurs, which leads to distortions of

the response behavior. To prevent this, this thesis is going to combine surveys with eye tracking. This gives the opportunity to move beyond self-reported measures [6]. Hereby, perception is an unconscious process that can still be recorded. Despite the advantages of this method, it has rarely been used in communication science, especially in Germany [7].

PLANNED NEXT STEPS

The research of this thesis is still at a very early stage. So far, the current state of research has been reviewed and the previously presented research gap has been identified. The next steps include identifying and determining the factors within the mobilization strategies to be studied in detail. After that the creation of

stimuli for the eye tracking study will follow. Finally, it should be mentioned that an eye tracking study requires a lot of preparation, it is important to plan them carefully and familiarize yourself with the devices.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

At this stage, many decisions related to the eye tracking study are to be made. Even if a cooperation within the LMU is already planned in this area, maybe someone has already done an eye

tracking study and can give some tips or is also interested in cooperation.

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Modeling, Estimation and Evaluation of Electric Vehicle Charging Flexibility for Ancillary Services

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To quantify electric vehicle (EV) charging flexibility for ancillary services in a power system with a high uncertainty use stochastic models and discrete-events simulation with randomness

Problem	Methodology	Results
<p>EV charging flexibility is hard to estimate due to</p> <ul style="list-style-type: none"> • a high uncertainty from the primary use of mobility • a high complexity from various significant influencing factors <p>However, ancillary services need a high reliability</p>	<ul style="list-style-type: none"> • Stochastic model of EV trip chains with logical constraints • Object-oriented EV-model • Meshed multi-point electric power system model • Stochastic flexibility estimation • Model-predictive control • Discrete-events simulation with randomness 	<ul style="list-style-type: none"> • EV mobility and charging flexibility quantification for Germany • Flexibility estimator and control • Techno-economical and reliability evaluation of EV-based grid services • Identification of critical parameters
<p>Relevance: The problem has been observed in real world projects with ChargingLedger, charge point operators, utilities and grid operators</p>		
<p>Evaluations: Sensitivity analyses of dependencies and simulation depth, model validation with real data, estimator evaluation</p>		
<p>Novelty: Possibility of reliable evaluation of EV based grid services, live flexibility estimation, scheduling algorithms and estimator evaluation</p>		

INTRODUCTION

A reliable electric power system (EPS) is commonly taken for granted. However, the energy transition leads to an increasing volatility, uncertainty and decentralization in supply. This poses challenges to the reliability of the EPS. New methods for ancillary services (e.g. redispatch or reserve power provision) capable of handling these challenges are necessary to maintain the reliability we highly depend on.

In addition, the mobility transition includes shifting towards electric vehicles (EVs). Charging an EV is not only a high power load, but also highly flexible in time and comes with additional storage capacity. Thus, it is a theoretically possible stochastic source for ancillary services. This PhD thesis aims to quantify and estimate large-scale flexibility from EVs and evaluate its possible applications for grid stability measures.

PROBLEM STATEMENT AND RESEARCH QUESTION

EV charging flexibility is hard to estimate mainly for two reasons. First, the constraints of the primary use of mobility are highly uncertain and require a joint consideration of the power and the mobility sector. Second, the complexity of describing charging flexibility is very high due to many influencing factors from both sectors. However, in order to provide ancillary services, a reliable estimation of the flexibility is necessary.

If this problem is solved, EV-based ancillary services become very low-cost due to a battery degradation close to zero for unidirectional charging. This adds value to EVs as their battery can be monetized for multi purposes and expensive alternatives to ensure reliability such as grid extensions, operation of balancing power plants or extension of large-scale battery storage are avoided. Thus, the key research questions are:

- a) How to model and estimate EV charging flexibility?
b) How reliably and feasibly can large-scale ancillary services be provided?
This is the first in-depth and reliable evaluation of EV-based grid service scenarios. In addition, new charging flexibility estimation meth-

ods are developed, evaluated and likely be applied by cooperation partners (ChargingLedger and The Mobility House) for grid optimization services in practice.

RESEARCH APPROACH AND METHODOLOGY

My bottom-up approach for modeling the mobility behavior is based on logically constrained multistage sampling of realistic trip chains based on the data basis of 1 million trips from [1]. In contrast to simple random sampling, the approach enables to consider user patterns and stochastic dependency of different features. I identify the most important dependencies via correlation analysis and fit according probability density functions based on the data basis. An object oriented EV model uses well-known equivalent electric circuit based battery models and empirical models for the energy consumption and power electronics efficiencies. Historical weather and grid data is included as exogenous simulation variables.

I model the flexibility with an enhanced time-variant equivalent storage approach based on [3]. Approaches for flexibility estimation include perfect foresight, probability density functions, classification and regression algorithms. A central flexibility controller optimizes the flexibility dispatch via model predictive control based on the estimation and the requirements from the application. Quantitative results for different scenarios are derived by discrete events simulation with randomness.

PRELIMINARY RESULTS

First results of the flexibility visualization show that there will be a large flexibility potential especially in southern Germany, North Rhine-Westphalia, Lower Saxony and in general in large cities. This is an indicator that there is a high potential for redispatch, especially in the TenneT control area. The key challenge is finding operational strategies that enable bidirectional flexibility potential. A first study on frequency reserve power, with a basic version of the mobility model shows that the provision is technically possible, but not in accordance with the regulatory framework. However, the application seems to be

In order to ensure the validity of my work I plan to perform sensitivity analyses of the necessary simulation depth considering the aggregation level and a mobility model validation with aggregate data from [1]. In addition, I plan to evaluate and compare the accuracy of the different estimators for different fleet sizes in the simulation and for real data from my cooperation partners based on their error rate and coefficient of determination in application.

Related work in [4] provides general notations for demand side flexibility not considering the uncertainty from the mobility constraints in the case of EVs. In [6], field tests of different ancillary services with stationary single EVs are performed and the expected fast response time was confirmed. In comparison to previous work my bottom-up approach enables a more detailed inclusion of the mobility sector characteristics and constraints in a high enough geospatial resolution, which have been neglected or assumed as fixed so far and which is one of the key research gaps considering EV based grid services.

feasible in a virtual power plant combined with power plants with low capacity reserve costs and high activation costs.

Considering the flexibility estimation a classification of charging processes according to the purpose of the trip and the arrival time seems promising. Expected further results are the necessary simulation depth, the estimator accuracies, flexibility control algorithms and the techno-economic and reliability evaluations for different scenarios.

PLANNED NEXT STEPS

To finish the mobility model, the systematic sensitivity analysis of features and the final parameterization for Germany is still open. Then, I will develop and evaluate the estimators and implement the model

predictive control agent. The last step is to define, simulate and evaluate future scenarios.

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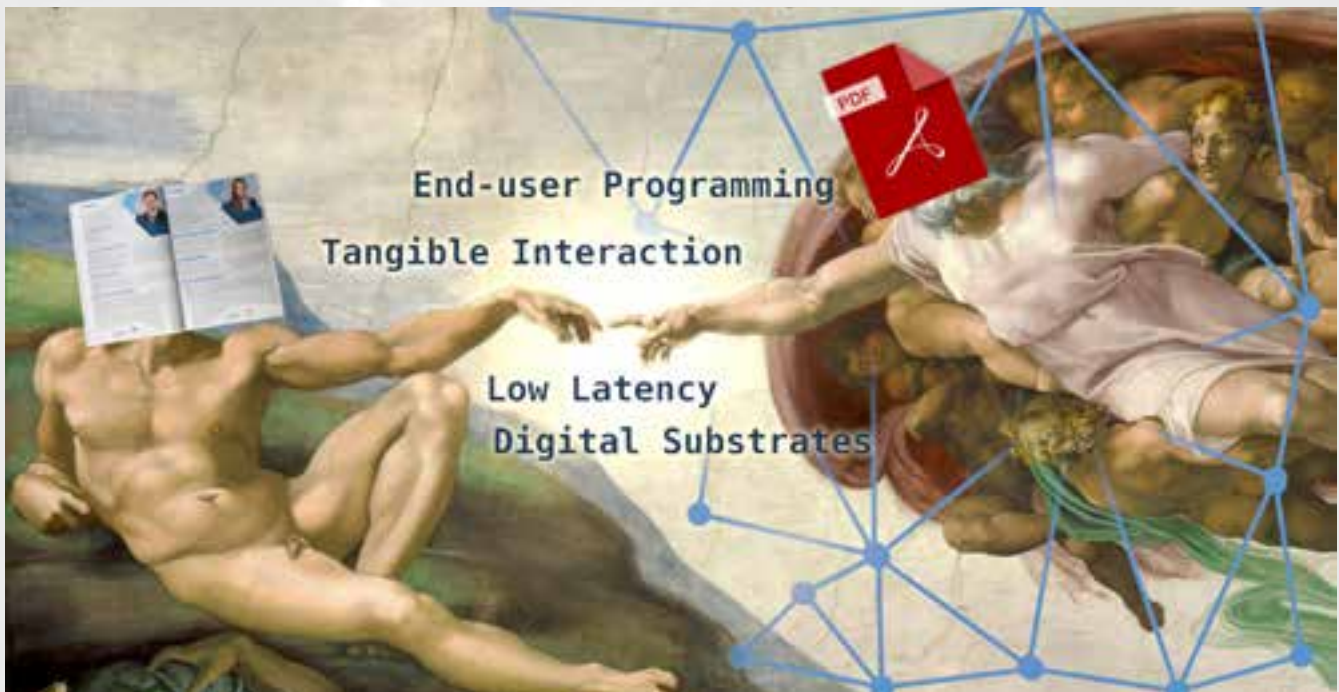
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28

Closing the Gap Between Physical Object and Digital Representation

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INTRODUCTION

Mark Weiser introduced the concept of ubiquitous computing in his seminal publication "Computer for the 21st Century" [1]. Eversince, the idea of integrating digital functions into physical environments has become commonplace. Digitization of physical documents in public administration and the emergence of the Internet of Things allow new affordances and workflows based on ever present digital data to arise. Hiroshi Ishii introduced the idea of Radical Atoms [2]-

a world where all data is present as tangible objects in the physical realm. Following Ishii's vision, the manipulation of a physical object should have a direct influence on its digital representation and the other way around. As both physical and digital environments have distinct advantages and disadvantages, my research focuses on creating a link between them while letting each be itself.

PROBLEM STATEMENT AND RESEARCH QUESTION

Digital files can be turned physical by printing, and these documents can in turn be digitized with scanners, text recognition or manual transcription. However, there is no actual link between those two representations of the same information. Thus, changing only one of those entities does not influence the other one. For example annotating the printed copy of a digital

file by highlighting text or making notes only changes this exact instance of the document. Physically possessing a paper document does not provide access to its digital representation in order to change its contents, create copies or distribute it over the world wide web. Furthermore, the transition of documents between the physical and digital world results in a loss of infor-

mation and restricts the possibilities to alter the document's content. In the Dynamicland project [3], researchers created an environment where the link between physical artifacts and digital files is maintained by augmenting tabletops and sheets of paper with projections and marker-based tracking, thus providing new affordances, ways of presenting a document's

contents, as well as innovative forms of interaction. However, Dynamicland focuses on building toolchains and exploring data with dynamic programming in an enclosed environment while ordinary office workflows need a more subtle approach striving for efficiency.

RESEARCH APPROACH AND METHODOLOGY

A first step towards Radical Atoms is to reinforce the link between physical objects and digital data. To achieve this, I follow a constructive and exploratory approach building prototypes for new forms of data transmission and interaction. The properties of physical objects have to be measured and represented in the digital system. For example, knowing the position of objects is fundamental for enabling advanced ways of interaction. Inside-out tracking approaches are a possibility to gather real-world data in the form of an object's spatial position and orientation without external tracking systems. This reduces cost and makes it more robust against outside influences such as oc-

clusion or disturbance by ambient light, thus making its use in ordinary office environments imaginable.

In order to enable realtime interaction with physical-digital artifacts, low latency is essential. Understanding the reasons for latency is crucial to find bottlenecks and build user interfaces with low latency. Therefore, we investigate the latency of computer systems, including input device latency [4], the latency of graphics frameworks and the latency of displays.

PRELIMINARY RESULTS

During our studies on latency, we have gained a thorough understanding of lag caused by input devices, which is the first link in the chain of end-to-end latency. We published the results of our measurements, as well as a model of input latency at CHI 2019 [4].

We explore the potential of tangible blocks for information transfer. Therefore, it is essential to reliably know the position

of those objects and whether they are in contact with a physical document. We investigated a pattern-based, inside-out tracking approach for tangible blocks in the project DotTrack [5]. A possible use case for such tangible blocks in an office environment would be to use them as dedicated tools, for example to digitally tag documents or store information.

PLANNED NEXT STEPS

The studies on the latency of computer systems will be continued by investigating the influence of latency on user experience and performance, as well as the lag caused by displays and graphics frameworks. Furthermore, I will examine affordances of physical and digital media and existing interaction techniques, and build

prototypes for physical-digital user interfaces and interaction techniques. An example for this would be augmenting physical paper with digital meta information.

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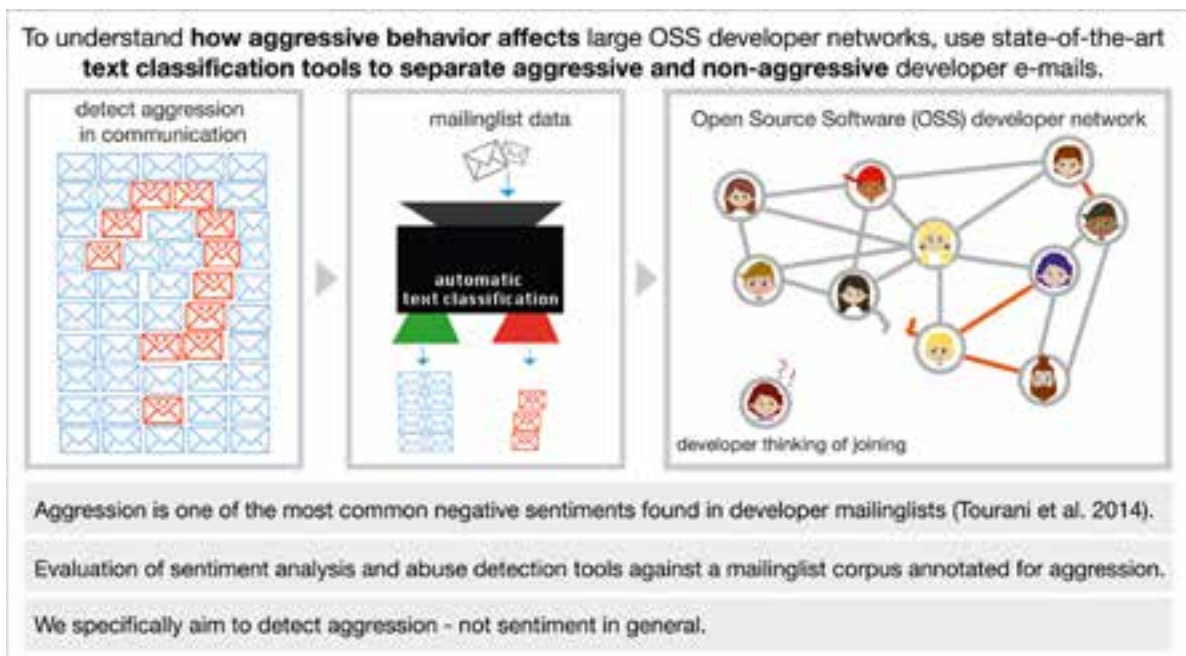
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Detecting Aggressiveness in OSS Developer Mailing Lists

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INTRODUCTION

Communication is a key factor in the success or failure of software projects, and we aim to understand how tonality, aggressiveness in particular, affects the evolution of large developer networks: How do aggressive e-mails affect the sender and recipient in terms of reputation or participation? Do communities known for their toxicity repel potential new contributors, which could stifle innovation? While Sentiment Analysis in the Software Engineering domain is

an active research field [3], only few studies are closely related to aggression in developer e-mails (e.g., Squire and Gazda focus on profanity and insults in FLOSS communities [1]). For our research, we select the Linux Kernel Mailing List (LKML) due to its active community, large scale, availability, and its notoriety for verbal abuse. We evaluate an annotated dataset of LKML e-mails against state-of-the-art off-the-shelf sentiment analysis and abuse detection tools.

PROBLEM STATEMENT AND RESEARCH QUESTION

As a first step, we explore existing classifiers to separate aggressive and non-aggressive e-mails automatically. To date, there are no established tools specifically for aggression detection in the software engineering domain, but existing classifiers might be suitable for our task:

RQ1: *What is the best sentiment analysis tool to automatically detect aggressive e-mails in a SEspecific mailing list?*

Once we have identified a suitable classifier, we use it to classify the entire mailing list and tackle the following research questions regarding the work climate:

RQ2: *To what extent does aggression occur in the developer network in terms of spread and intensity?*

RQ3: *To what extent do contributors reduce/increase their participation after having received aggressive e-mails? Do long-time contributors react differently than newcomers?*

RQ4: *To what extent does collaboration with a developer increase or decrease after they have sent an aggressive e-mail?*

RQ5: *To what extent do periods of heightened aggressiveness correlate with recurring events (e.g., end of a release cycle)?*

Each of these questions addresses important points that influence how OSS communities communicate. By answering these questions, we aim to understand the role aggression plays in the evolution of developer networks so that we can identify beneficial as well as problematic communication behavior and patterns that influence the work climate.

RESEARCH APPROACH AND METHODOLOGY

1. We derive our test data by semi-randomly sampling from the publicly available LKML after having observed that only a small fraction of emails is aggressive. In oversampling replies from specific individuals, during particular periods, we follow the example of Wulczyn et al. [2] who faced a similar class imbalance in corpus development.

2. We preprocess the e-mails (removal of names, removal of code snippets, stack traces, tabular text, signatures) to remove irrelevant information.

3. To create the ground truth, we gave the processed data to in-house annotators (all with programming experience; 4 have contributed to one or more open-source projects; 4 women, 5 men). According to two separate statistical measures, the Intraclass Correlation Coefficient and Krippendorff's Alpha, they achieve

an agreement of 0.45. This result is on par with similar studies of aggressive online communication [2]. In consideration of the disagreement that is inherent in subjective tasks [4], we base the ground truth labels on the fraction of annotators who see the e-mail as aggressive instead of the majority vote, as seen in the study of Wulczyn et al. [2].

4. To answer RQ1, we feed the data sample into several classifiers (e.g., Stanford CoreNLP, VADER, perspective API, SentiStrength-SE). Besides precision, recall, and F1-score, we use the Matthews Correlation Coefficient (to account for the high class-imbalance of our test set) as well as the Spearman correlation coefficient (to assess the relationship between fractional labels that stem from annotator disagreement and probability output of a tool respectively).

PRELIMINARY RESULTS

So far, we conducted multiple studies to optimize the annotation process (using a custom tool, including a tutorial to train the annotators) and acquired an annotated corpus of 360 LKML emails. Moreover, we have developed supportive NLP tools to

anonymize e-mails and to remove potential noise. The assessment of five sentiment analysis tools is currently underway.

PLANNED NEXT STEPS

Once we have answered RQ1, we will take up RQ2 to RQ5. Furthermore, this analysis complements the project of Barbara Eckl-Ganser, such that we relate the aggression levels to the evolution of hierarchy.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

We are interested in practical knowledge concerning annotation by crowd-workers, since building our own classification model is our alternative strategy if none of the off-the-shelf tools are up to the task.

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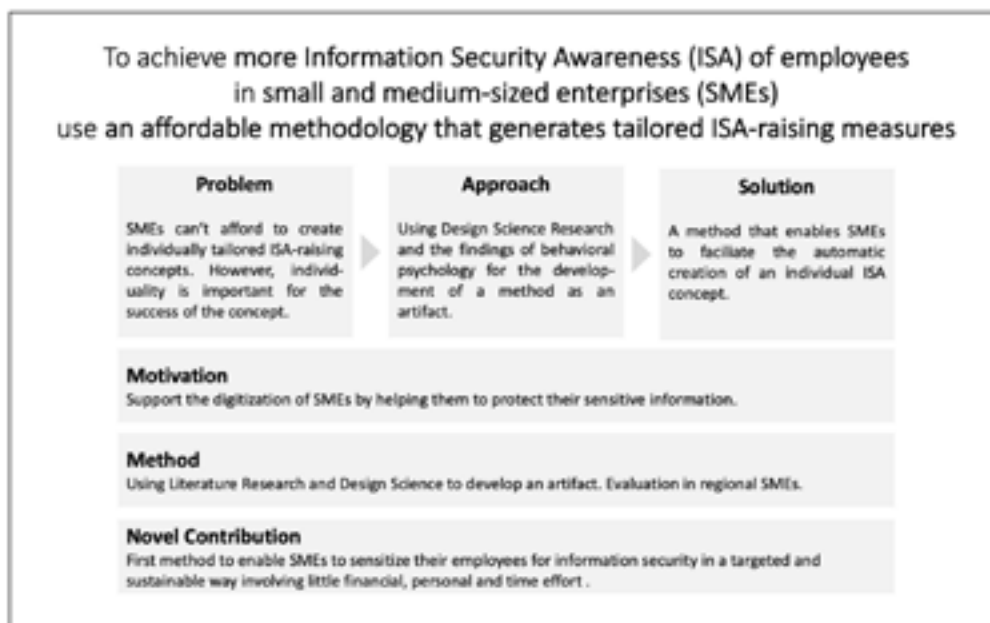
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Sensitizing Employees of Small and Medium-Sized Companies Individually for Information Security

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INTRODUCTION

Small and medium-sized enterprises (SME) are affected by the digitization progress. Digitized business processes challenge companies, e.g., there is a growing demand for information security [1]. Employees play a key role in information security. The behavior of employees at work and in their private life strongly affects the confidentiality, integrity, and availability of sensitive company information [2; 6]. Attackers deliberately exploit this "human factor" with

techniques such as phishing, malware, and social engineering [3]. For attackers, eliciting a password from an employee is often less laborious than "hacking" it with a compute-intensive brute-force attack. Especially, SMEs are increasingly affected by cyber-attacks [2]. With regard to the typically low budget of SMEs, it is necessary to offer them cost-effective support to sensitize their employees.

PROBLEM STATEMENT AND RESEARCH QUESTION

Employees need to be sensitized, in order to behave securely and to make them aware of their important role in information security [4]. We call this behavior information security compliant behavior. Concepts that raise Information Security Awareness (ISA) are successful if they are tailored individually to the needs of the company and its employees [5]. However, SMEs often have

limited financial resources for information security and therefore cannot afford such individual concepts.

These findings raise the following main research question: Is there a method that enables SMEs to sensitize their employees for information security in a targeted and sustainable way in-

volving little financial, personal and time effort. In this context, a method is understood as a planned procedure with verifiable results.

RESEARCH APPROACH AND METHODOLOGY

The doctoral project follows the artifact-creating research paradigm "Design Science Research". We are examining possibilities for measuring the degree of sensitization of a company and how ISA-increasing techniques can purposefully influence the behavior of employees. We follow the approach of action research, where researchers and the cooperating institution jointly devel-

op a problem solution. The evaluation with partner companies includes an analysis of the economic efficiency of ISA techniques. Subsequently, the findings are arranged and summarized in a method.

RELATED WORK

As a fundamental theory of human behavior, the Integrated Behavioral Model (IBM) [6] is used in the project. The IBM originates in the field of health psychology and is interpreted in the context of information security.

PRELIMINARY RESULTS

I already have examined the suitability of the IBM to be used in the information security context [7]. In the paper a model shows the various influencing factors on the information security-compliant behavior of humans. In addition, I developed a proposal of a complementary process that targets ISA of SME's employees [4]. It supplements the ISIS12 framework for installing an information

security management system (ISMS) in small and medium-sized enterprises. I applied and evaluated the findings from both projects in a university. I was able to show that the analysis can make a valuable contribution to the planning of an individual ISA concept.

PLANNED NEXT STEPS

I will investigate whether the contributions generated by the analysis can help to change the ISA of the university members. For this purpose, I will select measures to increase ISA according to the

analysis results. After implementing the measures, I will verify the success with different metrics.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

We are looking for medium-sized companies that can help evaluate the developed method in a real-life business environment.

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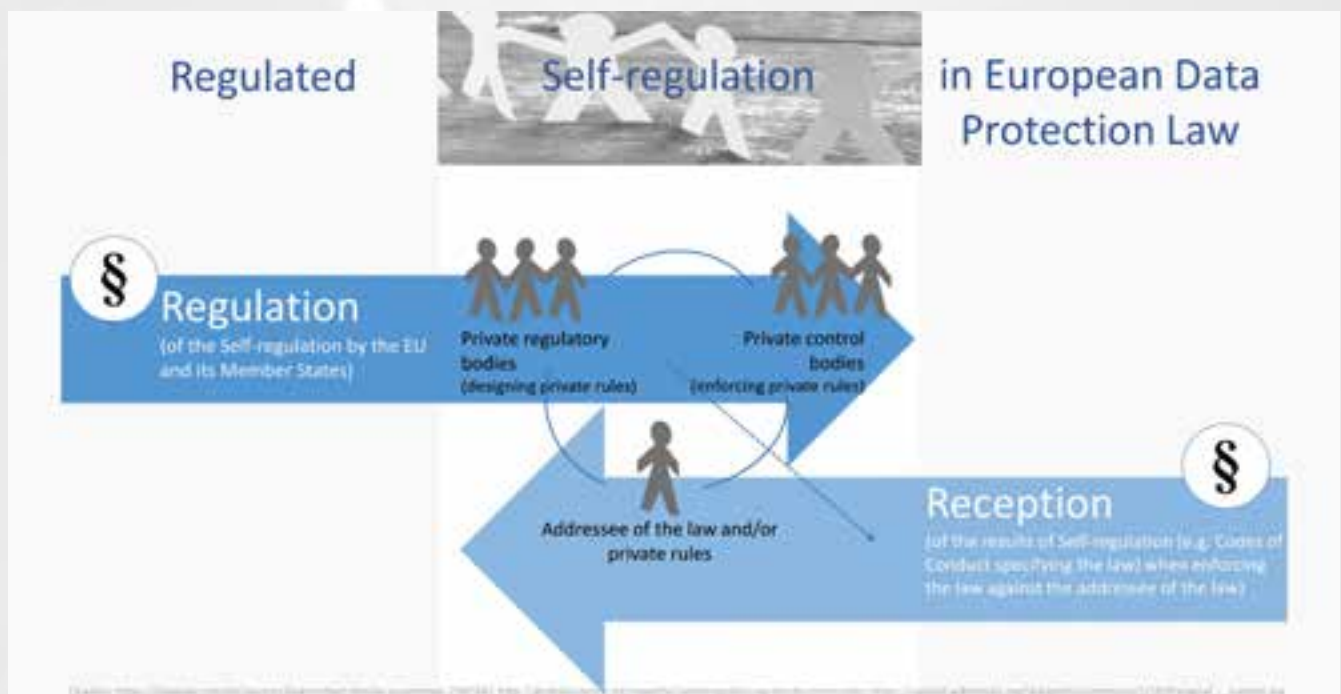
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Self-Regulation in European Data Protection Law

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INTRODUCTION

According to the concept of "Self-regulation" private individuals should be induced to design and enforce their own "private" rules for the purpose of specifying and enforcing the law [1]. It is hoped that they will find better adjusted and highly accepted solutions and therefore eliminate the shortcomings of imperative regulation.

The General Data Protection Regulation (GDPR) contains several instruments implementing this concept, in particular: Codes of

Conduct (Art. 40f. GDPR), Certification (Art. 42f. GDPR) and Binding corporate rules (Art. 47 GDPR).

The question arises, whether these instruments exploit the potentials of self-regulation and are able to improve European data protection law. Moreover, these instruments raise some highly interesting legal questions.

PROBLEM STATEMENT AND RESEARCH QUESTION

Against this background, the objective of the project is to examine and assess these instruments in a dogmatic, respectively political way, especially with view to their practical effectiveness.

In the beginning, the project focused on theoretical foundations

(general section). The most important finding was to distinguish between "self-regulation", its "regulation" and the "reception" of its results (see figure above): "Self-regulation" refers to private individuals designing and enforcing their own sector-specific rules while acting autonomously and self-servingly. Its "regulation" aims

to initiate, structure and accompany these actions in order to ensure their compatibility with the public interest. In principle, self-regulation takes place outside the scope of sovereign legislation and law enforcement. The results of self-regulation may, however, become relevant in this respect, e.g. when public authorities refer to them in the context of law enforcement (“reception”).

On this basis, the next step was to examine and assess the GDPR and its self-regulatory instruments (particular section). The key research questions were (amongst others):

- How are the actions of the relevant private individuals to be classified under administrative law?
- Which legal frameworks and enforcement mechanisms are in place to structure and accompany the private sector’s actions?
- Which are the internal and external legal effects of the private sector’s actions?
- Which conclusions can be drawn from the experience with previous instruments?

RESEARCH APPROACH AND METHODOLOGY

The research is predominantly based on the method of legal dogmatics, including an interpretation of the GDPR in accordance with European Methodology (e.g. interpretation according to the wording). It is important to note that the objective is not to find the “correct” interpretation, but rather to find the most convincing one taking into account all relevant legal literature.

In this respect, the research can refer to some legal commentaries [2] as well as essays examining the self-regulative instruments of the GDPR [3]. Compared to these works, the project intends to provide a broader reflection, because it is based on theoretical foundations and is able to derive overall results from an integrated view of all relevant instruments.

PRELIMINARY RESULTS

The key research questions can be answered as follows: All relevant private individuals act as private bodies. None of them exercises sovereign powers or acts in a way that is attributable to the Member States or the EU under liability law. The activities of these private individuals are structured and accompanied by comprehensive legal framework conditions and enforcement mechanisms, raising some legal questions in detail.

In principle, the designed private rules only become internally legally binding among private individuals. They do not constitute public data protection law externally enforceable by supervisory authorities. Moreover, sovereign data protection supervision is only complemented by self-regulative enforcement.

Nevertheless, sovereign data protection supervision and self-regulation are partly brought together in the GDPR: In particular, codes of conduct and certifications establish a voluntary

second tier of the accountability mechanism (Art. 5 para. 2 GDPR) going above and beyond the minimal legal requirements. They may even serve as accountability tools for the controller to prove that he has fulfilled his legal obligations.

Observations by supervisory authorities and jurists on the practical effectiveness of previous instruments suggest that the practical effectiveness is very much linked to modest procedural requirements, modest procedural periods and sufficient legal benefits resulting from participation. Since the GDPR reduces both procedural requirements and periods and strengthens the existing legal advantages, particularly by embedding and privileging them in the context of the accountability mechanism, its instruments of self-regulation are generally expected to become more effective in practice.

PLANNED NEXT STEPS

The next step is to examine the constitutionality and to finally revise the preliminary results.

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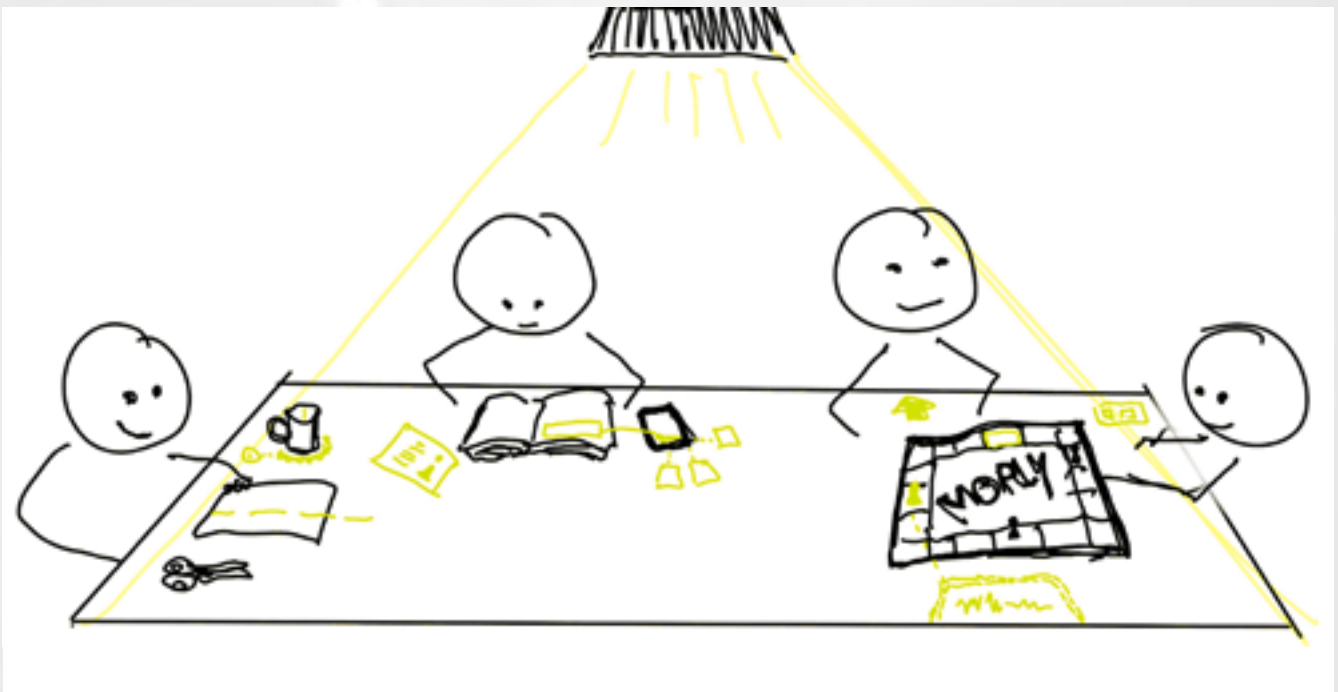
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Ethnographic Perspectives on Interactive Tabletops

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INTRODUCTION

In present-day contexts, social life, to a large extent, is mediated and shaped by and through digital and technological infrastructures. In turn, digital and technological infrastructures themselves are also deeply shaped by sociocultural setups and unavoidably intertwined with social practices and their manifold physical/material representations.

In the BMBF-funded project VIGITIA (2019-2022), this correlation literally is *put on the table*: [1] The project aims at developing a system to support everyday activities at tables via projected augmented reality (PAR). Thus, physical (inter-)actions at tables can be supported and extended by camera-based object recognition, which allows

non-digital objects to be augmented with projected informational content. In doing so, VIGITIA envisions developing digital tools that support users' activities, rather than applications users and with them their attention are drawn into. In this regard, the interface is thought to interlace with everyday life without inhibiting social interaction.

Furthermore, particular attention is paid to the issues of sustainability and everyday suitability, since, by using PAR, there is no need for additional electronics built into the table, which is why existing tables may easily be augmented and further used.

PROBLEM STATEMENT AND RESEARCH QUESTION

From an anthropological point of view, digital/technological infrastructures are thought of as embodiments of social practice situ-

ated in specific socio-historical contexts. And in that, they represent ethical, cultural, political and economic values, although at

the end of the process of development these choices may often merely surface as technical decisions [2]. This is where my dissertation project sets in. Throughout history, tables have been made use of in many different functional contexts – from the altar as a sacral object, to the prominence of the round table, to an essential part of modern-day work environments or, at the heart of social interaction, as private and public dining tables. In this regard,

both, the development of interactive tabletops in the context of VIGITIA as well as their usage in everyday settings can be subject of cultural analysis and provide insight into the question how individuals and social groups deal with technology in its social, material-sensory and biographical-narrational aspects.

FROM SKETCH TO RESEARCH DESIGN: NEXT STEPS

In terms of a dissertation project, the topic sketched above still stands at its very beginning and requires extensive further conceptualization in order to narrow down a distinct research question and corresponding research design. In order to do so, my next steps include: (a) further literature research with focus on digital anthropology as well as the interdisciplinary field of science and technology studies; (b) an evaluation of kinds of obtainable data and corresponding collection methods that suffice

both, the affordances of usability evaluation required for the developing process, as well as the affordances of qualitative cultural analysis; (c) narrowing down and refining the key research questions under investigation and framing ways to operationalize it; (d) incorporate further feedback and expertise from both, anthropologists and computer scientists.

RESEARCH APPROACH AND RELATED WORK

As the key research questions of my dissertation project are still to be refined, at this stage, I have not yet chosen a certain methodology. Apart from using basic methods of ethnographic fieldwork, such as participant observation and in-depth narrative interviews, my project aims at exploring a multi-modal methodological approach that inductively oscillates between different perspectives. As Jörg Niewöhner puts it: “Key to such an approach, however, is not the integration of different analyses into a coherent whole, but rather to explore how they relate to each other (...) and how the constant failure of any perspective to capture some-

thing whole and complete, starts to produce something interesting when put next to other failures” [2]. In the course of further refinement my project will draw from and intends to build upon existing research in technology and digitization studies focusing on social and cultural aspects, e.g. Beck 2012, Hengartner 2012 and Koch 2017 [3, 4, 5]. At this early stage of my dissertation I am particularly interested in discussing the relevance of potential research questions at the interface of cultural anthropology and computer sciences.

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Mixed Reality for Sighted, Low Vision and Blind People

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INTRODUCTION

Human-Computer Interaction proposes continuously new ways of interacting. On one hand, interactive technologies have been demonstrated as effective tools for accessibility of people with visual impairments (PVI). On the other hand, a lot of new technolo-

gies rely on visual feedback, e.g. virtual and augmented reality (VR, AR), graphical user interfaces and big-screen interaction, and exclude PVI. We propose to study how the same interactive systems can be inclusive for sighted, low vision and blind people.

PROBLEM STATEMENT AND RESEARCH QUESTION

In Germany, the prevalence of PVI is one of the lowest in the world: between 0.2 and 0.4%. Still, it represents at least 165 000 people, and may increase with aging population. It is important to propose systems usable by this population. Specialized assistive technologies (AT) for PVI only reach partially their inclusion goal. First, particularly the youngest users may reject AT due to stigmatization. Second, the sighted users can be disappointed by unusual interaction modalities [2,3]. Finally, most of PVI can use visual feedback (people with low vision).

We propose to study how to create interfaces usable by people with and without visual impairments, in VR, AR and physiological interaction. We propose as well to develop awareness about visual impairments using AR and VR. This would lead to rethinking multimodality. Audio and haptic are for now mostly supporting visual feedback. We can study multi-modality, with self-sufficient audio and haptics feedback. For instance, how to represent a vertical movement in VR without visual feedback? We propose to reconsider new interfaces uses with and with-

out vision from the design stage. We expect to foster inclusion, considering people with sensorial disabilities as real users — not only people to help.

RESEARCH APPROACH AND METHODOLOGY

To ensure the research goes beyond the lab, a participative design approach is followed [5,6]. It includes interviews and iterative design with end users (sighted, low vision and blind people).

PRELIMINARY RESULTS

From the study of the current works, we have identified that:

- Most of the systems for PVI do not provide visual feedback at all. However, nine tenths of PVI are low vision people and use their residual vision
- Multi-modality in VR and AR exists for long, but audio and haptic are often not sufficient for using the system.

PLANNED NEXT STEPS

The next step is to examine the constitutionality and to finally revise the preliminary results.

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Towards Dynamic 3D Scene Understanding

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INTRODUCTION

3D scanning and understanding of 3D indoor environments is a fundamental research direction in computer vision that establishes the basis of a large variety of applications ranging from indoor robotics to augmented and virtual reality. In particular, the rapid progress in RGB-D scanning systems now allows to obtain 3D reconstructions

of indoor scenes using only low-cost scanning devices. Along with the ability to capture 3D maps, researchers have shown significant interest in using these representations to perform 3D scene understanding and developed a rapidly emerging line of research focusing on tasks such as 3D semantic or instance segmentation [1,2,3].

PROBLEM STATEMENT AND RESEARCH QUESTION

However, the shared commonality between these works is that they consider only static scenes. In contrast, we focus on real world environments that change over time. Changes are mostly rigid (moved, removed or added objects). Additionally, non-rigid objects such as curtains or blankets and lighting changes create additional challenging scenarios. Even though, there is a high de-

mand for dynamic and high-level understanding, the field is still rather unexplored mostly due to lack of training and evaluation data. Open research questions involve 3D object instance and camera re-localization, persistent reconstruction, change detection and captioning of changes.

RESEARCH APPROACH AND METHODOLOGY

As a first step of this project, we proposed 3RScan [4], a large scale, real-world dataset which contains multiple 3D snapshots of naturally changing indoor environments. Based on this data, we set up a public benchmark for 3D instance-level object re-localization: given one or multiple objects in a segmented source scene, we want to estimate the corresponding 6DoF poses in a target scan of the same environment taken at a different point

in time. We evaluate the performance of a baseline method, a fully-convolutional multiscale network, on the newly-created benchmark. We publicly release our dataset with a standardized test, validation and training set and extensive annotations. To allow a fair comparison of different methods, we also release a hidden test set together with an automatic server-side testing script.

RELATED WORK

Even though state of the art approaches show impressive results on tasks such as 3D object localization and matching or RGB-D scene understanding, they are often restricted to static environments. In this work [4], we aim to localize given 3D objects from a source scan in a cluttered target scan which contains common geometric and appearance changes. Notably, only a few recent proposals started exploring the idea of collecting scene changes to allow long-term scene understanding. InteriorNet [6] is a large-scale synthetic dataset, with random physics-based furniture shuffles and illumination changes. Despite the impressive size

and indisputable usefulness, we argue that, due to the domain gap between real and synthetic imagery, the availability of real sequences remains crucial. To the best of our knowledge, the only real dataset encompassing scene changes is the one released by Fehr et al. [7], which includes three different rooms used to segment the scene structure from the movable furniture, though lacking the annotations and necessary size to train and test current learned approaches.

PRELIMINARY RESULTS

We released the first large-scale dataset of real-world sequences with temporal discontinuity that consists of multiple scans of the same environment. We propose a data-driven approach for the newly introduced task of 3D object instance re-localization being a

very challenging and particularly important task, yet to be further explored. Our method outperforms three different baselines with a large margin.

PLANNED NEXT STEPS

We believe that our new benchmark is the first step to accomplish dynamic 3D scene understanding. Our dataset comes with a large variety of annotations designed for multiple benchmark tasks. We believe our data helps the development and evaluation of these new algorithms to, in the end, accomplish persistent, long-term

understanding of indoor environments. For the dissertation, more aspects of dynamic scene understanding are planned to be explored.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

I am interested in projects that tackle changes over time, potentially involving domain transfer from different input / output data.

Also, since I started working with 3D scene graphs, I am interested in exchange in that field too.

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Framework for Strategy Selection of Atomic Units in Holonic Smart Grids

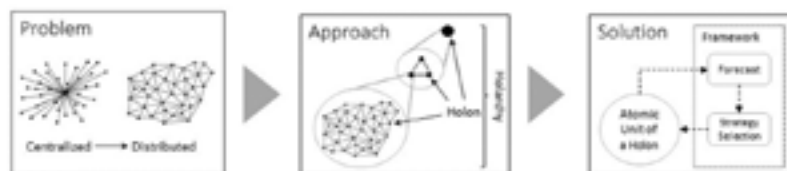
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To achieve **Holarchical operation in Smart Grids** do **Day-ahead Strategy Selection**



- Electrical grids are evolving from a centrally managed critical infrastructure to distributedly managed Smart Grids.
- This paradigm shift leads to an increase in the complexity of network management tasks.
- Holarchical organization for Smart Grids allows dynamical allocation of energy resources by including them into holons.
- Under optimal conditions, holons tend to form larger holons.
- We present a framework for stable holon operation based on a bottom-up approach.
- In particular, at an atomic level consisting of a prosumer, storage-unit and a power supply.
- Operation Strategy is chosen based on day-ahead forecast (production and consumption).

INTRODUCTION

Electrical grids are evolving from a centrally managed critical infrastructure to distributedly managed Smart Grids (SGs). This evolution is driven by the need for the grid to incorporate local production capabilities of renewable Distributed Energy Resources (DERs). The paradigm shift from centralized to distributed control, however, leads to a considerable increase in the complexity of network

management tasks. Various approaches for tight monitoring and fast control have been put forward to provide continuous operation and stability of distributed energy grids [1]. These approaches generally rely on strong support by Information and Communication Technologies (ICT).

PROBLEM STATEMENT AND RESEARCH QUESTION

Hierarchical and cellular network segmentation promises to simplify the mechanisms for controlling the SG. The next evolutionary step for cellular network approaches are holar structures [2]. In particular, these systems seek leverage formation and segmentation by enabling the reuse of mechanisms on different hierarchical levels. Entities in such a system (so-called

Holons) are simultaneously a “whole” and a “part” of something bigger. The emerging system-of-systems structure is referred to as a holarchy [3]. Holons are dynamic cells, which can merge with other holons (or separate into individual smaller ones) when suitable. Under optimal conditions, holons tend to form larger entities, while their capability to separate sub-parts aids

in increasing network stability (e.g., by splitting off potential misbehaving or faulty entities). This is ensured cause holochars are mainly based on the concepts of isolation and containment [4].

In this work, we consider single buildings, be they commercial or residential, to be the atomic building blocks of holons. With the integration of DERs, they may be both producers and consumers, so called prosumers of energy. In order to facilitate holon creation and stable operation, particularly in small-scale grid scenarios, accurate models for the behavior of these

prosumers is necessary. This, in turn, entails the need for a framework that is capable of forecasting, within reasonable limits, both electrical load and production behaviors. This need is exacerbated especially in small holons because smoothing effects on energy production and consumption fluctuations are not as effective here as in larger grids. In related work, battery energy storage system (BESS) for handling fluctuations in DER are a major research topic. May it be for migrating solar fluctuations or to reduce peak demand in distributed grids.

RESEARCH APPROACH AND METHODOLOGY

The results in BESS-oriented work suggest the potential of prediction-based strategy selection for the dynamic creation of holar microgrids. The framework proposed in this research aims to leverage these results and, in future work, to also integrate formation and control methods for merging and splitting holar microgrids. Based on the above mentioned considerations, we present a framework for stable holon operation. In particular, at an atomic level consisting of a consumer, production unit, storage system and a power supply. The main contributions of the proposed framework are:

- Provision of dynamic control via smart strategy selection for holar smart microgrids.
- Advancements of current smart microgrid capabilities by enabling forecasting and operation optimization on the level of atomic holons.
- Showcasing the application of the current deployment of the framework by deploying it at a real-world prosumer site.

PRELIMINARY RESULTS AND PLANNED NEXT STEPS

The presented approach is designed to improve current SG capabilities by providing a modular structure for forecasting and optimization. Based on historical load data our framework makes a day-ahead forecast for load consumption and PV production, within reasonable limits. After analyzing the historical data a LSTM (long-short-term-memory neural network), which is among machine learning technique, is presented. To validate the load forecast accuracy a RF (random forest) serves as a comparison, as well as the following three persistence models: previous one day, last week and average weekday value. The results

showed that both LSTM and RF are practicable methods with higher accuracy than the persistence approaches. The forecast values are the basis for the optimization part within the framework, which selects the strategy for next day's energy flow within a holon.

In further work, we are improving the forecast models by adjusting the different machine learning techniques. Furthermore, we are defining more strategies to optimize creation and managing of holarchical smart microgrids.

PLANNED NEXT STEPS

To finish the mobility model, the systematic sensitivity analysis of features and the final parameterization for Germany is still open. Then, I will develop and evaluate the estimators and implement

the model predictive control agent. The last step is to define, simulate and evaluate future scenarios.

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Host-Based Intrusion Detection in SME Company Networks

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Overview of Research Topic			
	What	Why	How
Data	System Calls	System calls are a reliable host-based data source that contain information about any change made to an operating system.	System calls need to be transformed into numerical vector representations in order to use them as input for neural networks.
Methods	Neural Networks	Neural Networks are fast decision engines that can be easily updated with new data and are capable of analysing sequences and modeling normal behaviour.	Modeling normal behaviour of sequences of system calls for anomaly detection can be done e.g. by using LSTM cells or Transformer models.
Target Group	SME Companies	Due to the lack of human and financial resources SMEs are in dire need of a decision support engine to close vulnerabilities.	Appropriate countermeasures are recommended based on suspected malicious behaviour, assigning the most likely scenario.

INTRODUCTION

Small and middle-sized enterprises (SMEs) make up an important part of the German economy – many of them have gained great importance through their innovative strength. This makes SMEs an appealing target for hacker attacks. However, a recent study [1] shows that due to the lack of time and human and financial re-

sources, SMEs still have a deficiency in the practical implementation of IT security systems. Another important reason is the lack of adaptation of existing IT security systems to specific target groups. Hence, SMEs are in need of an adaptive security system tailored to their needs.

PROBLEM STATEMENT AND RESEARCH QUESTION

In order to be able to support responsible employees with an intelligent security system, a fine-grained robust data source is necessary that is able to monitor every activity within an operating system. These requirements are met by system calls. If a program needs to access the resources of an operating system, it must make a request to the kernel. These requests are defined in the form of system calls. Hence, every change to an operating system will be shown within the system calls a program makes.

Proper analysis of system calls is challenging though, since machine learning methods typically rely on numerical input data while system calls are in categorical or even textual format. Thus, system calls need to be preprocessed and transformed into numerical representations. During the preprocessing of system calls for intrusion detection it is of particular interest that no information regarding the intent of a sequence of system calls (benign or malicious) is being lost.

RESEARCH APPROACH AND METHODOLOGY

In two recent projects [2, 3] our research group focuses on a systematic comparison of different transformation methods. Since sequences of system calls can be viewed as text where temporal ordering and context are relevant factors, different methods from the field of Natural Language Processing are adapted in order to extract numerical vector representations of system calls. Whether the basic intent of a sequence is maintained is evaluated by using a LSTM classifier. The different transformation methods tested so far are one-hot encoding, extending the original classifier model by an additional embedding layer and learning word2vec, fastText and GloVe vector representations.

Murtaza et al. [4] use kernel modules as a valid alternative to plain system calls. The authors achieve faster processing times with similar results by mapping each system call to its corresponding kernel module, thus reducing the input vector size in one-hot encoding. We view this approach as a valuable generalization step and adapt the use of kernel modules. Kernel modules may also add valuable information on the relationships of different system calls. They can therefore be seen not only as substitutes but also as additional information. Consequently, each transformation from [2, 3] is also applied to kernel modules as well as kernel modules and system calls in combination.

PRELIMINARY RESULTS

One-hot encoding achieves the best results with a true positive rate of 95% and a false positive rate of 16% [2] on the ADFA-LD [5] dataset. Furthermore, a detailed analysis [3] regarding the impact of different representation methods on the detection

of diverse attacks shows that adding kernel modules to system calls leads to the detection of a broader range of attacks.

PLANNED NEXT STEPS

Based on earlier results, next steps focus on the development of more sophisticated models for intrusion detection. In particular, LSTM Autoencoders are to be adapted to learn normal behaviour

of programs with the overall goal to detect anomalies based on the reconstruction errors of the models.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

A big challenge is still the lack of available datasets containing system call traces. Current datasets like the ADFA-LD [5] are too small for certain methods of deep learning since they rely on a huge amount of data. A cooperation for the joint creation of an extensive dataset is of interest. Simply recording the normal behaviour

of different users in a real environment proves to be difficult due to privacy concerns. When recording a dataset it is important to ensure that not only a wide variety of up-to-date attacks are included, but also that the normal behaviour generated is as diverse and realistic as possible.

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Automated Text Content Analysis of Digital Democratic Communication

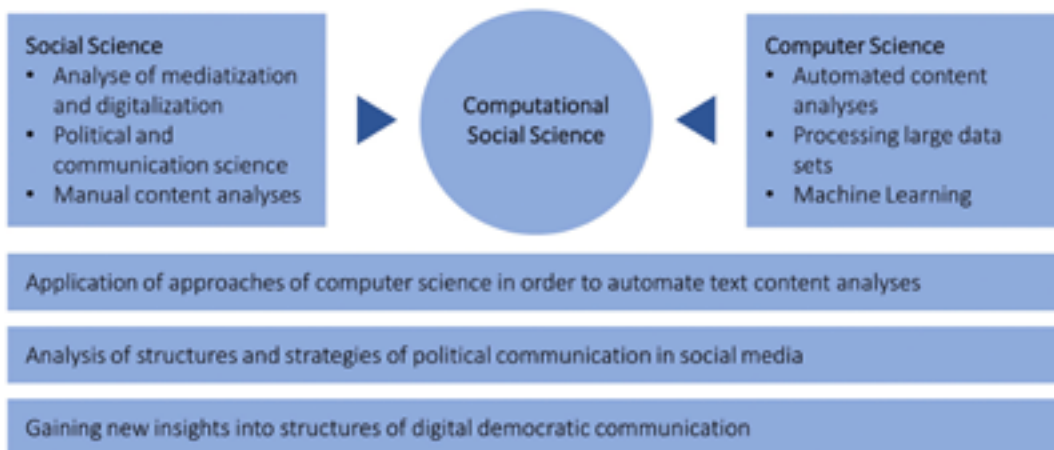
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Integration of Automated Text Analyses in Social Scientific Methods



INTRODUCTION

The digitalization of political communication has become an important factor in the democratic process. Our research group "Digital Democratic Mobilization in Hybrid Media Systems" explores the structures and evolvement of political digital communication. What is the impact of digitalization on social and political interaction? Which strategies pursue politicians and parties in their digital communication in different European countries? How do citizens participate and interact in the digital democratic processes?

To analyse the digital political communication and its impacts on mobilization and participation in democratic processes, social media platforms like Facebook are observed. Social networks provide a large quantity of data. Investigating and annotating this data means a lot of manual effort. In the last years automated methods

were introduced to reduce this effort. The integration of computer science in social science led to a new academic discipline: computational social science [1].

My PhD will be settled in this area of research between communication and computer science and, therefore, will be decidedly interdisciplinary. Different approaches of computational linguistics will be applied to text units of political communication in social media to give evidence about the applicability of automated methods to specific questions of communication science.

PROBLEM STATEMENT AND RESEARCH QUESTION

The large data sets of digital social media platforms are both, interesting and challenging objects of investigation for social scientists. There are already proven methods to meet large datasets in social science when e.g. handling articles of newspapers. In order to analyse those text units in a quantified manner the method of content analysis is applied. The text units are manually annotated based on a set of defined categories.

Within my PhD thesis, I want to contribute to the integration of computational methods in content analyses to gain further insights into the data. Category assignment represents a classifying

task, that is examined deeply in computational research areas like machine learning. Central questions of my PhD thesis are: Which computational methods are applicable - and are already applied - that lead to valid results? How can automated methods that were developed for other problems be transferred to the analysis of political communication in social media?

The content analysis will be applied to compare the messages of politicians and parties of different European countries, to identify the communicative strategies on social media platforms, and to explore the effects on democratic mobilization.

RESEARCH APPROACH AND METHODOLOGY

Data is collected from Facebook, Instagram, Twitter, and YouTube. The method of content analysis is applied and the manually annotated data serves as test data for following automated analyses. Text analysis algorithms will be applied to classify messages and to assign categories automatically.

The applicability of existing computational tools to analyse political communication will be evaluated. The problem of reliability and validity must be taken explicitly into consideration when using automated analyses for sociological research tasks. Because only when automated processes are reliable, can they have a benefit for social science.

RELATED WORK

The idea of computational support in social science is already existent and has become manifest in the area of computational social science [1], [2]. Serrano et al. [3] study the social media

strategy of the German party AfD by using topic modeling algorithms based on statistical models.

PRELIMINARY RESULTS

As this is the beginning of my PhD, I am still in the phase of exploration and preparation. Currently, we are preparing a structured data set of text units and their attributes by storing the data in a relational data base.

PLANNED NEXT STEPS

An exhaustive systematic literature review will be the first step of my PhD work to determine the attempts of automated methods in social science over the past years and identify relevant automated text analysis methods. Having identified relevant tools, they have

to be adapted for annotating the collected political messages. Test criteria have to be developed to evaluate the reliability and validity of the results.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

As we are dealing with different European languages in our project, multi-language approaches are interesting to explore and training data sets that can be applied in a political context have to be tested.

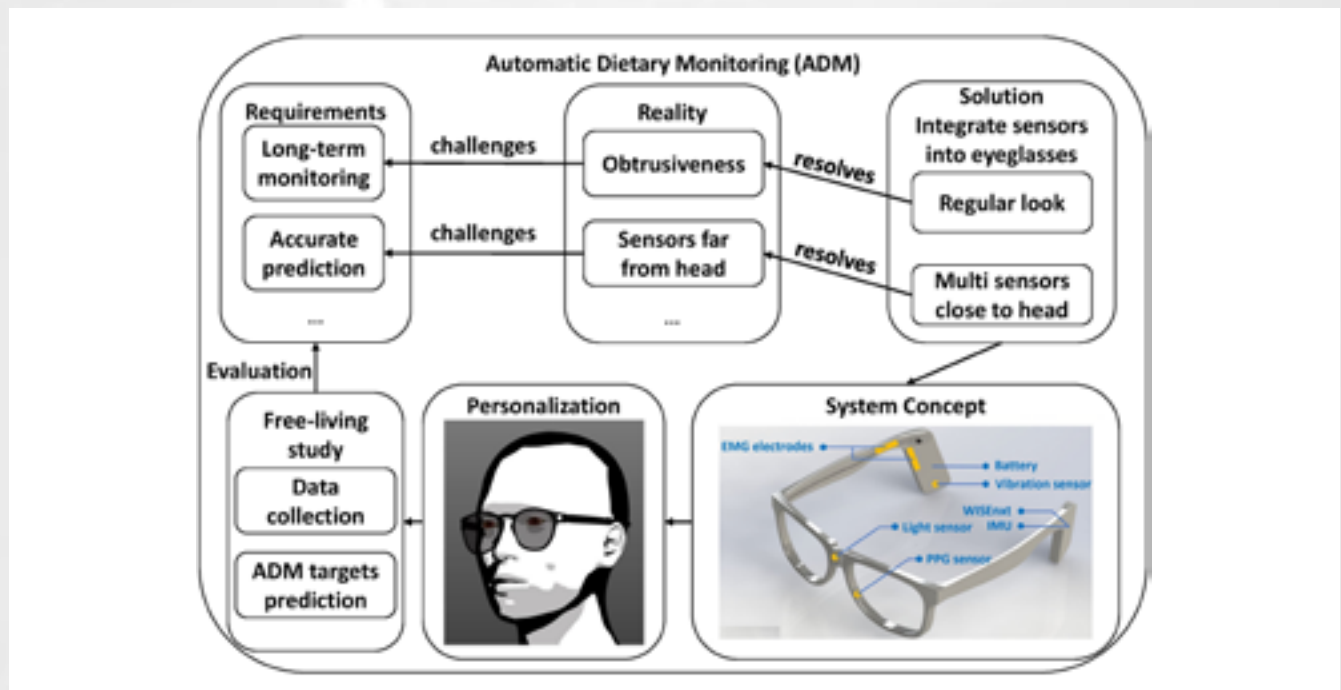
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INTRODUCTION

Long-term monitoring of eating is challenging due to the lack of reliable methods. Many daily activities including eating activities (e.g. biting, chewing, and swallowing, etc.) take place on the head. Attaching sensors directly to target areas on the head for monitoring purpose is nevertheless often an obtrusive method hindering

long-term monitoring. Eyeglasses are common daily head-worn accessories used by a large ratio of the population. We build dietary-monitoring eyeglasses integrated with multiple types of sensors. We record data of dietary activities using the eyeglasses and extract dietary information from the data.

PROBLEM STATEMENT AND RESEARCH QUESTION

Monitoring diet via manual logs is tedious and inaccurate across long term. Many sensor-based dietary monitoring technologies either face with the challenges of obtrusiveness in daily usage or inadequate monitoring performance. To resolve the challenges, we develop smart eyeglasses to support automatic dietary monitoring (ADM). We aim to answer the research questions such as when, what, and how much amount the food intake is. Potential application examples using the dietary-monitoring eyeglasses in-

clude predicting dietary habits by providing intake timing information of multi-resolution levels; tracking intake diversity

and calorie intake by estimating food category and consumption; assisting medical treatments by sending timely reminders, e.g. accurate insulin injection reminders in diabetes treatment, etc. and to explore the effects on democratic mobilization.

RESEARCH APPROACH AND METHODOLOGY

We build regular-look smart eyeglasses for long-term dietary monitoring by combining expertise knowledge in electronics, mechanics, fabrication and data science. We study how different sensor modalities can be integrated in eyeglasses to obtain information of dietary activities. We design eyeglasses frames, develop the sensing system, and personalize the eyeglasses frames to maximize sensor data quality and wearing comfort. We collect

data from in-lab and free-living studies with participants wearing the dietary-monitoring eyeglasses. We extract dietary information from the collected data and analyze dietary behavior using algorithms. Our evaluation targets include the performance of smart eyeglasses functionalities, eating prediction algorithms, and the eyeglasses personalization method.

RELATED WORK

Amft *et al.* [1] recorded eating sound using an in-ear microphone, recognized eating with up to 99% accuracy and classified four typical food types with accuracy above 80%. Merck *et al.* [2] combined in-ear audio, head and wrist motion for food classifi-

cation and food weight prediction. Food type was classified with an accuracy of 82.7% and weight was estimated with a relative error of 35.4%.

PRELIMINARY RESULTS

We summarize our current research results here. Zhang *et al.* [3] integrated electromyography (EMG) electrodes into eyeglasses frames and used them to monitor chewing. Zhang and Amft [4] integrated vibration sensors into eyeglasses frames and found out the sensor data can be potentially used for food type classification. Zhang and Amft [5] conducted a free-living study to collect Temporalis EMG data and detect eating. Eating time was detected with a

F1 score of more than 95%. Zhang *et al.* [6] 3D-printed conductive lines and EMG electrodes on eyeglasses frames. Tests show the printed components could function normally and provided excellent Temporalis EMG signals during chewing.

PLANNED NEXT STEPS

We expect to conduct a large-scale long-term free-living study with the focus on detecting eating time and food intake content.

OPEN ISSUES AND POSSIBILITIES FOR COOPERATION

Cooperation in micro-controller programming, wearable system design and manufacturing is appreciated to speed up the project.

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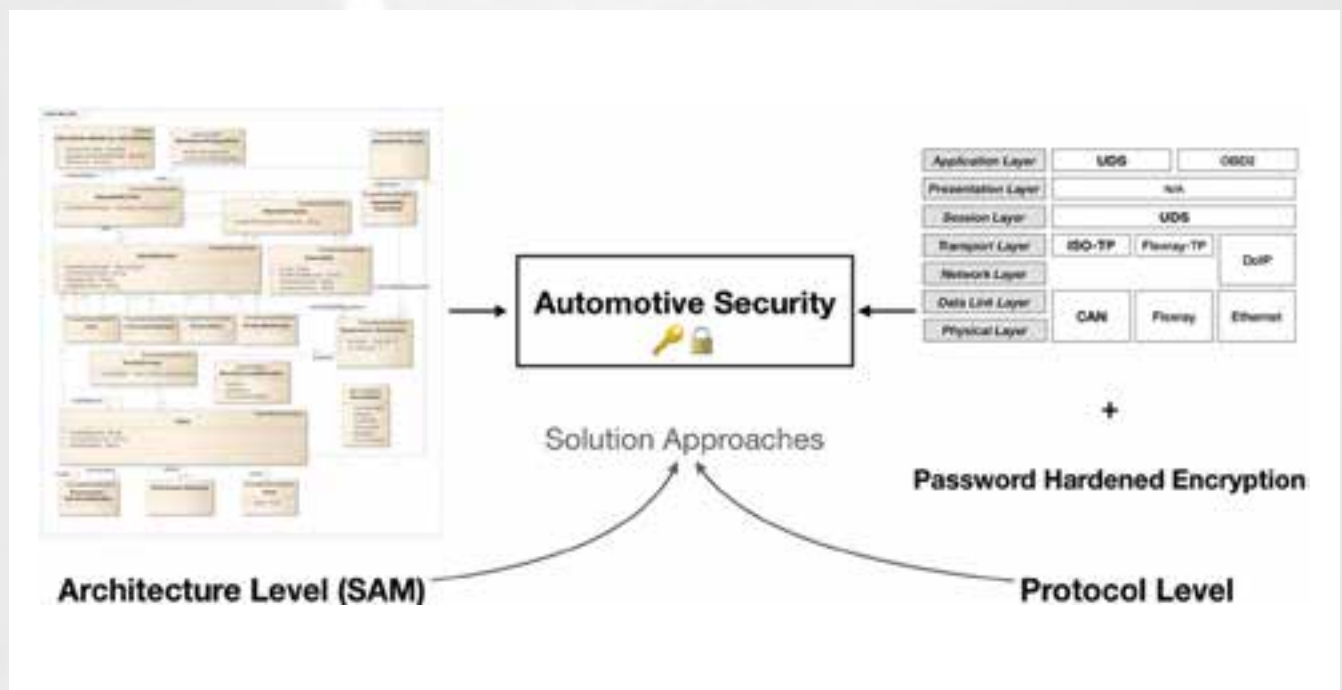
Automotive Security: Techniques for Modelling and Implementation

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INTRODUCTION

Autonomous vehicles have a greater attack potential than any previous individual vehicle. This is primarily due to the considerable communication demands of the vehicles, which on one hand emerge for reasons of functionality and safety, and on the other hand for reasons of comfort. Most existing countermeasures against cyber-attacks, e.g., the use of message cryptography, concentrate on concrete attacks and do not consider the complexity

of the various access options offered by modern vehicles. This is mainly due to a solution-oriented approach to security problems.

This PhD thesis combines security techniques for security modeling with a systematic analysis of current automotive network protocols and cryptographic protocol design, i.e., password hardened encryption (PHE) for trustless authentication in autonomous vehicles.

PROBLEM STATEMENT AND RESEARCH QUESTION

Modern vehicles are interconnected computer networks in which many electronic control units (ECUs) communicate with one another and with the environment (Vehicle-to-X communication). In recent years, car manufacturers have been producing vehicles that have an online connection and offer cloud services. These convenience features are intended to attract

new customers, but can also be access points for new attacks. Considering the fact that AVs will continue rather than reverse the trend, it is crucial to make collective research understandable. After all, human lives are at stake every time these “driving computers” are the target of attacks.

RESEARCH APPROACH AND METHODOLOGY

Our research tackles automotive security from both ends: the abstract (architecture) level and the low-level implementation details on protocol and even network level. A thorough analysis of many serious cyber-attacks on automotive software systems is conducted and the results are illustrated in a systematic analysis and grounded theory evaluations.

RELATED WORK

The ISO/SAE 21434 “Road Vehicles—Cybersecurity engineering” standard [1], which is currently under development, proposes the introduction of security work packages, security concepts and architectures along the V-Model [2]. Our work considers the early efforts and design principles of the ISO/SAE 21434 and integrates them into the EAST-ADL. The SAE J3061 “Cybersecurity

On the technical side, we reviewed relevant automotive networks and protocols to identify shortcomings and vulnerabilities. Those vulnerabilities are rated and classified with a Common Vulnerability Scoring System (CVSS). Furthermore, we develop security techniques to mitigate some of the most relevant shortcomings, e.g., network / message authentication.

Guidebook for Cyber- Physical Vehicle Systems” [3], also available as a work in progress, wants to establish a set of high-level guiding principles for cybersecurity as it relates to cyber-physical vehicle systems, including lifecycle process frameworks and information on common existing tools and methods.

PRELIMINARY RESULTS

The first published result was SAM: A Security Abstraction Model for automotive software systems. It is a solution for modeling secure automotive systems in the early system development phase in order to reduce risks connected to late identification of security threats and vulnerabilities in the automotive system life cycle. The approach tightly couples security management with model-based systems engineering by an abstract description of automotive security modeling principles. The resulting SAM language specification is based on security requirements elicited from common industrial scenarios. It is a suitable solution for representing attack vectors on vehicles and provides a thorough security modeling for the automotive industry.

Moreover, one of our studies showed that the majority of today's automotive security research is focused on (message) cryptography, which does not mitigate the majority of the most relevant attacks. A highly topical research challenge is flexible extensibility, which at the same time provides protection against arbitrary manipulation and would generally be a helpful approach for over-the-air updates. A possible research challenge is a lean system for (embedded) virtualization, as it limits the scope of the vulnerability and can obliterate some of the weaknesses in automotive security, e.g., CAN authenticity.

PLANNED NEXT STEPS

Next steps will focus on developing a secure and trustless authentication scheme for autonomous driving using password hardened encryption (PHE) services. This can be used for secure over-the-air updates and securing driver data without having to trust third parties.

Future research solutions should also focus on a combination of countermeasures regarding both security and dependability to

provide adequate and flexible protection against cyber-attacks on cars. In the future, autonomous vehicles will probably be more susceptible to attacks than today's cars already are. Our work is aimed at developing the necessary knowledge and principles to ensure that traffic safety and security will continue to rise steadily in the future.

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