ANNUAL
REPORT

CRITICAL
INFORMATION
INFRASTRUCTURES
RESEARCHGROUP

KIT
Karlsruhe Institute of Technology

aifb

2022

PREFACE

Dear Friends,

It's more exciting than ever to study future digital systems and their symbiosis with our society. I think 2022 was a great year for the cii research group—by making several remarkable contributions to research, teaching, and innovation in this area. Our academic endeavors continue to balance theoretical and applied research at the intersection of information systems and computer science.

We published several research papers that were very well received by the academic community. We presented and discussed our research at leading scientific conferences, like the International Conference on Information Systems (ICIS), the Conference on Business Informatics (CBI), the International Conference on Design Science Research in Information Systems and Technology (DESRIST), and the Hawaii International Conference on System Sciences (HICSS).

The biggest highlight was definitely that in December Dr. Sebastian Lins was awarded the prestigious ACM SIGMIS Doctoral Dissertation Award during the ICIS conference in Copenhagen.

After two years of COVID-19 restrictions and collaborating mostly in a virtual working mode, we finally met in person as a whole group for a doctoral seminar in 2022. The three-day retreat in the middle of the year 2022 was an excellent opportunity to see each other again in person, get to know the many new team members, and have great discussions both in professional and personal manners. The group grew a bit last year. Highly talented and motivated colleagues joined the team and started working on new cool research projects.

In 2022, we again offered numerous multi-faceted lectures, seminars, programming courses, and hackathons. For the first time, we also had a teaching class on innovative projects to develop and evaluate innovative teaching formats. The number of students attending our lecture „Applied Informatics – Internet Computing" grows continuously with every year. In 2022 we received the certificate for good education from the KIT Department of

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Economics and Management. We are very encouraged by the students' highly positive feedback and look forward to our teaching activities in 2023.

Regarding innovation, I would like to highlight our new research projects AAIS, DIRECTIONS, and GAIA-X 4 ICM. The DFG-funded project Accountable Artificial Intelligence–based Systems (AAIS) explores a sociotechnical set of relationships between humans interacting with artificial intelligence (AI) systems to perform specific tasks. The aim of the project Data Protection Certification for Educational Information Systems (DIRECTIONS) is the conceptual design, exemplary implementation, and testing of a sustainable, applicable data protection certification for educational information systems. The project is funded by the Federal Ministry for Education and Research (BMBF) for 6 years. In the GAIA-X 4 ICM project, different stakeholders aim to make Gaia-X usable for production, to realize a concrete instance, and to enable coupling with production systems. The project is funded by The Ministry of Science, Research, and the Arts in Baden Wuerttemberg.

Last but most importantly, I am pleased to have welcomed seven new Ph.D. students in my research group in 2022—Maximilian Blume, Kathrin Brecker, Richard Guse, Eva Späthe, Valeria Smolenskaya, and Daniel Kirste. Welcome again and great to have you on board! I would also like to congratulate Dr. Sebastian Lins, Dr. Malte Greulich, and Dr. Scott Thiebes, who successfully finished their Ph.D. in 2022. So proud of you, guys.

Much more information regarding our team, research projects, talks, teaching activities, publications, industry-related activities, and community services can be found in this annual report of the research group's critical information infrastructures. I hope you will enjoy reading the report and gaining some interesting insights into our highlights of 2022.

I am looking forward to the year 2023 !

Very Best

Ali Sunyaev

INTRODUCTION

Critical information infrastructures are sociotechnical systems comprising essential software components and information systems with pivotal impacts on individuals, organizations, governments, economies, and society. We work on research challenges concerned with the design, development, and evaluation of reliable, secure, and purposeful software and information systems. Our research features a strong domain focus, in particular, on the internet and healthcare industries. The principal goal of our research is theorizing on and designing the applications and methods required for the creation and innovation of sociotechnical systems with auspicious value propositions. In our studies, we rigorously employ a variety of interdisciplinary methods and build on theories from information systems and related disciplines. Our work accounts for the multifaceted use contexts of information and communication technologies with research on human behavior affecting critical information infrastructures and vice versa. This enables us to rigorously generate strong theoretical insights while simultaneously producing research outputs of relevance to practical audiences.

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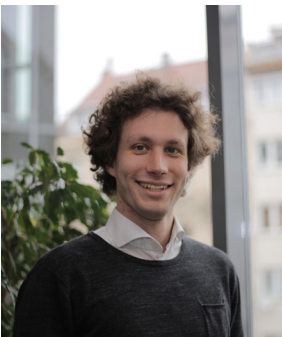
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RESEARCH PROJECTS

Accountable Artificial Intelligence-based Systems

Developments in Artificial Intelligence (AI) offer new innovative ways to contribute to the well-being and progress of individuals and society. However, due to a multitude of incidents with AI (e.g., discrimination through AI predictions), the accountability of AI becomes more and more important. In general, accountability means that actions performed can be clearly assigned to a person. Applied to AI, accountable AI-based information systems (AAIS) refer to a socio-technical set of relationships consisting of humans interacting with AI technologies to perform certain tasks, where the actions taken in the course of the interaction can be uniquely attributed to a person. AAIS is intended to ensure that someone can be held legally responsible if the AI-based IS fails.

While calls to develop and embed mechanisms to create accountability in AI-based IS are growing, research on AAIS is still in its infancy. This project aims to answer three research questions: (1) „What facets of accountability are relevant to AAIS?", (2) „What impact does accountability have on perceptions during the development, operation, and use of AI?", and (3) „How does accountability affect the behavior of AI users and architects?".

Project Title: Accountable Artificial Intelligence-based Systems: A Multi-Perspective Analyses

Contact Persons: Sebastian Lins, Ali Sunyaev

Funded by: German Research Foundation

Project Partners: Prof. Dr. Alexander Benlian, Technical University of Darmstadt

Website: _https://cii.aifb.kit. edu/110_1119.php -_

TECHNISCHE
UNIVERSITÄT
DARMSTADT

AUDITOR

The objective of the research project European Cloud Service Data Protection Certification (AUDITOR) is the conception, exemplary implementation, and testing of an enduring EU-wide data protection certification for cloud services. The certification in accordance with the EU General Data Protection Regulation (GDPR) is in the interests of everyone involved: the cloud customers, who are only permitted to work with cloud providers that can guarantee a sufficient level of data protection, the cloud providers, who can offer just this security with such a certification, the auditing and certification bodies, for whose business area the GDPR stipulates strict laws, and the end-user, potentially affected by the data usage, the protection of whose personal data is in the focus of certifications of cloud services. The highly political project is led by our research group and already enjoys the highest attention internationally. AUDITOR is carried out in cooperation with numerous partners from large, medium-sized, and small companies (e.g. IBM, Salesforce, Microsoft, Fujitsu, Deutsche Telekom, and SAP), several major ministries and authorities (e.g. the Deutsche Akkreditierungsstelle), and a large number of German data protection authorities.

Project Title: European Cloud Service Data Protection Certification (AUDITOR)

Contact Persons: Sebastian Lins, Heiner Teigeler, Ali Sunyaev

Funded by: Federal Ministry for Economic Affairs and Climate Action

Project Partners: CLOUD&HEAT Technologies GmbH; datenschutz cert GmbH; DIN-Normenausschuss Informationstechnik und Anwendungen (NIA), DIN e.V.; ecsec GmbH; EuroCloud Deutschland_eco e.V., eco – Verband der Internetwirtschaft; University of Kassel

Website: *www.auditor-cert.eu*

BISE Student

The BISE Student project develops an innovative open-access platform for publishing excellent student dissertations, like Bachelor, Master, and Diploma theses. Typically, after a thesis has been handed in and graded, it simply disappears into a non-public university archive or desk drawer, never to be seen again. However, many of these theses are being carried out with great thoroughness and present results of high practical and scientific value for other students, researchers, and practitioners. Following the open knowledge idea, which is to allow anyone to freely access, use, modify, and share knowledge, BISE Student makes the publication of excellent student theses much easier for students and universities as well as provides an open and highly visible platform revealing the real worth of Bachelor, Master, and Diploma theses.

BISE Student utilizes the innovative potential of distributed ledger technology to archive the system's three primary design goals: ease of use, openness, and content excellence. The entire submission process is transparently documented and safeguarded by the bloxberg blockchain (https://bloxberg.org). In order to create a truly open publication platform, BISE Student stores the theses and accompanying research data (e.g., interview transcripts, statistical data, program code) using a public decentralized storage solution - the InterPlanetary File System (IPFS).

Project Title: BISE Student – An Open Access Dissertation Library

Contact Persons: Benjamin Sturm, Ali Sunyaev
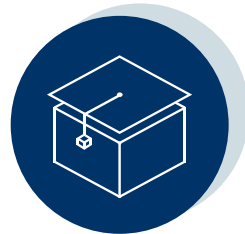
Funded by: -

Project Partners: BISE Journal (https://bise-journal.com)

Website: *https:// bise-student.io*

BISE Student

BloG3

Members of the BloG3 project intend to design, develop, and evaluate a blockchain-based system for the management of health data. The system enables oncology patients leaving the Charité hospital in Berlin to manage access rights to their data. This allows patients to grant data access to other doctors, hospitals, and nursing services in the context of follow-up care conveniently via a smartphone app. In order to consolidate scattered records, and form different institutions, the blockchain-based system integrates different health information systems and builds a bridge between different electronic data sources.

The project consortium comprises partners from IT services, healthcare, and computer science research. The main objective of this project is to investigate the tangible benefits of blockchain technology for the German healthcare system from a technical, economic, and social perspective. Within this project, KIT particularly works on the design of the system architecture, the perception of the system by different user groups, and the development of incentive mechanisms for the continuous use of the platform.

Project Title: BloG3 - Blockchain-basiertes Gesundheitsdaten-management für gesamtheitliche Gesundheitsprofile

Contact Persons: Shanshan Hu, Scott Thiebes, Ali Sunyaev

Funded by: Federal Ministry of Education and Research

Project Partners: Research Center for Information Technology, FU Berlin, Charité Berlin, Pflege-werk Berlin, C&S Computer und Software GmbH, nubedian GmbH, easierLife GmbH, CircularTree GmbH, ITK Engineering AG

Website: *www.blog3.de*

Certification of AI-based Systems

Artificial Intelligence (AI) represents one of the most discussed technology trends in research and practice. For example, the McKinsey Global Institute predicts that the use of AI could generate an additional $13 trillion in global economic output by 2030. Examples of AI-based technologies include AI-enabled autonomous driving or the use of AI for voice recognition (e.g., Amazon's Alexa). In the process, AI is increasingly permeating existing technologies, requiring understanding and investigation of the impact on users. A core objective of existing efforts is the creation of trustworthy AI (TAI) because only if we trust AI and its results, its full potential can be exploited. For example, if an AI-based system diagnoses a disease and provides appropriate treatment, but neither the doctor nor the patients trust it, even if it could save lives, AI will not help.

Independent assessments (e.g., certifications) can help to achieve TAI by creating transparency about the AI used. Unfortunately, it remains unclear how AI can be assessed by third parties to build trust in AI offerings. Based on years of experience in the certification of cloud services, the research group has set itself the goal of holistically researching the certification of AI-based systems.

Project Title: Certification of AI-based Systems

Contact Persons: Sebastian Lins, Ali Sunyaev

Funded by:

Project Partners:

Website: *https://cii.aifb.kit. edu/110_373.php*

COOLedger

Over the past decade, various application areas have been identified for the use of Distributed Ledger Technology (DLT), including concepts such as blockchains. These application areas have specific requirements for DLT characteristics (e.g., fast consistency or high availability). However, trade-offs between these characteristics prevent the development of universally applicable distributed ledgers that can simultaneously address all requirements. Instead, a large number of distributed ledgers exist (e.g., Bitcoin, Ethereum, or IOTA), each optimized to meet the requirements of a specific application area. Since the retroactive switch out of an underlying DLT design is hardly possible, developers need to ponder the suitability of DLT designs for their use cases before implementing them.

In order to support the selection and configuration of a suitable distributed ledger, the COOLedger research project develops a model that identifies the dependencies between DLT characteristics and presents them in an understandable way. The model will be embedded in a process and implemented as software, which facilitates finding the optimal configuration of distributed ledgers for specific applications.

Project Title: COOLedger

Contact Persons: Niclas Kannengießer, Benjamin Sturm, Ali Sunyaev

Funded by: Helmholtz Association and the Russian Science Foundation

Project Partners: Higher School of Economics

Website: *https://cii.aifb.kit.edu/110_119.php*

DaWID

Information is a fundamental component of services, platforms, and new business models within today's IT landscape. Consequently, digital service providers collect data on a large scale whenever someone uses their applications. This has led to a situation where citizens seized to be the sovereigns of their data.

The DaWID project aims to develop a meta platform that makes it possible for citizens to ensure their data sovereignty on the one hand and creates cross-platform mechanisms to link previously siloed services and platforms on the other hand. As a result, data can be collected and refined by an orchestrated sequence of IT services in a data-driven value chain.

The DaWID consortium consists of industry and research partners who investigate economic, ethical, and sociotechnical issues in data-driven value chains. The cii group focuses on the development of methods and mechanisms for (re-)establishing citizens' data sovereignty. We will enable citizens to trace and influence the flow of their data across the platforms involved. Citizens' preferences for data usage will be stored in a machine-readable manner, matched with the respective data flows, and made enforceable across all platforms.

The DaWID project started in February 2020 and will run until January 2023.

Project Title: DaWID: Data-Centered Value Creation

Contact Persons: Jan Bartsch, Tobias Dehling, Ali Sunyaev

Funded by: Federal Ministry of Education and Research (BMBF; funding reference number: 16SV8383)

Project Partners: Fraunhofer Institute for Software and Systems Engineering (ISST), Institute for Digital Transformation in Healthcare (idigiT), Fraunhofer Center for International Management and Knowledge Economy (IMW), T-Systems International GmbH - IoT Data Analytics

Website: *https://cii.aifb.kit.edu/english/110_121.php*
https://www.dawid-projekt.de/

Datenzentrierte Wertschöpfungsplattform für Interaktive, assistierende Dienstleistungssysteme

digilog@bw

Digitalization is changing social co-existence in a variety of ways, some of which are fundamental. The aim of digilog@bw is to analyze the influence of digitalization on people and the resulting social changes in an interdisciplinary way. The digilog@bw project develops scientifically sound decision bases for politics and society in order to enable digitalization to be designed for the benefit of people. This design task requires orientation towards critically reflected values, norms, and framework conditions. The collaborative projects „Autonomy", „Knowledge" and „Participation" will be carried out on an interdisciplinary and cross-location basis and will focus on the question of criteria for a promising and responsible digital society. To this end, the Research Network brings together Baden-Württemberg expertise from university and non-university research in the humanities, social sciences, law, economics, media, and communication sciences, ethics, computer science, and interdisciplinary technology assessment at the highest scientific level.

Project Title: digilog@bw – Digitalisierung im Dialog

Contact Persons: Benjamin Sturm, Ali Sunyaev

Funded by: Ministry of Science, Research and Arts Baden-Württemberg

Project Partners: Eberhard Karl University of Tübingen, International Center for Ethics in the Sciences and Humanities (IZEW), Knowledge Media Research Center(IWM), The Karlsruhe Institute of Technology(KIT), University Mannheim, Leibniz-Centre for European Economic Research(ZEW), Center for Art and Media(ZKM)

Website: *https://digilog-bw.de*

Digital Transformation in Healthcare

One of the most striking examples of digital transformation, with supposedly profound societal and organizational impacts, is the field of personalized medicine. The impact of new technology is huge in healthcare, for example, because genomic data will certainly reach the clinical routine and thus make personalized medicine available for everybody. However, digitization does not only have the potential to offer benefits. For example, the changing care model due to personalized medicine is also expected to dramatically change the work practices and the economics of healthcare professionals. Entire medical professions may become obsolete or see their work practices turned upside-down. Even though we are facing striking and massive changes in healthcare due to digital transformation, we currently lack theories to guide us and help us to understand, describe, explain, and predict this phenomenon.

The project Digital Health Work investigates how digitization shapes work in the healthcare sector. To do so, we draw on the Theory of the Smart Machine, seeking to test the theory within the healthcare domain. Moreover, we develop a new explanatory theory for the phenomenon of digital transformation in healthcare by means of a qualitative research design.

Project Title: Digital Transformation in Healthcare: Theoretical Perspectives and Conceptualization of Digitization Effects on Human Work in Healthcare

Contact Persons: Scott Thiebes, Ali Sunyaev

Funded by: German Research Foundation (DFG)

Project Partners: University of Cologne, University Hospital Cologne

Website: *https://digitalisierung-der-arbeitswelten.de/*

DIRECTIONS

The research project Data Protection Certification for Educational Information Systems („DIRECTIONS") aims to design, implement, and test a sustainable data protection certification for educational information systems. Two stages of DIRECTIONS are planned to achieve the project goal: First, a quality seal will be designed and tested. Second, the quality seal will be further developed to become an approved and recognized data protection certification. By developing a quality seal in the first stage, DIRECTIONS provides a short-term means for providers of school information systems to communicate their data protection practices. This can create transparency and comparability on the market at an early stage and reduce potential uncertainties. However, a quality seal is insufficient to demonstrate compliance with the GDPR. Therefore, it is planned in the second stage to develop the quality seal into a data protection certification in accordance with Art. 42 of the GDPR and to have it formally approved. The six-year project officially kicked off in January 2022 and reached its first milestone of defining the certification scope in 2022. DIRECTIONS is supported by over 40 associated partners from the educational sector and funded with more than 6 million euros.

Project Title: DIRECTIONS – Data Protection Certification for Educational Information Systems

Contact Persons: Sebastian Lins, Ali Sunyaev

Funded by: German Federal Ministry for Education and Research (BMBF)

Project Partners: Prof. Dr. Gerrit Hornung, University of Kassel; Dr. Sönke Maseberg und Dr. Irene Karper, datenschutz cert GmbH

Website: *https://directions-cert.de*

DLT4Life

Modern life sciences with their highly sensitive omics data sets face several challenges with regard to data storage and sharing. On the one hand, data must be protected in order to preserve the privacy of those individuals who contributed their data to research. On the other hand, the true value of omics data can only be realized if shared with as many researchers as possible. In an ideal world, data subjects (i.e., patients) should be able to control access to their data directly. However, granting and revoking access to data is a slow and tedious process within the current life sciences research paradigm, where most data is either stored in central controlled-access data repositories or kept locally within the respective research groups. Distributed ledger technology (DLT; e.g., blockchain) enables immutable transactions between untrustworthy parties, which are kept in a consistent state through automated, algorithm-based consensus-building mechanisms, thus eliminating the need for third-party trust enforcement. Applications of DLT within the life sciences promise to enable data subjects to grant and revoke access rights flexibly, independent of intermediaries, and on an individual basis, giving way for data subjects' direct control over who may access their data for what purposes.

Project Title: Distributed Ledger Technology for Life Sciences

Contact Persons: Mikael Beyene, Scott Thiebes, Ali Sunyaev

Funded by: Helmholtz Association, Helmholtz Information and Data Science School for Health

Project Partners: German Cancer Research Center (DKFZ, Deutsches Krebsforschungszentrum)

Website: *https://www.hidss4he-alth.de/*

FLAIROP

Artificial Intelligence (AI) has proven to enable large economic efficiency gains in the context of the recent digital revolution. AI-based systems typically need large amounts of data to provide good results. As many industrial manufacturing companies are small or medium-sized, picking items are highly individual. This results in a small amount of data for a specific task. Sharing data across factories and companies is a promising approach to gaining more data for industrial use cases. However, sharing data has proven to be challenging in real-world applications, as companies do not like to exchange their critical production data with other companies. Federated learning is an emerging approach toward distributed, privacy-preserving machine learning. The training of AI-based systems is done locally and only AI model parameters are then uploaded to a central cloud server which is shared by multiple stakeholders. All stakeholders then benefit from an aggregated AI model, without violating the data privacy of the participating companies. In this project, we aim to develop an international federated learning system in the domain of robotic picking and placing of unknown objects. The goal is to boost current AI solutions with more data while preserving privacy regulations.

Project Title: FLAIROP

Contact Persons: Sascha Rank, Florian Leiser, Scott Thiebes, Ali Sunyaev

Funded by: Federal Ministry for Economic Affairs and Climate Action (BMWK)

Project Partners: KIT IFL, University of Waterloo, Festo SE & Co. KG, Darwin AI

GAIA-X 4 ICM

Digital solutions play a central role in the Innovation Campus Mobility of the Future (ICM) and Gaia X is seen as a potential enabler for a variety of research activities. The goal of this project is to make Gaia-X usable for production, to realize a concrete instance for this purpose, to enable coupling with production systems, and thus to create the basis for a strongly scaling innovation platform for the ICM, but also beyond that for research and industry. The identification of open research questions, a reflection of the findings in the Gaia-X initiative as well as knowledge transfer in the focus. The research group supports the project GAIA-X 4 ICM by identifying requirements to set up an ecosystem that is compliant with the GAIA-X principles and foundations. Together with the project partners, the research group will conceptualize and prototypically implement an ecosystem for production systems.

Project Title: GAIA-X 4 ICM

Contact Persons: Sebastian Lins, Valeria Smolenskaya, Ali Sunyaev

Funded by: Das Ministerium für Wissenschaft, Forschung und Kunst von Baden-Württemberg

Project Partners: University of Stuttgart

Website: *https://cii.aifb.kit. edu/110_673.php*

Universität Stuttgart

Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg

GaMeIT

Cognitive surgical assistance systems like surgical robots require image-based scene understanding to perceive and comprehend the surgery context to eventually generate safe trajectories to assist during the surgery. To this end, recognition and semantic segmentation of different surgery aspects (e.g., shown organs, used surgical tools, different surgery stages) are necessary pre-conditions. Machine Learning (ML) approaches are a promising technology for the semantic segmentation of images. To train robots with ML methods, annotated image data (e.g. in the form of videos) is required. Image annotation of surgical images and videos is often manually conducted by healthcare professionals with a certain level of medical expertise. Manual annotation is prone to human errors since it can be tedious, monotonous, and exhausting. Hence, poor annotation quality is a common problem. However, for surgical robots to improve surgical procedures, sufficient annotation quality is important. If ML models for surgical robots are trained based on poorly annotated image data, this may negatively influence patients' health. In this project, we address the problem of poor annotation quality of surgical image data by augmenting the annotation process with persuasive technology. In particular, we design, implement, and evaluate a data-driven ML-based gamification concept to foster annotators' engagement and, thereby, ensure high-quality data labeling. By drawing on ML methods, the gamification concept is able to adapt to individual user preferences and overcome the weaknesses of one-size-fits-all gamification approaches.

Project Title: Data-driven Gamification to Improve Quality in Medical Image Annotation Tasks (GaMeIT)
Contact Persons: Simon Warsinsky, Manuel Schmidt-Kraepelin, Scott Thiebes, Ali Sunyaev
Funded by: Helmholtz Association, Helmholtz Information and Data Science School for Health
Project Partners: University Hospital Heidelberg
Website: *https://www.hidss4health.de/#projects*

Intelligent Security Handwerk

The digital transformation of German small and medium-sized craft businesses is creating IT security challenges. The project Intelligent Security Handwerk as part of the BMWi initiative "IT-Sicherheit in der Wirtschaft" will address those challenges by sensitizing SME craft businesses to IT security and technically and organizationally enabling businesses to improve their IT security.

To this end, the cii research group led by Prof. Dr. Ali Sunyaev will develop and test an intelligent IT security assistant for German craft businesses. The assistant will capture the business IT infrastructure and IT security preferences to recommend an individual course of action. This will enable SME craft businesses to make competent and independent IT security decisions. An interactive application will allow for easy and intuitive usage which will be tested and evaluated in multiple lab and field studies.

The project consortium consists of the University of Kassel, the Berufsförderungswerk des Handwerk, and the KIT. The project started in August 2021 and will run until July 2024.

Project Title: Intelligent Security Handwerk

Contact Persons: Benjamin Sturm, Tobias Dehling, Ali Sunyaev

Funded by: Federal Ministry for Economic Affairs and Climate Action (BMWK)

Project Partners: University of Kassel, Berufsförderungswerk des Handwerk (BFH)

Website: *https://cii.aifb.kit.edu/ english/110_1107.php https://intelligent-security-handwerk.de*

KASTEL

Within KASTEL Engineering Secure Systems, the research group cii focuses on the design of secure decentralized information systems (IS). In the application context of networked mobility, we focus on implications for consumers emanating from different degrees of decentralization of IS. Decentralization of IS can increase data sovereignty for users in IS but requires also that users take on new tasks and roles when processing information. For example, users of decentralized IS need to make efforts to operate their data repositories. Moreover, the degree of decentralization of an IS is not a constant property but changes over time due to economic, political, social, and technical dynamics. These dynamics make it difficult to design decentralized IS in such a way that they continue to meet user needs while allowing them to harness the benefits of decentralized IS (e.g., increased data sovereignty). To better understand the design of decentralized IS, the research group cii focuses in particular on the following research topics:

1. Dynamics influencing decentralization of IS
2. Choosing appropriate degrees of decentralization to meet application-specific requirements of IS
3. Implications of different degrees of decentralization for users of IS

Project Title: KASTEL Engineering Secure Systems

Contact Persons: Niclas Kannengießer, Tobias Dehling, Ali Sunyaev

Funded by: Helmholtz-Gemeinschaft

Project Partners: KASTEL Security Research Labs

Website: *https://zentrum.kastel.kit.edu/*

NephroCAGE

The NephroCAGE consortium applies machine learning technology to address a multi-national healthcare challenge in nephrology. We combine medical and technical innovations to build a real-world demonstrator incorporating data and expertise of two leading nations: Canada and Germany. Machine learning (ML) methods can allow for future predictions of clinical outcomes (e.g., the success of kidney transplantations) but require clinical data, which are highly protected through data protection regulations. Especially multinational projects are hindered due to different data protection regulations and data formats at each site. Therefore, we propose the use of a secure federated learning infrastructure, where data resides at their original locations and only ML model data are exchanged instead of raw patient data. If the consortium outcomes prove to be successful, the developed platform and methods will be applied to additional medical indications and chronic diseases.

Furthermore, the results would be applicable to other multinational projects, e.g., industry cooperation in automotive construction, transportation, or renewable energies.

Project Title: NEPHROCAGE

Contact Persons: Konstantin Pandl, Florian Leiser, Scott Thiebes, Ali Sunyaev

Funded by: Federal Ministry for Economic Affairs and Climate Action (BMWK)

Project Partners: Hasso Plattner Institute, Charité, University of British Columbia, Centre hospitalier de l'Université de Montréal, McGill University, Pirche AG

Website: _https://www.nephrocage. org_

PANDIA

Today's privacy notices of interactive assistance systems in the healthcare domain are usually too long and not informative for lay users due to their legal jargon. As a consequence, consumers remain unaware of the specific terms of use and how their information is used.

The PANDIA project aims to develop a platform and innovative tools that enable consumers and companies in the healthcare domain to automatically check and understand information processing in interactive assistance systems (e.g., electronic health records, and mHealth apps). By applying natural language processing (NLP) algorithms, the information essential for consumers will be extracted from privacy notices. Legal and complicated formulations will be simplified, enriched with visualizations, and communicated in an informative way. How consumers' information is used in the healthcare domain will be abstracted from various sources (e.g., apps, and websites). Within the scope of PANDIA, the cii research group develops personalized solutions that inform all interested stakeholders about what information is stored, transmitted, or processed, in which way, by whom, and for what purposes in interactive assistance systems.

The PANDIA project runs from March 2020 to February 2023.

Project Title: PANDIA: Platform for the Analysis of Privacy Notices of Interactive Assistance Systems in the Health Care Domain—Consumer-centered Privacy Communication

Contact Persons: Mandy Goram, Tobias Dehling, Ali Sunyaev

Funded by: Federal Ministry of Education and Research (BMBF; funding reference number: 16SV8398)

Project Partners: Snoopmedia GmbH, Ascora GmbH, AI4BD GmbH, OFFIS e.V. Institut für Informatik, FIZ Karlsruhe Leibniz Institut für Informationsinfrastruktur

Website: *www.pandia-projekt.de*

ReDiBlock

The data generated along the product life cycle serves as the basis for many decisions.

Both the upstream areas of production and distribution and the downstream areas of collection, reuse, and recycling could benefit from this information.

An information exchange forms the basis for effective design and control of resource-efficient recycling management and economy. Flows of materials and goods must be analyzed over the entire product life cycle so that they can be controlled from each phase.

Since this is not (or partially) the case in practice, the approach of a Distributed Ledger Technology (DLT) platform offers the possibility to improve the data basis for all actors in value-added and recycling management networks.

Sharing access to this information would significantly increase the effectiveness and efficiency of the entire system. This information is indispensable in the course of societal expectations of climate protection and in the course of a sustainable industrial society with efficient, environmentally compatible flows of energy and materials.

The project's goal is to clarify technical approaches and prerequisites, analyze correctness guarantees of transfers of real data into the digital system, develop a DLT system concept, as well as build and test a platform with real data from participating companies.

Project Title: ReDiBlocK

Contact Persons: Mikael Beyene, Scott Thiebes, Ali Sunyaev

Funded by: Ministry for the Environment, Climate Protection and Energy Secotor State of Baden-Württemberg

Project Partners: Institute for Applied Geosciences (AGW), Institut für Industrial Ecology (INEC), iPoint-systems GmbH

Website: *https://cii.aifb.kit.edu/110_929.php*

SDM4FZI

The challenge in the vehicle and supplier industry today is to produce economically despite highly volatile markets and dynamic conditions. The decisive competitive factor here is the adaptability of production systems. In order to achieve maximum adaptability, a strict separation must be created between the hardware of the production systems and the controlling software. The SDM4FZI project, therefore, deals with a new method: software-defined manufacturing (SDM). Analogous to solutions from information and communication technology, non-predefined functions are also to be realized by automatically generated software. The basic prerequisite is the abstraction of the existing hardware through digital twins with the help of which the software can be automatically derived and distributed. For this purpose, the existing production OT (Operational Technology) must be rethought in order to make the control and communication infrastructure SDM-capable. SDM creates the basis for innovative applications and business models that use digital twins as their core to optimize adaptable production systems.

Project Title: SDM4FZI - Software-defined Manufacturing for the vehicle and supplier industry
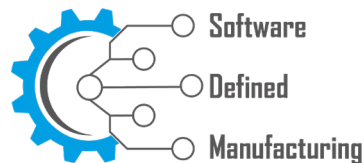
Contact Persons: Sebastian Lins, Heiner Teigeler, Ali Sunyaev

Funded by: Federal Ministry for Economic Affairs and Climate Action

Project Partners: ABB, Audi, Bosch, HOMAG, University of Stuttgart, and many more

Website: *https://www.sdm4fzi.de/*

SPECK

Agriculture, and particularly animal husbandry, is currently facing major challenges, such as ensuring food quality and creating sustainable value chains. Regional and global food security, animal welfare, efficient use of raw materials, climate, and environmental protection, and their interactions play a prominent role in addressing these challenges.

To address the challenges regarding food quality and sustainable value chains, the digitization of food supply chains seems necessary in order to generate and analyze associated data. Digitization harnesses the potential of novel technologies, such as Artificial Intelligence and Distributed Ledger Technology (DLT), to improve the productivity, quality, and sustainability of food supply chains. For example, DLT has the potential to increase productivity and ensure quality by improving food traceability. The research project SPECK (Systemic optimization of the meat value chain using the example of pig farming through the development and embedding of digital tools), aims to improve the meat value chain by developing and embedding digital tools (e.g., DLT) and developing a digital application for optimized, animal-specific traceability and for continuous process diagnostics and process control along the value chain.

Project Title: SPECK

SPECK

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Project Title: SPECK
Contact Persons: David Jin, Niclas Kannengießer, Benjamin Sturm, Ali Sunyaev
Funded by: Federal Office for Agriculture and Food
Project Partners: University of Kassel, Chair of Agricultural and Biosystems Engineering, Karlsruhe Institute of Technology, Institute for Industrial Production
Website: *https://cii.aifb.kit.edu/110_1019.php*

Toward better Devolopment of Applications on DLT

During the emergence of Distributed Ledger Technology (DLT) over the past decade, various applications of DLT have been proposed, implemented, and even patented. In the course of the development of such applications, new challenges arose from the inapplicability of extant programming paradigms to application development on DLT. Since these new challenges have not been fully identified and are only barely solved, various incidents have already shown how devastating the effects of faulty applications on DLT can be (e.g. the loss of 50 million US dollars in The DAO Hack). The research project has not only synthesized existing development challenges related to smart contracts but has also provided solutions and software design patterns that help developers make DLT applications perform, secure, and maintainable. Results of the research project have been recently published in the prestigious journal IEEE Transaction on Software Engineering.

Project Title: Toward better Smart Contract Development

Contact Persons: Niclas Kannengießer, Benjamin Sturm, Mikael Beyene, Ali Sunyaev

Funded by: EnBW

Project Partners: EnBW

Website: *https://cii.aifb.kit. edu/110_133.php*

Unblackboxing IT Certifications

This research project examines when and why information system certifications are effective in electronic markets. We explain how factors in the certification ecosystem can influence consumers' and platform providers' perceptions of IS certifications. Specifically in electronic markets, such as online platforms in e-commerce, two factors are of the utmost importance in the certification ecosystem: first, an independent third party as a certification authority, and second, competing for information signals on an online marketplace. Moreover, prior studies have not explored how customers perceive IS certifications in the long term. Thus, this research project next seeks answers to the following questions: (1) how does a certification authority as an independent third-party impact the perception of IS certifications, (2) which effects have different information signals on the perception of IS certifications and (3) what are the long-term effects of IS certifications (if customers interact several times with a certified online platform).

Project Title: Unblackboxing IT Certifications

Contact Persons: Sebastian Lins, Maximilian Renner, Ali Sunyaev

Funded by: German Research Foundation (DFG)

Project Partners: Prof. Dr. Alexander Benlian, Technische Universität Darmstadt

Website: *https://cii.aifb.kit.edu/110_208.php*

TECHNISCHE UNIVERSITÄT DARMSTADT

DFG Deutsche Forschungsgemeinschaft

UNBLACKBOXING IT CERTIFICATIONS

XAIOmics

As it is becoming progressively challenging to wholly analyze the ever-increasing amounts of generated biomedical data (e.g., CT scans, X-ray images, omics data) by means of conventional analysis techniques, researchers and practitioners are turning to artificial intelligence (AI) approaches (e.g., deep learning) to analyze their data. Extant AI approaches are often inaccessible and non-transparent to humans, thus limiting us from fully understanding and therefore trusting the produced outputs. Explainable AI (XAI) addresses this opacity issue by producing (more) interpretable AI models whilst maintaining high levels of performance and accuracy. The objective of the XAIOmics research project is to design, develop, and evaluate XAI approaches to biomedical (i.e., omics) data. In particular, we will identify biomedical use cases and current, viable approaches in the domain of XAI and apply and adapt them to the identified use cases. With regard to the highly interdisciplinary field, a central research hurdle will be the development of an understanding of the different kinds of biomedical data and the subsequent feature engineering in the context of the design of AI algorithms. In doing so, this project will not only aid researchers and physicians in obtaining a better understanding of the outputs of contemporary AI approaches for biomedical data but also create more transparency, which will support the building of trust in AI-based treatment and diagnosis decisions in personalized medicine.

Project Title: Explainable Artificial Intelligence in Life Science: An Application to Omics Data

Contact Persons: Philipp Toussaint, Scott Thiebes, Ali Sunyaev

Funded by: Helmholtz Association, Helmholtz Information and Data Science School for Health

Project Partners: German Cancer Research Center (DKFZ, Deutsches Krebsforschungszentrum)
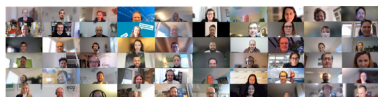
Website: *https://www.hidss4he-alth.de/*

TALKS& HIGHLIGHTS

## DIRECTIONS Kick-off - Data Protection Certification for Educational Information Systems

The kick-off of the Projekt DIRECTIONS was conducted virtually on 26 January 2022. DIRECTIONS conceptualizes, develops, and validates a sustainable data protection certification for educational information systems. Predominantly with a focus on students' virtual learning environments, content platforms, and apps while taking the underlying learning infrastructures into account.

BISE Student – Blockchain-Enabled Open Access Publication Platform for Student Theses goes Online

BISE Student, a new blockchain-enabled publication platform, was launched on February 22, 2022. In collaboration with the Business & Information Systems Engineering (BISE) Journal, Bloxberg Blockchain, and the Karlsruhe Institute of Technology, the project envisions transparent, secure open knowledge sharing and publishing of student theses. the BISE Student open-access publication platform offers students and scholars a way to publish and access student theses reliably and securely through its decentralized bloxberg blockchain system. The platform provides a fast and effective publication process while ensuring openness and transparency. Moreover, the blockchain system offers high integrity, system availability, scalability, and, most important, the security of author rights.
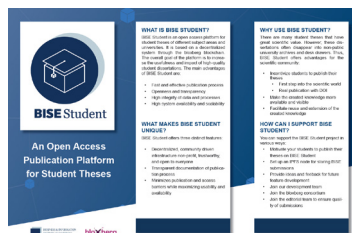
First Podcast from Ali Sunyaev about BISE Student

In the third episode of the podcast digilogbw, Ali Sunyaev talks about knowledge dissemination through blockchains in BISE Student.

Best Paper Award @ WI22 for the cii research group in the DaWID project

The paper "Linking Data Sovereignty and Data Economy: Arising Areas of Tension" (from Florian Lauf, Simon Scheider, Jan Bartsch, Philipp Herrmann, Marija Radic, Marcel Rebbert, André T. Nemat, Christoph Schlueter Langdon; Ralf Konrad, Ali Sunyaev, and Sven Meister) has been awarded the Best Paper Award at the 17th International Conference on Wirtschaftsinformatik.

Congratulations to Sebastian Lins for his successful doctoral examination

On March 24, 2022 Sebastian Lins successfully defended his PhD thesis! His dissertation is entitled "Unveiling and Enhancing the Effectiveness of Information System Certifications".

Should KIT offer a degree in Blockchain? – Prof. Dr. Ali Sunyaev talks in FinanzBusiness interview

Since 2018 the Hochschule Mittweida (University of Applied Science) has been the first and only university in Germany to offer a Master's degree in Blockchain. In the interview with FinanzBusiness Prof Dr. Ali. Sunyaev elaborates on which Distributed Ledger Technology/Blockchain-focused courses are already offered at KIT and whether he sees potential for a Blockchain degree at KIT.

Fourth „cii Blockchain Hackathon"

From September 1st to September 19,2022, we the cii research group offered students of KIT the opportunity to design and implement Blockchain-based solutions for current challenges in practice. Exciting insights were given into the potential of blockchain by discussing the use of blockchain in different fields together with industry partners. Interesting topics to work on were presented by onino GmbH, the Center of Art and Media Karlsruhe (ZKM), and EXXETA AG.
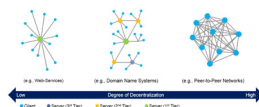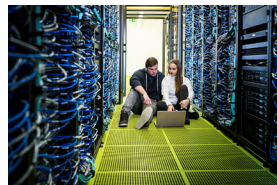
TALKS & HIGHLIGHTS

Prof. Dr. Ali Sunyaev as the new GI FB-WI speaker

On May 1st, Prof. Dr. Ali Sunyaev took over the speakership of the department of business informatics of the „Gesellschaft für Informatik" at the KIT, succeeding Prof. em. Dr.-Ing. Dr. Peter Lockemann, Prof. Dr. Andreas Oberweis and Prof. Dr. Christof Weinhardt.

FACHBEREICH
WIRTSCHAFTSINFORMATIK

Congratulations to Scott Thiebes for his successful doctoral examination

On May 24th, 2022, Scott Thiebes successfully defended his Ph.D. thesis! His dissertation is entitled "A Socio-Technical Analysis of Genetic Privacy and its Role in Genetic Data Sharing".

AUDITOR research project at Cloud Expo Europe Frankfurt 2022

This year's Cloud Expo Europe took place in Frankfurt on 11 and 12 May 2022, in conjunction with the BIG DATA & AI WORLD and Data Centre World events at the Frankfurt exhibition center. The AUDITOR consortium was represented with its own information stand to inform interested visitors about the current progress of the research project. This made it possible to establish further interesting contacts from research and industry.

TALKS & HIGHLIGHTS

Congratulations to Malte Greulich for his successful doctoral examination

On May 18th, 2022, Malte Greulich successfully defended his Ph.D. thesis! His dissertation is entitled "Unveiling Adverse Effects of Organizational Information Security Practices".

Research Project DIRECTIONS Presenting at DigitalPakt Schule Statuskonferenz 2022

The first status conference on 'Digital-Pakt Schule' took place on the 23rd and 24th of June 2022. Research project DIRECTIONS (Data Protection Certification for Educational Information Systems) presented at the World Conference Center Bonn, showing the projects' current state on "Data Protection Certifications to Facilitate Digital Tool Selection".

New Articles published at the 2022 IEEE International Conference on Business In Informatics

The articles „Understanding Interdependencies among Fog System Characteristics" by Maximilian Blume, Sebastian Lins, and Ali Sunyaev and „Toward a Unified Framework for Information Systems Certification Internalization" by Philipp Danylak, Sebastian Lins, Malte Greulich, and Ali Sunyaev were published at the 2022 IEEE International Conference on Business Informatics.
https://doi.org/10.1109/CBI54897.2022.00021
https://doi.org/10.1109/CBI54897.2022.00027

New Article on how Employees Perceive Digital Transformation and its Effects Accepted at the International Conference on Information Systems (ICIS) 2022

The paper "How Do Employees Perceive Digital Transformation and its Effects? A Theory of the Smart Machine Perspective" by Richard Guse, Scott Thiebes, Phil Hennel, Christoph Rosenkranz, and Ali Sunyaev has been accepted at the International Conference on Information Systems (ICIS). The conference will take place in Copenhagen, Denmark form December 9 to 14th.
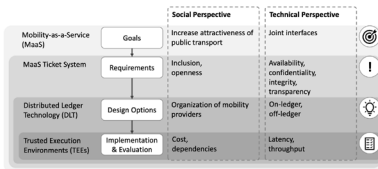The preprint is freely available online via KITOpen: https://doi.org/10.5445/IR/1000151848
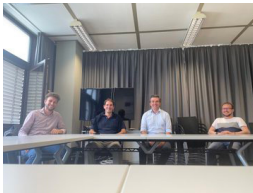
TALKS & HIGHLIGHTS

New Paper Published and Presented at the 14th Wissenschaftsforum Mobilität

Marc Leinweber, Niclas Kannengießer, Hannes Hartenstein, and Ali Sunyaev have published and presented a new paper at the 14th Wissenschaftsforum Mobilität. The paper was also published in the book „Toward the New Normal".

Jason Bennett Thatcher (Prof. at Temple University, USA) visits KIT

„Standing on the shoulders of giants" - Renowned IS researcher Prof. Jason Bennett Thatcher from Temple University, USA, visits the KIT for a three-day research stay from Monday, June 10th to Wednesday, June 12th.

Research Project BloG3 Summer Meet-up 2022

The BloG3 summer meet-up took place on the 05th and 06th of July 2022 in Berlin. The consortium of BloG3 gathered to present the progress within the ongoing work packages to the project-executing organization VDI/VDE – Innovation + Technology GmbH on behalf of Germany's Federal Ministry of Education and Research (BMBF).

Doctoral Seminar 2022 – Bad Herrenalb

After a more than two-year pause, the cii research group once again held a doctoral seminar in 2022. The three-day retreat was held at the Haus der Kirche Evangelische Akademie Baden, Bad Herrenalb from July 27th through July 29th.

Dealing with the general topic of "research practices," the research group around Prof. Dr. Ali Sunyaev organized multiple lectures and workshop sessions addressing various aspects of research and Ph.D. study. Finally, there was a guided evening city tour through Bad Herrenalb.

Digital Campus Challenge 2022

Being offered for the 6th year in a row, the Digital Campus Challenge 2022 focuses on the topics of data-driven farming, good digital health practice, data science, and automation & process mining. Bayer invited students to participate and submit their ideas on how digital technologies can be used in healthcare.
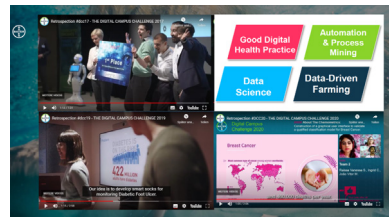
BISE Call for Papers - Reimagining Digital Health

Ali Sunyaev, Daniel Fürstenau & Elizabeth Davidson published a call for papers on the topic area „Reimagining

TALKS & HIGHLIGHTS

Digital Health: Advances in Patient-Centeredness, Artificial Intelligence, and Data-Driven Care Research".

The article is available online: https://link.springer.com/article/10.1007/s12599-022-00763-x

Dr. Sebastian Lins presented the DIRECTIONS research project to State Secretary Sandra Boser

On September 7, 2022, State Secretary Sandra Boser visited the KIT and gained research group cii presented the groundbreaking project DIRECTIONS, which develops a data protection certification for school information systems and tests it in the real world.

Further information on the DIRECTIONS project: www.directions-cert.de

Four papers accepted at the Hawaii International Conference on System Sciences (HICSS) 2023

At the 56th Hawaii International Conference on System Sciences (HICSS) four papers of the cii research group were accepted. The Conference has taken place in Maui from January 3 to 6, 2023.

Prof. Sunyaev held a keynote at the Open Source Automation Days (OSAD) 2022 in Munich

On October 04, 2022, Prof. Sunyaev opened the Open Source Automation Days in Munich with his keynote on „A Step toward Digital Sovereignty in the Cloud: Developing the AUDITOR Certification,". Current developments were highlighted by providing insight into the Gaia-X project and the AUDITOR research project led by the Karlsruhe Institute of Technology (KIT).
AUDITOR website: www.auditor-cert.de
Further information on the conference: https://osad-munich.org

Research Project DIRECTIONS Presenting at 'Forum Privatheit' Annual Conference 2022

The annual conference 'Forum Privatheit' took place on the 13th and 14th of October 2022. This year's conference theme was defined as 'Data Fairness in a Globalized World – Fundamental Rights Protection and Competition for an International Data Governance". Research project DIRECTIONS (Data Protection Certification for Educational Information Systems) presented a poster (Certifications to Safeguard Data Protection Standards? How Superficial Internalization Thwarts the Plan) at the Humboldt-Carré in Berlin.

Exclusive Internships at Arizona State University, Phoenix in 2023

Prof. Ali Sunyaev from the cii research group at the Institute of Applied Informatics and Formal Description Methods (AIFB) is offering a research internship in cooperation with Prof. Dr. Julian Lehmann at Arizona State University.

TU Dortmund University invites Prof. Dr. Ali Sunyaev as a distinguished speaker for the 50-year celebration

On October 18, 2022, Prof. Dr. Ali Sunyaev visited TU Dortmund University. As part of their distinguished speaker series for the department of computer science's 50-year celebration, Ali Sunyaev spoke about the convergence of distributed ledger technology & artificial intelligence and reported on the design of a distributed collaborative machine learning system to counter trust and privacy issues.

Prof. Dr. Sunyaev gave a Talk on Federated Learning during the KIT Welcome Week 2022

On October 17, 2022, Prof. Dr. Ali Sunyaev welcomed the 600 new students of the industrial engineering course at KIT with an insight into everyday lectures and study life by giving a talk on the subject of Federated Learning.

TALKS & HIGHLIGHTS

Project Status Workshop "ISH: Intelligent Security Handwerk"

On October 26, 2022, the first status workshop of the research project „ISH: Intelligent Security Handwerk" took place in Karlsruhe. In addition to the project partners, consisting of the FgTIME research group of the University of Kassel, the cii research group of the KIT and the Berufsförderungswerk des Handwerks, representatives of the German Aerospace Center (DLR), the Scientific Institute for Infrastructure and Communication Services (WIK) and the Federal Ministry for Economic Affairs and Climate Action (BMWK) also took part.

After the presentation of the accompanying research by the BMWK, the results to date were recapitulated and the current status of the work packages was presented and discussed together.

Prof. Sunyaev held a Keynote at the Technology, Innovation, and Entrepreneurship (TIE) Scientific Commission Conference 2022

On 8th September 2022, Prof. Sunyaev held a keynote titled „First, it comes differently, and secondly, then you think" at the Technology, Innovation, and Entrepreneurship (TIE) scientific commission conference 2022. Other prominent keynote speakers at the TIE scientific commission conference included Prof. Dietmar Harhoff (Director at the Max-Planck-Institute for Innovation and Entrepreneurship).

Research group cii receives a certificate for good education

For the tutorial of the course „Angewandte Informatik - Internet Computing" by Prof. Dr. Ali Sunyaev, the research group cii receives the certificate for a good education in the summer term of 2021. The KIT Department of Economics and Management awarded the certificate based on the student evaluation results. Besides Prof. Dr. Ali Sunyaev, the event was conducted by Mikael Beyene, Heiner Teigeler, and the tutor team consisting of Bjarne Sauer, Daniel Ullrich, Matthias Bickel, Oliver Klaus, and Sophie Witt.
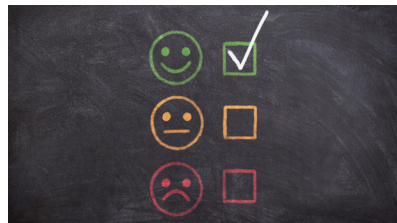
TALKS & HIGHLIGHTS

Paper presented at the International Conference on Information Systems in Copenhagen (ICIS'22)

Richard Guse from the cii research group presented a paper at the International Conference on Information Systems (ICIS). The conference took place in Copenhagen from December 11-14, 2021. The paper "How Do Employees Perceive Digital Transformation and its Effects? A Theory of the Smart Machine Perspective" was co-authored by Scott Thiebes, Phil Hennel, Christoph Rosenkranz, and Ali Sunyaev.
The research paper is freely available via open access: *https://publikationen.bibliothek.kit.edu/1000151848/pre*

Sebastian Lins was awarded the prestigious "ACM SIGMIS Doctoral Dissertation Award"

Beginning in 1992, the ACM SIGMIS Doctoral Dissertation Award has been awarded annually to an outstanding MIS dissertation. At the International Conference on Information Systems (ICIS), it has been announced that Sebastian Lins has been awarded the ACM SIGMIS Doctoral Dissertation Award in 2022. Sebastian is the first Ph.D. student from Germany that has received this award. He lines up with famous senior scholars in the information systems discipline that have also received the award, such as Prof. Nicholas Berente (2009), Prof. Andrew Burton-Jones (2006), and Prof. Paul Pavlou (2004).
https://ishistory.aisnet.org/awards/acmsigmis/

TEACHING & RESEARCH

LECTURES

Applied Informatics - Internet Computing (Bachelor)
The lecture Applied Informatics – Internet Computing provides insights into fundamental concepts and future technologies of distributed systems and Internet computing. Students should be able to select, design and apply the presented concepts and technologies. The course first introduces basic concepts of distributed systems (e.g., design of architectures for distributed systems, internet architectures, web services, middleware). In the second part of the course, emerging technologies of Internet computing will be examined in depth. These include, among others: cloud computing, fog computing, the internet of things, blockchain, and artificial intelligence. Practical topics are discussed in tutorials.

Critical Information Infrastructures (Master)
The course critical information infrastructures introduce students to the world of complex sociotechnical systems that permeate societies on a global scale. Students learn to handle the complexities involved in the design, development, operation, and evaluation of critical information infrastructures. At the beginning of the lecture, critical information infrastructures are introduced on a general level. The following sessions focus on an in-depth exploration of selected cases that represent current challenges in research and practice.

Digital Health (Master)
The course Digital Health introduces master students to the subject of digitization in health care. Students learn about the theoretical foundations and practical implications of various topics surrounding digitization in health care, including health information systems, telematics, big health care data, and patient-centered health care. After an introduction to the challenge of digitization in health care, the following sessions focus on an in-depth exploration of selected cases that represent current challenges in research and practice. Students work (in a group of 3-4) on a selected topic and have to write a course paper. Students can choose a topic from a variety of topics. To answer the research questions, students use literature reviews but also interviews, surveys, programming tasks, and other research methods.

SEMINARS

Seminar Emerging Trends in Internet Technologies (Bachelor/Master)

The seminar aims at providing insights into current topics in the field of Information Systems with a focus on fundamental and innovative Internet technologies. There are short introductions and corresponding seminar paper topics for different topics around the lectures and research topics of Prof. Sunyaev's research group "Critical Information Infrastructures" including distributed ledger technologies (e.g. blockchain), cloud computing, green IT, artificial intelligence, security, and privacy. Students can also propose their own topics within the framework of the given topic areas. The seminar aims to pro- vide insights into current topics in the field of business informatics and to offer students the opportunity to write a scientific paper in a group of students for the first time.

Seminar Emerging Trends in Digital Health (Bachelor/Master)

The seminar aims at providing insights into current topics in the field of Information Systems with a focus on innovative digital healthcare systems. There are short introductions and corresponding seminar paper topics for different topics around the lectures and research topics of Prof. Sunyaev's research group "Critical Information Infrastructures" including genomics, distributed ledger technologies (e.g. blockchain), artificial intelligence, and gamification in healthcare. Students can also propose their own topics within the framework of the given topic areas. The seminar aims to provide insights into current topics in the field of digital health and to offer students the opportunity to write a scientific paper in a group of students for the first time.

Seminar Selected Issues in Critical Information Infrastructures (Master)

The seminar aims at introducing master students to innovative, digital, and scientifically based teaching concepts. In groups of up to five, they independently develop and analyze a teaching concept for KIT courses. Existing teaching units (e.g. basic lectures, seminars, or ILIAS learning modules) are used as examples and prototypically reviewed. Modern teaching concepts, such as interactive learning modules, gamification, serious gaming, or flipped classrooms, are examined and critically discussed with regard to their applicability and usefulness. Furthermore, students have the opportunity to integrate their own ideas and concepts based on current scientific knowledge. In a final session, the teaching concepts will be applied as examples and discussed within the group.

Research Seminar: Critical Information Infrastructures (Ph.D. Students)

The cii research seminar aims to strengthen the rigor and relevance of the research conducted in the cii research group. In weekly sessions, Ph.D. students present their ideas for and challenge their current research to the entire research group to obtain feedback. The cii research seminar fosters the exchange of ideas and knowledge within the research group, enables the effective mastering of arising challenges, and

PRACTICAL COURSES

Practical Course Blockchain Hackathon (Bachelor/Master)
The practical course „Blockchain Hackathon" aims to teach students the basics of developing sociotechnical information systems in the context of blockchain or distributed ledger technology (DLT) in a practical way. To this end, students are introduced to DLT and the development of DLT applications in a kick-off event. Subsequently, students work in groups to implement a software artifact (e.g., desktop application, mobile app, or web application) that solves a given problem. The practical course is held in the form of a 1-week hackathon. The hackathon also focuses on quality assurance (e.g. by implementing tests) and documentation of the implemented software artifact.

Practical Course Sociotechnical Information Systems Development (Bachelor/ Master)
The goal of the practical course is to understand the fundamentals of developing sociotechnical information systems for different application areas. Within the scope of the course, students learn to identify a suitable solution strategy for a given problem, define requirements and implement them in form of a working software product (e.g., web platforms, mobile apps, desktop applications). Students also learn to test the quality of the developed sociotechnical system and document it in accordance with established standards.

TEAM PROJECTS

Team Project Economy and Technology (Bachelor)
The team project course „Economics and Technology" is conducted in cooperation with colleagues from the Institute of Information Systems and Marketing (IISM). It aims to prepare students for working in heterogeneous teams. The course implements the concept of research-oriented teaching and fosters students' problem-solving competencies. In teams of four or five, students work on defined interdisciplinary problems at the intersection of economics and technology. Potential results of the projects include artifacts, such as methods, algorithms, models, software, or components. Each team writes a final report and presents its findings to its supervisors and fellow students. Each semester, our research group offers interesting topics in the areas of digital health and information privacy.

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SELECTED PUBLICATIONS

Sunyaev, A.; M. Renner, P. A.; Toussaint, S.; Thiebes & S.; Lins, Eds. (2022)
cii Student Papers – 2022
Karlsruher Institut für Technologie (KIT)
doi: 10.5445/IR/1000150078

Sunyaev, A.; Fürstenau, D.; Davidson, E. (2022)
Call for Papers, Issue 3/2024 – Reimagining Digital Health: Advances in Patient-Centeredness, Artificial Intelligence, and Data-Driven Care Research
Business & Information Systems Engineering, 64 (4), 543–545.
doi:10.1007/s12599-022-00763-x

Sunyaev, A.; Weinhardt, C.; van der Aalst, W.; Hinz, O. (2022)
BISE Student: From Desk Drawer to Center Stage: Highlighting the Value of Student Theses
Business & Information Systems Engineering, 64 (6), 701–706.
doi:10.1007/s12599-022-00781-9

Bartsch, J; Dehling, T; Lauf, F; Meister, S; Sunyaev, A. (2022)
Let the computer say NO! The neglected potential of policy definition languages for data sovereignty. Friedewald M, Kreutzer M, Hansen M, eds. Selbstbestimmung, Privatheit und Datenschutz : Gestaltungsoptionen für einen europäischen Weg. (Springer Fachmedien Wiesbaden, Wiesbaden, Germany), 449–468.

Beyene, M.; Toussaint, P. A.; Thiebes, S.; Schlesner, M.; Brors, B.; Sunyaev, A. (2022)
A scoping review of distributed ledger technology in genomics: thematic analysis and directions for future research
Journal of the American Medical Informatics Association, 29 (8), 1433–1444. doi:10.1093/jamia/ocac077

SELECTED PUBLICATIONS

Blume, M.; Lins, S.; Sunyaev, A. (2022)
Understanding Interdependencies among Fog System Characteristics
2022 IEEE 24th Conference on Business Informatics (CBI), Amsterdam, Netherlands, 15-17 June 2022, 126–135.doi:10.1109/CBI54897.2022.00021

Danylak, P.; Lins, S.; Hsu, C.; Sunyaev, A. (2022)
Making Sense of Certification Internalization: A Process Model for Implementing Information Security and Data Protection Certifications
Proceedings of the 17th Pre-ICIS Workshop on Information Security and Privacy (WISP 2022), Kopenhagen, Denmark. 1–20. doi: 10.5445/IR/1000153861

Danylak, P.; Lins, S.; Greulich, M.; Sunyaev, A. (2022)
Toward a Unified Framework for Information Systems Certification Internalization
24th IEEE Conference on Business Informatics (CBI 2022), Amsterdam, Netherlands, 15-17 June 2022.doi:10.1109/CBI54897.2022.00027

Danylak, P.; Brecker, K.; Lins, S.; Sunyaev, A. (2022)
Certifications to Safeguard Data Protection Standards? How Superficial Internalization Thwarts the Plan
Proceedings of the Forum Privatheit, Berlin, Germany, October 13–14, 2022.

Greulich, M. (2022)
Unveiling adverse effects of organizational information security practices
Karlsruher Institut für Technologie (KIT)

Guse, R.; Thiebes, S.; Hennel, P.; Rosenkranz, C.; Sunyaev, A. (2022)
Datenmarktplätze für Künstliche Intelligenz im Gesundheitswesen: Potenziale, Herausforderungen und Strategien zur Bewältigung
HMD, 59 (6), 1527–1544. doi:10.1365/s40702-022-00922-4

SELECTED PUBLICATIONS

Guse, R.; Thiebes, S.; Hennel, P.; Rosenkranz, C.; Sunyaev, A. (2022)
How Do Employees Perceive Digital Transformation and its Effects? A Theory of the Smart Machine Perspective
Proceedings of the 43rd International Conference on Information Systems (ICIS), 9th - 14th December 2022, Copenhagen, Denmark

Hasebrook, N.; Morsbach, F.; Kannengießer, N.; Franke, J.; Hutter, F.; Sunyaev, A. (2022)
Why Do Machine Learning Practitioners Still Use Manual Tuning? A Qualitative Study
Karlsruher Institut für Technologie (KIT). doi:10.48550/ARXIV.2203.01717

Jin, D.; Kannengießer, N.; Sturm, B.; Sunyaev, A. (2022)
Tackling Challenges of Robustness Measures for Autonomous Agent Collaboration in Open Multi-Agent Systems
Proceedings of the 55th Hawaii International Conference on System Sciences (HICSS), Maui, Hawaii, 03.01.2022-07.01.2022, 7585–7594. doi:10.24251/HICSS.2022.911

Kannengießer, N.; Lins, S.; Sander, C.; Winter, K.; Frey, H.; Sunyaev, A. (2022)
Challenges and Common Solutions in Smart Contract Development. IEEE Transactions on Software Engineering, 48 (11), 4291–4318. doi:10.1109/TSE.2021.3116808

Klein, T.; Fenn, T.; Katzenbach, A.; Teigeler, H.; Lins, S.; Sunyaev, A. (2022)
A Threat Model for Vehicular Fog Computing
IEEE Access, 10, 133256–133278. doi:10.1109/ACCESS.2022.3231189

Leinweber, M.; Kannengießer, N.; Hartenstein, H.; Sunyaev, A. (2022)
Leveraging Distributed Ledger Technology for Decentralized Mobility-as-a-Service Ticket Systems
Towards the New Normal in Mobility. Ed.: H. Proff

SELECTED PUBLICATIONS

Lins, S.; Becker, J.-M.; Lyytinen, K.; Sunyaev, A. (2022)
A Design Theory for Certification Presentations
The Database for Advances in Information Systems. http://dl.acm.org/citation.cfm?id=J219

Lins, S.; Sunyaev, A. (2022)
Advancing the presentation of IS certifications: theory-driven guidelines for designing peripheral cues to increase users' trust perceptions
Behaviour & Information Technology, 1–24. doi:10.1080/0144929X.2022.2113432

Ohagen, P.; Lins, S.; Thiebes, S.; Sunyaev, A. (2022)
Using ChatOps to Achieve Continuous Certification of Cloud Services
Proceedings of the 55th Hawaii International Conference on System Sciences (HICSS), Online Conference, 3rd – 7th January 2022, 1-10. doi: 10.5445/IR/1000138360

Petry, L.; Lins, S.; Thiebes, S.; Sunyaev, A. (2022)
Technologieauswahl im DigitalPakt: Wie werden Entscheidungen im Bildungssektor getroffen? HMD Praxis Wirtschaftsinformatik, 59, 912–925. https://doi.org/10.1365/s40702-021-00751-x

Pfister, M.; Kannengießer, N.; Sunyaev, A. (2022)
Finding the Right Balance: Technical and Political Decentralization in the Token Economy
Blockchains and the Token Economy. Ed.: M. C. Lacity, 53–86, Springer Nature Switzerland AG. doi:10.1007/978-3-030-95108-5_3

Renner, M.; Lins, S.; Söllner, M.; Thiebes, S.; Sunyaev, A. (2022)
Understanding the Necessary Conditions of Multi-Source Trust Transfer in Artificial Intelligence
Proceedings of the 55th Hawaii International Conference on System Sciences (HICSS), Online Conference, 3rd – 7th January 2022, 5901–5910. doi:10125/80057

SELECTED PUBLICATIONS

Schmidt-Kraepelin, M.; Warsinsky, S.; Thiebes, S.; Sunyaev, A. (2022)
Conceptualizing Narratives in Gamified Information Systems.
Proceedings of the 55th Hawaii International Conference on System Sciences (HICSS), Online Conference, 3rd – 7th January 2022. doi:10.24251/HICSS.2022.197

Thiebes, S. (2022)
A socio-technical analysis of genetic privacy and its role in genetic data sharing
Karlsruher Institut für Technologie

Toussaint, P. A.; Renner, M.; Lins, S.; Thiebes, S.; Sunyaev, A. (2022)
Direct-to-Consumer Genetic Testing on Social Media: Topic Modeling and Sentiment Analysis of YouTube Users' Comments
JMIR Infodemiology, 2 (2), Art.-Nr.: e38749. doi:10.2196/38749

Toussaint, P. A.; Thiebes, S.; Schmidt-Kraepelin, M.; Sunyaev, A. (2022)
Perceived fairness of direct-to-consumer genetic testing business models
Electronic Markets, 32 (3), 1621–1638. doi:10.1007/s12525-022-00571-x

Warsinsky, S.; Schmidt-Kraepelin, M.; Thiebes, S.; Wagner, M.; Sunyaev, A. (2022)
Gamified Expert Annotation Systems: Meta-Requirements and Tentative Design
The Transdisciplinary Reach of Design Science Research – 17th International Conference on Design Science Research in Information Systems and Technology, DESRIST 2022, St Petersburg, FL, USA, June 1–3, 2022, Proceedings. Ed.: A. Drechsler, 154–166, Springer International Publishing. doi:10.1007/978-3-031-06516-3_12

COMMITTEES AND MEMBERSHIPS

Prof. Ali Sunyaev is assigned to specific committees and is a member of various associations.

Gesellschaft für Informatik (GI)

Spokesperson of Department of Information Systems of the German Informatics Society (GI)

Association for Information Systems (AIS)

Deutsche Gesellschaft für Medizinische Informatik, Biometrie und Epidemiologie e.V. (GMDS)

Editorial Board Journal of the Association for Informtion Systems (JAIS)

Editorial Board Journal of Information Technology (JIT) Editorial Board Electronic Markets (EM)

Member of the Scientific Advisory Coucil of the Anwenderverein Fujitsu NEXT e.V. („Network of Experts")

Verband der Hochschullehrer für Betriebswirtschaft (VHB)

Founder and Spokesperson of the "Digital Health" section in the German Informatics Society (GI)

Chairman of the examination board for the course of studies "Information Systems" at the KIT

Board Member of the KIT Division II – Informatics, Economics, and Society

Advisory council at the Fraunhofer Blockchain Center

AIS Distinguished Member - Cum Laude

Committee Member, Council for Research and Promotion of Young Scientists (CRYS), KIT

Scientific Committee Member, ETH Library Lab, ETH Zurich

Chairman of the examination board for the course of studies "Information Systems" at the KIT

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