

# INNOVATIONSTAG DIGITALISIERUNG NRW 2018 – ID@NRW 2018

## der Fachgruppe *Digitalisierung in Wirtschaft und Gesellschaft*

**01.03.2018, 10.00-17.50 Uhr, Rheinische Fachhochschule Köln, Vogelsanger Str. 295**  
([http://www.rfh-koeln.de/die\\_rfh/studienorte/e1277/index\\_ger.html](http://www.rfh-koeln.de/die_rfh/studienorte/e1277/index_ger.html))

### Kommentiertes Programm (Stand: 26.02.2018)

10.00 Uhr: **Registrierung**

10.30 Uhr: **Begrüßung** (Raum V 7 Aula)

**Session 1      Physical and Technical Modelling and Simulation** (Raum V 7 0.02) Chair: Prof. Dr. Uwe Tröltzsch

11.00-11.20 Uhr: **Dynamical Evacuation Route Systems for Intelligent Buildings**

(*Tim Wächter u. Martin Hoffmann, FH Bielefeld*)

This work examines different approaches in the area of dynamical evacuation systems in smart buildings. The focus is on the building representation inside the system, the used evacuation path planning algorithm and the building information important for a dynamical evacuation system. Finally, an approach is discussed that will be investigated in the future.

11.20-11.40 Uhr: **Running with Technology: Interaction Design to Enable Digital Tools for Motivation and Health**

(*Matthias Seuter u. Gernot Bauer, FH Münster*)

Running sport is a popular activity for reasons of health, fun, or socializing. The benefits of running sport are well understood and make the use of technology in running sport one area of everyday and social aspects of the digital transformation. One problem in the area of using technology while running is that interaction potentially introduces interference. We summarize insights from our experiments into the field of designing interaction for running activities. Our experiments explore minimizing interference with movement, ambient and wearable devices, and the timing-context of a run. We describe how triggering functions enable new applications and how other interactions may be postponed in the application, e.g., for later completion after the run.

11.40-12.00 Uhr: **Development of a water reservoir simulation model**

(*Arne Pahl, Steffen Menz u. Uwe Tröltzsch, RFH Köln*)

Hydrogen is likely to become more important in the context of the energy transition, however this required a greenhouse gas-neutral manufacturing process. As part of the ASTOR project, such a manufacturing process is to be modeled and simulated. This paper discusses the general procedure for creating simulation models using the example of a water reservoir. Furthermore, the currently implemented properties of the simulation model and further perspective integrable properties are explained.

12.00-12.20 Uhr: **Thermodynamic modeling of a solar-chemical hydrogen reactor**

(*Steffen Menz, Arne Pahl u. Uwe Tröltzsch, RFH Köln*)

As part of the further development of renewable energies and ecological power plant technologies, the solar-chemical production of hydrogen offers promising potential. To optimize this technology, a simulation model of a test unit is created, where control strategies can be developed and tested. This paper deals with the modeling of thermodynamic and heat transfer processes in the hydrogen reactor. First, the operating principle will be described. Second, the properties of the used simulation platform Matlab/Simscape and the implementation of expanded physical properties are explained. Finally, the approached model design by using the cell method and the verification of simulation results using the Design of experiments method are presented.

12.20-12.40 Uhr: **WiFi-based Long-Distance Networks: From Disparity to Dignity in Broadband Access**

(Michael Rademacher u. Karl Jonas, HS Bonn-Rhein-Sieg)

WiFi-based Long Distance networks are a promising alternative for rural areas to tackle the massive disparity in broadband access. In this work, we provide a short overview of our research efforts conducted in the last years. We selected three distinctive research topics evaluated with three different methodologies: Propagation measurements in our testbed, mathematical modeling of the WiFi MAC-layer and simulations of interferences among WiFi radios with directional antennas.

**Session 2      Robotics, Interfaces** (Raum V 7 0.04) Chair: Prof. Dr. Ivan Volosyak

11.00-11.20 Uhr: **Towards Improving Reliability of Service Robots by Autonomous Handling External Fault**

(Anastassia Küstenmacher, HS Bonn-Rhein-Sieg)

In the field of domestic service robots, recovery from faults is crucial to promote user acceptance. In this context, this work focuses on some specific faults which arise from the interaction of a robot with its real world environment. Even a well-modelled robot may fail to perform its tasks successfully due to external faults which occur because of an infinite number of unforeseeable and unmodelled situations. Through investigating the most frequent failures in typical scenarios which have been observed in real-world demonstrations and competitions using the autonomous service robots Care-O-Bot III and youBot, we identified four different fault classes caused by disturbances, imperfect perception, inadequate planning operator or chaining of action sequences. This thesis then presents two approaches to handle external faults caused by insufficient knowledge about the preconditions of the planning operator.

11.20-11.40 Uhr: **Multi-Modal Sensor Technologies and Methods for Human-Machine Interaction in Working Life**

(Lukas Wöhle, Westfälische HS)

Direct interaction with assistive technologies, i.e. collaborating with a robot while the hands are usually occupied, needs to be precise, robust, fail save and demand for new interaction technologies. To handle these requirements multi-modal sensor systems and technologies need to be explored. Various sensors are considered for human-machine interaction, many of them are commercially available. The most promising are the Magnetic Angular Rate Gravity (MARG)-sensors, which allow a complete measurement of orientation relative to the direction of gravity and magnetic field of the earth. MARGs are used in hands free interfaces to directly control a robot via head motion estimation. The proposed approach here is to add technologies, e.g. eye tracking or electrooculography, to design a multi-modal sensor system and to condense the multitude of raw sensor data through new methods of sensor data fusion. The aim is to generate redundant, robust and precise data for specific interaction tasks. This contribution deals with recommendations and ideas for robust interaction technologies through multi-modal sensor data fusion, incorporating recent algorithms and sensors.

11.40-12.00 Uhr: **Grenzen der Autonomie: Interventionsstrategien für die Mensch-Roboter Interaktion**

(Max Pascher, Westfälische HS)

Inmitten unserer Gesellschaft leben Menschen, welche unter einer Funktionsstörung aller vier Gliedmaßen leiden. Dabei kann diese Beeinträchtigung durch einen Unfall und somit einer Schädigung des Rückenmarks ihre Ursache finden oder bedingt durch eine degenerative Erkrankung oder Entzündung des zentralen Nervensystems. Im Folgenden werden die Betroffenen als Tetraplegiker bezeichnet. Diese Personengruppe benötigt bis zu 24 Stunden täglich eine Pflegekraft, welche sie in allen Abschnitten des alltäglichen Lebens begleitet und ihnen assistiert. Der Einsatz von autonomen Robotern kann an dieser Stelle helfen, den Betroffenen einen bestimmten Grad an Selbstbestimmung zu ermöglichen. Jedoch bedarf der Einsatz von autonomen Robotern, welche in Körperkontakt mit dem Menschen treten, bestimmten Sicherheitsbestimmungen und steckt aus Forschungs- und Entwicklungssicht noch ganz am Anfang, so dass ein zuverlässiger Betrieb nicht realistisch ist.

12.00-12.20 Uhr: **Plattformunabhängigkeit in der Kognitiven Robotik**

(Victor Mataré, FH Aachen)

Um in dynamischen Umgebungen flexibel handeln zu können, benötigen Roboter ein logisches Modell ihrer Umwelt (Domänenmodell), auf dem Handlungsabläufe geplant werden können. In der Praxis ergeben sich jedoch immer wieder komplexe Interaktionen zwischen dem Domänenmodell und einzelnen Komponenten der Roboterplattform. Als Folge muss entweder das Domänenmodell auch Plattfordetails beschreiben werden, oder die Komponentenmodule müssen sämtliche Details verkapseln. Der erste Ansatz verkompliziert allerdings das Planungsproblem deutlich, während der zweite Ansatz die Möglichkeiten zur intelligenten Fehlerbehandlung stark einschränkt. In diesem Beitrag wird das ConTrAKT-Projekt vorgestellt, in dem eine spezialisierte Constraint-Sprache zur expliziten Modellierung der internen Abhängigkeiten einer Roboterplattform entwickelt wird, um eine logische Entkopplung zwischen der eigentlichen Aufgabenstellung und der Roboterplattform erreichen zu können.

12.20-12.40 Uhr: **Optimal GUI for multimodal BNCI-based VR interface**

(Piotr Stawicki u. Ivan Volosyak, HS Rhein-Waal)

Brain/Neural Computer Interfaces (BNCI) are a specific type of Human-Computer Interaction devices that utilizes an alternative communication channel by analyzing the brain activity and decoding it into computer commands. This allow the user e.g. to communicate without using neither peripheral muscles nor nerves.

The recent trends in augmented and virtual reality (VR) provide a new platform and opportunities for physically impaired people. Thanks to the VR those people could better integrate with their environment and furthermore, e.g. get out of their comfort zone into the real word while exploring the surroundings through a remote telepresence.

**Mittagspause**

12.40-13.50 Uhr (Raum V 7 0.15)

**Session 3      System Design Techniques** (Raum V 7 0.02) Chair: Prof. Dr. Udo Seelmeyer

13.50-14.10 Uhr: **Soziotechnische Herausforderungen bei maschinellen Entscheidungsprozessen in wohlfahrtsstaatlichen Institutionen**

(Diana Schneider, FH Bielefeld)

Im Beitrag werden einige soziotechnische Herausforderungen diskutiert, die bei der Etablierung von maschinellen Systemen zur Entscheidungsunterstützung zu Tage treten. Neben klassischen Problemen wie der Frage nach der Agency von Technik und des Datenschutzes wird sich folgend auch auf Probleme aus konkreten Handlungszusammenhängen konzentriert.

14.10-14.30 Uhr: **Anforderungsanalyse für intelligente technische Systeme**

(Fabian Kneer u. Erik Kamsties, FH Dortmund)

In diesem Beitrag wird der Bedarf für neue Methoden der Anforderungsanalyse für intelligente technische Systeme diskutiert. Diese Systeme sind komplex, vernetzt und adaptiv und werden beispielsweise in vielen Systemen aus der Domäne Mobilität eingesetzt, so z.B. die Fahrerassistenz. Im Promotionsvorhaben werden die entstehenden Probleme für die Anforderungsanalyse analysiert und Lösungen zur Anforderungserhebung zur Laufzeit entwickelt. Diese Methoden sollen durch die Konstruktion eines Werkzeugs unterstützt werden.

14.30-14.50 Uhr: **Design Exploration and Optimization via Machine Learning**

(Kevin Cremanns u. Dirk Roos, HS Niederrhein)

Machine learning is an increasingly used tool in the daily design process of mechanical engineers. Due to the ever increasing demands on the design and the increasing complexity at the same time, it is more difficult with conventional tools to achieve the best possible performance. Methods of machine learning offer various possibilities to support the engineer in the design process. On the one hand, these methods can be used to explore the available design space, on the other hand, they can also learn complex relationships between design input and output parameters and thus create a so called surrogate model, which is a mathematical approximation

of the unknown relationship. This surrogate model can then be used to perform optimizations or design studies, that are usually too time consuming and or costly. Likewise, the main influencing factors can be recognized from an arbitrarily large number of available input parameters and thus the relevant design space can be significantly reduced. This gives the engineer a deeper understanding of his design and the optimization possibilities. In order to make an effective use of these methods, it is particularly important to know where the pros and cons of each method are and how they can effectively interact with each other.

**Fast Forward Poster Presentations** 14.50-15.50 Uhr (Raum V 7, Aula) Chair: Prof. Dr. Rainer Herpers

### **Eine Ontologie für die Wissensrepräsentation in e-Business-Projekten**

*(Benjamin Matthies, FH Südwestfalen)*

e-Business-Projekte (eBP) sind komplexe Unterfangen, die meist umfangreiche Veränderungen der unternehmerischen Wertschöpfungsprozesse einleiten und begleiten. Dieser Beitrag greift das Komplexitätsproblem in eBP auf und schlägt für dessen Lösung eine Ontologie für die Wissensrepräsentation in eBP vor. In dieser Ontologie werden die aufgabenorientierten Wissensgebiete (d.h. Projektthemen, -prozesse und -objekte) entlang eines Phasenmodells organisiert und ferner hierarchisch gegliedert. Außerdem werden die dynamischen Beziehungsnetzwerke der Wissensgebiete in logischen Relationen modelliert und relevante Projektinformationen (u.a. Ressourcen, Stakeholder oder Risiken) ergänzt. Die Ontologie verfolgt dabei das Ziel, die spezifischen Themengebiete in eBP strukturiert abzubilden und im Zuge dessen zum ganzheitlichen Verständnis solcher komplexen Vorhaben beizutragen. Der e-Business-Disziplin wird auf diese Weise ein domänenspezifisches Wissensmodell geliefert, welches die kontextualisierte Wissensakquisition im Rahmen des praktischen Projektmanagements von eBP unterstützt.

### **Situational Project Management for Collaborative Research Projects**

*(Ala Nuseibah, FH Dortmund)*

In the time of rapid changes, disruptive innovations and transitions towards a digitalized world, collaborative research projects bring industry, academic and public partners together to face those challenges. From a project management point of view, these collaborative applied research projects are atypical in many senses and pose a challenge in their management due to the ambiguously defined goals and varying interests of relevant stakeholders. The challenges range from the traditional iron triangle, to project-type specific challenges of consortium and partner management, obtaining funds, innovation and technology and knowledge transfer. In this research work, the focus is on those projects that are publicly-funded, of applied nature and are based on cooperation between academia and industry. The research context is limited to collaborative research projects enabling digital transformation, such as those aimed at revolutionary or evolutionary technologies, research on business models and the digital business ecosystem and regulation of the digital context. The current focus is within Germany, with the possibility to extend the scope to European Union partner countries.

### **Towards User-centered Interactive Web Scraping**

*(Mandy Neumann u. Philipp Schaer, TH Köln)*

Building up new collections for digital libraries is an expensive and demanding task. Not only do digital content curators need to assess many different data sources intellectually but also need to invest a lot of time and effort to extract the available data sets. (Meta-)Data providers might make their data available via different channels: Some offer an API where the data can be pulled from via standardized protocols (e.g. OAI-PMH). Some others prepare spreadsheet files with the metadata of their recent publications that they share regularly. But not every publisher, especially the smaller ones, are willing or able to make such an effort. On the other hand, data providers usually maintain websites where more or less structured metadata is available for public display – even in cases where the content itself is not open access.

### **Intelligent Brain Machine Interface (IBMI)**

*(Abdul Saboor u. Ivan Volosyak, HS Rhein-Waal)*

Steady state visual evoked potentials (SSVEPs)-based Brain Computer Interfaces (BCIs) can provide hand-free human interaction with the environment. However, such systems are limited to special designed graphical user interface, and can only perform the limited tasks hardcoded in the system. The proposed Intelligent Brain Machine Interface (IBMI) provide the initiative way of interaction, in which the SSVEP-based BCI system will automatically adopt according to the usage domain, thus will enhance the user's ability to understand and operate the surroundings better, by providing overlaid information on real world patterns. The IBMI will track the eye gaze direction by using the spatial distribution of the SSVEP signals across the human scalp to provide the reliable and fast tracking of user interface components.

### **Finding an objective visual fatigue measure for an SSVEP-based BCI**

*(Mihaly Benda u. Ivan Volosyak, HS Rhein-Waal)*

In this work we attempt to find an objective measure for visual fatigue, caused by a prolonged use of Steady State Visually Evoked Potential (SSVEP)-based Brain Computer Interfaces (BCIs). Instead of investigating the traditional frequency bands of brain activity, such as alpha (8-13 Hz) for the fatigue level estimation, we propose the using of smaller frequency ranges. The activity of the traditional bands can be changing quite differently. When BCI users get more tired, fatigue detection using these bands can be challenging. Smaller frequency ranges might be better at indicating visual fatigue levels, and become an appropriate measure. If the level of fatigue will be reliably and objectively detected, the performance and accuracy of the BCI can be maintained or even improved after a prolonged use of the system.

### **High literacy rates in cVEP-based BCIs**

*(Felix Gembler, Piotr Stawicki u. Ivan Volosyak, HS Rhein-Waal)*

Brain-Computer Interfaces (BCIs) interpret recorded brain signals in real time and allow control and communication without muscular activity. Communication tools can be realized with code modulated visual evoked potentials (cVEP) which interpret brain responses to external flickering stimuli. A major challenge in BCIs development is to balance between speed and accuracy. BCI performance varies across users. Focusing only on the maximum achievable speed might exclude some users from using the system with sufficient level of control. For cVEP BCIs, the time for the system to classify the brain signals is usually restricted to approximately one second only. A short classification time window can however cause misclassification and lead to insufficient control for some users. In this contribution we tested larger different classification time windows for cVEP BCIs.

### **Hybrid Asynchronous BCI Speller Based on SSVEP and EMG**

*(Aya Rezeika u. Ivan Volosyak, HS Rhein-Waal)*

A Brain-Computer Interface (BCI) interprets brain signals, which are measured by an electroencephalogram (EEG), to allow communication without the need for any muscular movement. Brain waves are interpreted and analyzed by a computer to result in the desired output according to the application. BCI speller is the most commonly discussed BCI application in the literature, and one of the commonly used brain responses in BCI systems is the Steady-State Visual Evoked Potential (SSVEP). Hybrid BCIs are a recent approach to develop practical BCI applications. Consequently, the here-studied hybrid BCI system discusses the parallel usage of SSVEP and surface-electromyographic (sEMG) activity to accomplish a more reliable and faster-performing spelling application. sEMG is the electric potential generated due to muscle activity, and it is measured using electrode placed on the skin over the muscle. EMG signal was used for character selection for an already developed SSVEP-based speller. Twelve participants carried out four copy-spelling tasks to compare between both paradigms: SSVEP alone and the hybrid speller. Results showed that participants who experienced low SSVEP performance could control the hybrid system much better. In addition, the hybrid speller proved that it could achieve faster performance without affecting the accuracy, verifying our hypothesis.

### **Adaptive Machine Learning for the Efficient Reliability Analysis of Multimodal Limit State Functions**

*(Can Bogoclu, HS Niederrhein)*

Reliability analysis of non-linear and multimodal limit state functions is a computationally burdensome task, especially if the sampling based strategies are followed. Response surface methods with various adaptive sampling schemes are previously developed to greatly reduce the required number of sample points but these methods either do not account for the multimodal limit state function or use linear regression based designs of experiments (i.e. D-Optimal) which do not harmonize as well with other response surface methods. We propose combining an unsupervised learning algorithm (DBSCAN) for handling the multimodality with a Latin hypercube design based approach similar to and adapting the process to reliability analysis efficiently. Gaussian process is used for surrogate modelling in combination with directional sampling for limit state functions with a low number of parameters  $n \leq 10$  and Monte-Carlo method for  $n > 10$ .

### **Global Optimization Strategies: Analogies to Human Behavior**

*(Jörg Stork u. Thomas Bartz-Beielstein, TH Köln)*

Optimization algorithms [9] are present everywhere in our daily live. Without even noticing them, they ensure that our orders arrive on time, our phones have the best connection and products have a certain quality. If we walked through a modern company, we would notice that nearly every production process was optimized and every machine was developed with help of mathematical optimization. During the last decades, several new design schemes for optimization algorithms were developed and new algorithms are proposed every day. Particular two groups of algorithms are in the focus of current research. First, the so-called metaheuristics, which are capable of solving a large variety of optimization problems with stochastic strategies without much knowledge about the problem to solve. Second, model-based and especially surrogate-assisted optimization algorithms, which dominate the field of costly real-world applications and have become the state-of-the-art for this task in efficient algorithm design. Similar to many modern technical developments, many of these algorithms are nature-inspired. For example, these search strategies have analogies with the behavior of animals. To give an overview of the different available optimization methods, we want to use a similar approach and classify them based on the natural human behavior in path finding. To establish such a comprehensive taxonomy, we focus on identifying key elements of algorithm design and utilize these to define a clear separation between a small number of algorithm classes. In contrast to other work, by these means we will keep the level of detail on an abstract, but still valuable level. This abstraction level allows us to present simply comprehensible ideas on how the individual classes differ and moreover, how the respective algorithms perform their searches. For this purpose, we divide optimization algorithms into intuitive classes: Wanderer, Guide, Cartographer.

### **Automatische Methoden zur Verbesserung von 3D-Stadtmodellen**

*(Simon Hensel, HS Niederrhein)*

Die automatisierte Rekonstruktion von Fassaden in 3D-Stadtmodellen bildet die Hauptthematik dieser Arbeit. 3D-Stadtmodelle können in der Praxis zum Beispiel dafür verwendet werden die Stadtplanung zu vereinfachen, eine Datenbasis für Building Information Modeling (BIM) zu schaffen oder damit Simulationen, wie zum Beispiel Computational Fluid Dynamics (CFD), durchzuführen. Ausgangspunkt ist eine Punktwolke einer Stadt oder einzelner Bezirke, wobei es verschiedene Techniken gibt, um diese zu erfassen. Das meist genutzte Verfahren ist hierbei die LIDAR (Light Detection and Ranging)-Datenerfassung oder auch Laserscanning genannt, was durch die Präzision begründet ist. Dies führt zu Punktwolken mit einem hohen Detailgrad, welcher gerade bei der Rekonstruktion von Fassaden wichtig ist, da diese sehr detailreich sein können. Eine photogrammetrische Technik der Punktwolkenerstellung ist SfM (Structure from Motion), wobei eine Punktwolke aus einer Videoaufzeichnung oder Bildern erstellt wird. Dieses Verfahren ist zwar nicht so präzise im Vergleich zu LIDAR, da Bilder verschiedene Lichtverhältnisse (Schatten, Spiegelungen etc.), Unschärfe oder Verzerrungen aufweisen können, aber der Vorteil dieses Verfahrens ist, dass keine spezielle Ausrüstung notwendig ist und dass man zusätzlich zur Position jedes Punktes innerhalb der Punktwolke auch einen Farbwert erhält.

## **Interaction Techniques for Human-Robot Interaction: Towards a novel way of cooperation at the workplace for the severe motor impaired**

*(Stephanie Arévalo Arboleda, Westfälische HS)*

Severe motor impairments affect a considerable number of the population worldwide. One of this motor impairments is caused by spinal cord injuries at a C1-C8 level, which produce paralysis in the four limbs, tetraplegia. According to the World Health Organization every year between 250 000 and 500 000 suffer from spinal cord injuries and could benefit from supportive technologies. A series of limitations affect the normal lives of people who suffer tetraplegia. Limitations that range from activities of daily living to their work life. For this reason, it is important to mention that most of the population who suffer tetraplegia are still in a working age and maintain their mental capacity. Nevertheless, this group of people have lower rates of economic participation, hence, adequate environments need to be settled in order to help them join the working market. A way of re-introducing severe disabled people in the working market is through designing solutions within the scope of Human-Robot Interaction (HRI), which expands the span of collaboration at the workplace. Particularly in the Human-Robot Collaboration area, human supervisory control of robots have been used for semi-autonomous tasks, for instance, robots used in manufacturing companies performing assembly line tasks. The proposed research is based on the MIA project from Westphalian University of Applied Sciences, which combines sensor technologies with novel interaction design within the spectrum of human robot interaction.

**Poster Session und Kaffeepause** 15.50-16.30 Uhr (Raum V 7 Aula)

**Session 4 Cyber Security** (Raum V 7 0.02) Chair: Prof. Dr. Norbert Pohlmann

16.30-16.50 Uhr: **GHOST: Ein Competence Developing Game für das Cybersecurity Awareness Training**

*(Johannes Alexander König u. Martin R. Wolf, FH Aachen)*

In diesem Beitrag wird erläutert, wie ein Competence Developing Game für den Zweck eines Cybersecurity Awareness Trainings im Unternehmen realisiert werden kann. Die zunehmende Digitalisierung wirkt sich auf alle Lebensbereiche aus. Die damit einhergehenden Wandlungsprozesse betreffen entsprechend das private und das berufliche Leben. Dabei wird die Digitalisierung zwangsläufig von Veränderungen in der Informationshaltung begleitet, womit über Jahrhunderte bewerte Sicherheitsmechanismen, wie z.B. das Wegschließen von Unterlagen, nicht mehr verwendbar sind. Zwar bietet die digitale Informationshaltung äquivalente digitale Sicherheitsmechanismen, diese zeigen allerdings genauso wie die analogen durch den Faktor Mensch Schwachstellen. Bei analog gesicherten Informationen ist es für den Einzelnen nachvollziehbar, dass bspw. keine Fremden Zugang zu Archiven erhalten dürfen oder dass selbst wenn der Gebäudeschutz scheitert, die Informationen in einem Tresor liegend, durch einen zusätzlichen Schlüssel geschützt sind. Dass äquivalente Mechanismen auch für digitale Daten greifen, ist für nicht geschulte Endanwender nur schwer verständlich. Gleiches gilt für mögliches Fehlverhalten, welches Angreifern überhaupt erst ermöglicht, die Schutzmaßnahmen zu umgehen.

16.50-17.10 Uhr: **IP Protection in Embedded Systems: A Side Channel Perspective**

*(Peter Samarin u. Kerstin Lemke-Rust, HS Bonn-Rhein-Sieg)*

Given two embedded systems that perform the same task, how can we tell without looking at their source code whether or not they have been independently developed? This is a serious problem that might cause large monetary loss for embedded software companies that distribute their intellectual property (IP) without taking countermeasures against plagiarists. By committing IP violation, the plagiarist can save the cost and time that it took to develop the original software and bring a system with the same functionality but for a cheaper price to market. We address this problem by making use of side channels—properties of physical

systems that allow us to distinguish some of the performed instructions and computations. By passively observing the side channels, or even by actively creating them, we can detect plagiarized IP and prove or disprove its existence. In this work we present several methods for IP protection in hardware and in software.

**17.10-17.30 Uhr: Implications of Adversarial Input for Smart Health**

*(Matteo Cagnazzo, Westfälische HS)*

This work gives background on adversarial learning and smart health. It outlines implications and threats caused by the interconnection of both subjects in real world scenarios. Furthermore it gives future research directions within this emerging research challenge. AI based solutions are more and more emerging and deployed in real world scenarios. Especially health providers are putting a lot of hope into AI because of their potential cost effectiveness and time savings through automated medical diagnosis and treatment or operations performed by an autonomous system, which will lead towards smart health or mHealth if the solution can be deployed in a mobile way for the patient e.g. via smartphone application. On the other hand, healthcare is a domain which often lacks integral security and privacy protection mechanisms, which causes data breaches compromising more than 500 patients per breach only in the US, to occur on a monthly basis according to the US Department of Health and Human Services<sup>1</sup>. This work aims to explore the interfaces and interconnections of security, healthcare and AI by introducing adversarial learning and smart health. After the background section this paper outlines threats and implications from the connection of the two research fields and discusses outcomes and future research directions.

**17.30-17.50 Uhr: Towards Privacy Implications of Adware**

*(Tobias Urban u. Norbert Pohlmann, Westfälische HS)*

Web Advertisements are one primary financial source for many online services as for criminals. Successful ad campaigns rely on good online profiles of their potential customers. Different user tracking techniques are used to create these profiles. The financial potentials of displaying ads have led to the rise of malware that injects or replaces ads on websites (adware). This development leads to always further optimized and customized advertising. For these customizations, various tracking methods are used. However, only sparse work has gone into privacy issues emerging from that kind of malware. In this paper, we investigate the tracking capabilities of adware. Therefore, we developed a framework that allows us to analyze the network communication of the Firefox browser - on the application level. We use that framework to dynamically analyze the communication streams of over 13,000 malware samples that tamper with the users' browser session. We compare our findings to the privacy leakage of 5,500 Firefox extensions and previous work regarding chrome extensions. Our results show that roughly 37% of the requests issued by the malware samples contain private information or track users. Furthermore, we analyze which tracking techniques and services are used.

**Session 5      Imaging and Image Data Processing** (Raum V 7 0.04) Chair: Prof. Dr. Rainer Herpers

**16.30-16.50 Uhr: Advantages of Deep Learning Techniques on Grayscale Radiographs**

*(Obioma Pelka, FH Dortmund)*

Due to advances in software, hardware, and digital imaging in the medical domain, the number of images taken per patient scan has rapidly increased. To maintain the maximum interpretation of these radiological images, there is need to create computer-aided interpretation and categorization. This works presents modeling approaches performed to obtain an automated classification and annotation of radiographs. The focus is on image enhancement methods combined with deep learning techniques.

**16.50-17.10 Uhr: Intrinsische 2D-3D-Registrierung von DSA-Zeitserien und unvollständigen 3D TOF MRA-Daten mit Deep Learning**

*(Christian Neumann, HS Niederrhein)*

Für die Planung der Bestrahlung von arteriovenösen Malformationen (AVM) durch Gammastrahlung wird eine intrinsische 2D-3D-Registrierung benötigt. Die zu registrierenden Modalitäten sind eine dreidimensionale



Magnetresonanztomographie-Angiographie (MRA) mit geringer Schichtanzahl und eine 2D-Röntgenprojektion in Form einer biplanaren, digitalen Subtraktionsangiographie (DSA) als Zeitserie. Bei der Registrierung sollen diese Modalitäten in räumliche Übereinstimmung gebracht werden – also letztendlich die Kameraposition der DSA-Bilder relativ zu dem MR-Volumen geschätzt werden.

**17.10-17.30 Uhr: Software Framework for Spatio-temporal Satellite Image Data Fusion**

*(Christof Kaufmann, Dinesh Kumar Babu u. Marco Schmidt, HS Bochum)*

Daily high resolution satellite images have an ever growing influence on many day to day remote sensing applications. Farming is one such area where the application of high spatial resolution data helps in the optimization of farming and potentially changing the future of farming methods itself. With satellite images, specific models can be used for crop monitoring and phenology change detection. This leads to optimized irrigation, fertilization and thus to more efficient farming in general. In the end this might also semi-automate some tasks in farming. However, the models require proper satellite images; this means high resolution images with preferably daily availability. While both on its own is not a problem, their combination is. The satellites from which images are available for free have an architecture that allows either daily low resolution images or high resolution images every 8 to 16 days. Here, low resolution means a pixel size of about 250 m to 500 m and high resolution 10 m to 30 m.

**17.30-17.50 Uhr: Registrierung und Analyse Multimodaler Daten in der Raman- und Infrarot-Mikrospektroskopie**

*(Christoph Pomrehn u. Rainer Herpers, HS Bonn-Rhein-Sieg)*

Raman- und Infrarot-Mikrospektroskopie sind komplementäre Messverfahren, die durch die Interaktion von Licht und Materie zur Aufklärung der molekularen Struktur einer Probe beitragen können. Durch beide Messverfahren werden hyperspektrale Bilddatensätze generiert, die örtlich aufgelöste spektrale Signaturen zur Bearbeitung analytischer Fragestellungen liefern. Wir konnten unter Verwendung einer Polymerprobe beispielhaft zeigen, dass ein multimodaler Ansatz mit beiden Messverfahren im Rahmen einer Klassifizierungsaufgabe bessere Ergebnisse liefert als die jeweiligen einzelnen Modalitäten.

**Meet the Scientist** 17.50 Uhr (Raum V 7 Aula)