International Workshop on
Intelligence Augmentation and Amplification

ABSTRACTS

January 15-17, 2019
Kaiserslautern, Germany
Yusuke Sugano  
(Associate Professor, Graduate School of Information Science and Technology, Osaka University)

**Research Theme**  
Analyzing Human Attention and Behavior via Collective Visual Sensing for the Creation of Life Innovation

**Research Outline**  
The project aims at developing technologies, which we call collective visual sensing (CVS), to understand group attention and activities by analyzing information gathered from multiple wearable devices, such as wearable cameras and eye trackers. In particular, the project will focus on: (1) developing technologies for extracting measurements through the use of collective visual sensing, (2) developing technologies for understanding group activities and intent, and (3) building assistive systems based on developed technologies for various applications such as supporting collaborative work in an operation room and assisting a blind person to navigate in an open and complex environment.

**Seeds**  
As a basis for collective visual sensing platform, we developed computer vision-based methods for attention estimation and analysis. Our appearance-based gaze estimation approach allows for calibration-free, fully unconstrained eye tracking using off-the-shelf RGB cameras. We have also developed application systems of our appearance-based gaze estimation including public display gaze estimation and unsupervised eye contact detection.

**Needs**  
Our research provides a strong technical basis for attention and activity sensing using multiple cameras, and can be further deployed to various application scenarios such as marketing and medical diagnosis. It will be also promising to investigate multi-modal human sensing approaches by combining our vision-based approach with different sensing modalities.
Kenji Suzuki  
(Professor, Faculty of Engineering, Information and Systems, University of Tsukuba)

**Research Theme**  
Social Imaging: Technologies for Supporting Creative Activities and Facilitating Social Interaction

**Research Outline**  
We aim to establish social imaging technology for measurement, analysis and modeling of social interaction among people. By applying wearable and mixed reality technologies, we will create an interactive environment entitled future gymnasium, where we can support creative activities and facilitate social interaction for children with autism and other developmental disorders. While conducting fundamental research and feasibility studies of children’s development in collaboration with schools for children with special needs and non-profit organizations, we pursue the challenge to explore a new area of human informatics and the science of personal and emotional experiences.

**Seeds**  
* Wearable device to measure social behaviors, in particular, children with neurodevelopmental disorders.  
* Wearable / assistive robotics technology

**Needs**  
* Research partners in psychology, medicine who are interested in working with engineers in assistive technologies
Takahira Yamaguchi  
(Professor, Faculty of Science and Technology, Keio University)

**Research Theme**  
A Framework PRINTEPS to Develop Practical Artificial Intelligence

**Research Outline**  
We develop PRINTEPS, a platform to construct practical applications of artificial intelligence, integrating common sense reasoning, dialog system, user’s emotion recognition, and computer vision, based on large scale of ontologies. We also do two practical case studies: student friendly robots and teaching assistance robots in elementary school, and service robots for worker robot cooperation.

**Seeds**  
* PRINTEPS (PRactical INTElligent aPplicationS): An integrated intelligent application development platform  
* PRINTEPS workflow editor: SOA (Service Oriented Architecture) and ROS (Robot Operating System) based workflow editor  
* ROS based spoken dialogue system  
* Multiple knowledge base (ontology, workflow, rule base, goal tree)  
* Knowledge-based reasoning  
* DL (Description Logic) based reasoning  
* SWRL (Semantic Web Rule Language) based reasoning  
* Ontology learning

**Needs**  
* Distributed network for muti-robot and multi-sensor systems  
* Distributed Architectures  
* Real-time systems  
* IoT platform  
* Real-world machine learning  
* Real-world data collection  
* Multi robot cafe and classroom

Specific AI applications, such as Google's Alpha Go and IBM's Watson, may go beyond human capability on specific tasks. However, it takes still many costs to develop integrated intelligent applications such as service robot applications. In fact, many AI applications require the difficult integration of different intelligent behaviors, such as listening and speaking (speech dialogue understanding), thinking (knowledge-based reasoning), watching and moving (image sensing and motions), and learning (machine learning). Processing time scales change, depending on types of intelligence. In other words, it is necessary to integrate symbols and signals to develop integrated intelligent applications. Moreover, the applications should cooperate with other robots, sensors, and people to achieve intelligent services.

From the above background, we are developing PRactical INTElligent aPplicationS (PRINTEPS) [1, 2], which is a user-centric platform to develop integrated intelligent applications only by combining four types of modules such as knowledge-based reasoning, speech dialog, image sensing and motion management. PRINTEPS supports end users to care about AI application design (user participation design) and to develop it easily. To evaluate our platform, we have applied our platform to multi-robot cafe and teaching assistant robots.


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Research Outline
My research focuses on body-brain interaction, particularly under the situation of interpersonal communication. It involves: Interactions between implicit eye/body movements and autonomic activities during conversation, Cardiac modulation of emotion perception, Social modulation of bodily self-awareness, and Development of facial mimicry and social cognition. I have several methods to measure biological signals of social interactions in humans and theoretical interpretations of such measures. My research involves Seeds for IAA in that understanding how body communicates with the mind and developing technologies to properly control them will improve the quality of activities on various interpersonal situations including sports and collective actions. Also, some colleagues of mine in JST-CREST projects have various procedures to measure human cognition and behaviors. These procedures from experimental psychology, cognitive psychology, and neuroscience would be combined with those in the research field of IAA. Needs of my research lies in increasing the opportunity of practical researches to apply our findings under experimental settings to real-life situations and more theoretical interpretations of measured signals. For this, my research will derive benefits from input and advice in terms of theoretical aspects (in terms of self-awareness and understanding social situations) and methodological aspects (including novel measurement of biological signals, noise reduction, time series analysis, etc.). In addition, I would like to have communications with other researchers in experimental psychology and cognitive science which will also expand my research fields.

References:
Takayuki Ito  
(Professor, Department of Techno-Business Administration and Department of Computer Science, Nagoya Institute of Technology)

Research Theme  
Large-scale Consensus Support Systems based on Agent Technologies

Research Outline  
Large-scale consensus support technologies are new platforms for the next generation Democracy, which can enhance the collective intelligence of us, the human race. In this study, we innovate new large scale consensus support systems based on our agent-technologies. The issue is to support better consensus-making while avoiding characteristic problems of online large scale discussion, like flaming. In this study, we will establish agent-technologies that can effectively support consensus-making by harmoniously extracting participants’ opinions and preferences.

Seeds  
Large-scale Discussion Platform  
Automated Negotiation  
Facilitator agent

Needs  
Natural Language Processing  
Linked Open Data
Komei Sugiura  
(Senior Researcher, Advanced Speech Translation Research and Development Promotion Center (ASTREC), National Institute of Information and Communications Technology (NICT))

Seeds

Our group has been working on robotics and speech processing. In particular, we have core technologies in multimodal language processing and time series prediction. Recently, we are working on Generative Adversarial Nets (GAN) in the data augmentation domain.

Our representative product Voicetra can translate 31 languages including German, and used by 3 million users. In addition, we have been organizing RoboCup, a benchmark test for domestic service robots for over 10 years. Therefore, we can provide software licenses and know-how in these domains. We are also working on applications of deep neural networks in areas where time series prediction is not fully utilized (e.g. solar flare prediction and air pollution prediction).

Needs

We can collaborate with researchers in ANY field. In most research fields, our time series prediction technology will be applicable. In particular, I would like to discuss research with robotics and language processing researchers.
Research Theme
Brain network analysis, emotion (stress) analysis, Personality prediction from SNS and brain data.

Research Outline
This study aims to elucidate neural mechanism behind different social attitudes and stresses of human by integrating computational neuroscience, natural language processing of real-world texts, and measurements from biosensors. By our unique methodology linking brain activity data with real-world behavioral data, we are also targeting for the neural mechanism of "symbol", which is one of most fundamental questions in human information processing.

Seeds
Brain network analysis, emotion (stress) analysis, Personality prediction from SNS and brain data.

Needs
Formal analysis method of dynamic network, quantification of stress.
Koichi Kise  
(Professor, Graduate School of Engineering, Osaka Prefecture University)

**Research Theme**  
Behavior change and harmonious collaboration by experiential supplements

**Research Outline**  
Most of the problems we face in our life have already been experienced and solved by others. In this research, focusing on this point, we realize human-machine harmonious collaboration by recording experiences as digital data, store them in “experience bank” for their distribution. In this process, we transform the digital record of experiences into a user-adapted form called “experiential supplement” taking into account users’ cognitive biases. This makes the experiences more acceptable by users to change their behavior. We demonstrate the effectiveness of the above process in the fields of learning, health care, sports and entertainment.

**Seeds**  
* basic sensing/actuation (maybe a combination of both, machine learning)  
* how to build evaluate the above feedback loops?  
* build systems/apps with various sensing devices.  
* analysis of images and documents, and their recognition  
* signal processing for human behavior analysis

**Needs**  
* other research fields (except for a learning area) where an ICT-based behavior change can be applied or is required.  
* evaluation methods from other viewpoints such as Psychology, behavioral economics, industrial health.  
* new sensing devices and materials that can’t buy in the commercial market.  
* what are our goals in relation to human behavior and habits?  
  make live more efficient?  
  Increase quality of life?  
* how to improve behavior patterns? (In relation to goals?)  
  can we create a feedback loop using implicit behavior?  
  how to change human behaviors  
* how to motivate people to achieve goals  
* how to stimulate people to form a productive group
Research Outline

My technological seeds are sensing system including hardware and software. I've developed a tiny wearable system and various mobile applications especially for researches on human activity recognition. SenStick, presented in Ubicomp/ISWC2016 (Best Demo Award), is the ultra-tiny multiple sensor board. Eight kinds of sensors (Accelerometer, Gyro, Magnetic, Temperature, Barometer, Humidity, Illuminance, UV) are embedded on 10mm x 50mm board. Now, I’m develop an energy-harvest wearable place recognition system using multiple solar cells (Accepted for IEEE Percom2019). Another research is research on smart homes. We have a smart home environment with a bath and toilet in the university, where we can actually live. In our smart home environment, it is possible to collect data of activities of daily living through various sensors. Currently, I'm interested in a persuasive system based on information technologies, that can change human behavior.

To extend my research, I would like to discuss possibilities and feasibility to sense human inner state (stress and emotion) by sensors at the actual working/educational spaces. Sensors are useful for quantifying the phenomenon. However, it includes the problem of privacy, compliance, ethics, etc. if we actually use it in the actual environment. For example, Japanese researchers in occupational health have much interest in our technologies. With several companies, I've started the experiment to ask the employees always to wear the wearable sensors, bring the environmental sensor, and answer the questionnaires for mental health. Also, I've started to measure the behavior of students in e-learning (a part of Kise-CREST project), and in a group meeting. I would like to know the situation in Europe and explore the chance to collaborate.
Research Outline

Today's sensor technologies such as cameras and microphones are in many ways complementary and/or superior to human senses (e.g. temporal/spatial resolution). This technology can enhance our senses. My goal is to use technical systems to enhance existing human abilities and to create new capabilities.

My background can be summarised in 3 major directions: eyewear computing, activity recognition and body schema extension. My current work is mostly on human computer interaction/integration. My work direction aims at modelling and augmenting performance fluctuations in the human mind, using wearable sensors (e.g. smart eyeglasses) and machine learning. I assess the current cognitive state of the user. I explore ways to collect data using unobtrusive sensory devices so we can collect them in a naturalistic setting. With this information available we have to find ways to combine our naturally perceived stimuli with new information from technical sensors.

My current interest is about modifying and extending the sense of our bodies. To augment senses and maybe to create artificial reflexes, I require collaborators in wearable robotics/prosthetics and physiology experts (especially related to the somatosensory subsystem) to enable successful integration. On the modelling side, it would be interesting to get input from cognitive scientists, psychologists (related to the attention and perception).
Research Theme
Cognitive Mirroring: Assisting people with developmental disorders by means of self-understanding and social sharing of cognitive processes

Research Outline
This project aims at developing cognitive mirroring systems that make human cognitive processes observable. We hypothesize that predictive coding in the human brain plays a crucial role in cognition and intend to better understand its principle and mechanism with/without developmental disorders by integrating computational modeling approach and Tohjisha-kenkyu (first-person view research of developmental disorders). Cognitive mirroring systems, which we design based on the theory of predictive coding, will assist people with developmental disorders by means of self-understanding and social sharing of their cognitive processes.

Seeds
* Head-mounted displays to reproduce atypical perception in ASD
* Computational neural networks to model typical/atypical cognitive capabilities

Needs
Researchers who:
* develop assistive technologies for people with autism spectrum disorder (ASD)
* investigate neural mechanisms of ASD by means of brain imaging and/or behavioral experiments
Atsuyuki Morishima (Professor, Faculty of Library, Information and Media Science, University of Tsukuba)

**Research Theme**
CyborgCrowd: Flexible and Scalable Aggregation of Human-Machine Intelligence

**Research Outline**
We conduct research on theory and implementation of middleware that achieves flexible integration of crowdsourced processing, machine processing and any combination of them, taking the availability of people and algorithms into consideration. We also conduct feasibility studies in various application domains including natural disaster domains, aiming to establish flexible and scalable infrastructure that aggregates human and machine intelligence.

**Seeds**
* [Tools and Middleware] We can provide some of the tools developed in the CyborgCrowd project for the immediate, united, and optimized solutions with crowdsourcing and AI. For example, the task on the floor system can distribute microtasks to floors so that people perform microtasks while walking. CrowdSheet is a spreadsheet interface to help us implement complex crowdsourcing applications involving dataflows among different tasks.
* [Open Platform] We can give opportunities for your research results to be used in the real-world applications with our Open crowdsourcing platform Crowd4U. We have implemented several algorithms published by specialist contributors on Crowd4U and they have been used in the real-world applications.

**Needs**
* [Experts on ELSI (Ethical, Legal, Social Issues)] ELSI is an important issue in our project. We have started the discussion on ELSI in the CyborgCrowd world where crowd workers and AI workers cooperate. We are seeking experts who are familiar with these issues.
* [Real-world Applications outside Japan] Most of the real-world applications currently running on Crowd4U are from Japan. We are seeking those who have real-world applications of crowdsourcing and are looking for an appropriate platform that satisfy their requirements.
Toshihiko Yamasaki  
(Associate Professor, Department of Information and Communication Engineering, Graduate School of Information Science and Technology, The University of Tokyo)

Research Theme  
FolkPopularityRank: Tag Recommendation for Enhancing Social Popularity using Text Tags in SNSs

Research Outline  
Our research group has been working on (1) scoring the text tags in terms of the influence to the numbers of views, comments, and favorite ratings of images and videos on SNSs, and (2) recommending additional tags to increase such popularity-related numbers.  
Our FolkPopularityRank (FPRank in short) algorithm can recommend hash tags that can increase popularity. We are now looking for collaborators who can “generate” new hash tags or impressionable descriptions rather than recommending them from database.
Koichi Shinoda  
(Professor, School of Computing, Tokyo Institute of Technology)

**Research Theme**  
Fast and cost-effective deep learning algorithm platform for video processing in social infrastructure

**Research Outline**  
We aim to establish a high-performance real-time deep learning algorithm basis for detecting objects and anomalies from a large amount of high definition videos recorded by drive recorders, surveillance cameras, and the like. Computer science researchers specializing in four different levels from architectures to applications including GPU fast computation, parallel computation, machine learning, and data mining, collaborate to realize 1000 times faster processing with 0.1% the amount of memory compared to conventional platforms.

**Seeds**  
We are developing a co-design framework to provide efficient deep learning system architecture, middleware, and applications. One of our target areas is information retrieval from video sources like drive recorders and surveillance cameras.  
We can provide:  
1) High-performance computing resources such as TokyoTech TSUBAME, AIST ABCI.  
http://www.gsic.titech.ac.jp/en/tsubame  
https://abci.ai/  
2) System optimization framework to develop deep learning applications.  
3) Fast and accurate deep learning methods for, primarily, video applications.

**Needs**  
We plan to extend our co-design framework on both ends: hardware and software. We would like to collaborate with researchers/research groups who are working with:  
1) FPGAs, approximate computing, and quantum computing for deep learning; and  
2) Deep learning applications in which the co-design framework is expected to be useful.  
Of course, we also welcome those who study computer system architectures for deep learning and/or deep learning itself.
Research Theme
An Edge Learning Infrastructure Supporting Realtime and All-Data Capabilities

Research Outline
A huge amount of stream data is generated continuously by industries and network services. For automated monitoring and anomaly detection by learning such big data, tendency changes of targets should be reflected to the learned parameters immediately, though deep learning is a time-consuming task. In this project, we will develop an AI infrastructure that can reflect recent data tendency in addition to all the past data to the learned parameters. We will validate our concept through experiments targeting industries and network services.

Seeds
We are working on an online sequential learning and unsupervised anomaly detection (OSL-UAD) algorithm and its related technologies.

The target domain was production lines in factories including forging, welding, cutting, and pressing, but our application is currently expanding, such as anomaly detections in datacenter and UAV.

One of the biggest issues when applying AI to industries is to prepare training data sets for all the possible situations, because noise patterns (e.g., vibration) are fluctuating and status of products/tools varies with time.

Our OSL-UAD learns normal patterns including noises in a placed environment extemporarily to detect unusual ones, so no prior training is needed.

Our core competency:
(1) Ultra light-weight OSL-UAD algorithm (pseudo-inverse of matrices is replaced with reciprocal calculation)
(2) Experience of anomaly detection using OSL-UAD for high-dimensional time-series data
(3) VLSI tech to build environmental sensor chips supporting (1) + (2)

This project started in October 2017.
As of today, (1) and (2) can be provided. (3) is still on-going and collaboration is welcome.

Needs
H. Matsutani and M. Kondo have been working in research fields of computer architecture, VLSI, and distributed systems.

Currently we are working on OSL-UAD by taking advantage of our background and past experience. We are not pure AI/ML researchers.

Expected collaborators (but not limited to):
- Research groups working on anomaly detection for practical problems
- AI/ML researchers interested in computer architecture and embedded systems
- Robotics/mechanical engineering researchers interested in anomaly detection
Taketo Shiode  
(MD, Graduate School of Information Science and Technology, The University of Tokyo)

**Research Outline**

I am an active neurosurgeon specializing in the creation of fusion three dimensional computer graphics based on medical images for use in surgical simulation. Currently I belong to graduate school and conduct research to automatically extract the data of brain and blood vessel model for use in fusion three dimensional computer graphics from head MRI by deep learning. The volume data of the head MRI is handled and the models of the brain and blood vessel obtained by deep learning are used for the preoperative simulation in the actual surgery performed in the Department of Neurosurgery, the University of Tokyo Hospital.

In this workshop, I think that I can make practical proposals to other researchers about what type of AI technology is required in clinical practice from a position involved in clinical practice by an active doctor. And I can contribute to the development of discussion about how technology developed by engineers will be appropriately utilized in medical field.

In addition, I am hoping that there will be chances to exchange opinions with those who are studying AI which handles medical images, especially this time, and have the opportunity to learn technology. As a result, I hope that we will develop into research that leads to the solution of the problems in the medical field, such as early detection of the disease.
Takayuki Kanda
(Professor, Graduate School of Informatics, Kyoto University / Group Leader, Human-Robot Interaction Department, ATR)

**Research Theme**

Human-Robot Interaction for Symbiotic Robots in a Public Space in a City.

**Research Outline**

Since artificial intelligence and robotics technologies have recently grown fast, it is expected that diverse human works will be eventually replaced by artificial intelligence and robots. However, although many works expected to be automated in reality also play the role of bringing safety feelings to our society, the robots today are yet far from providing such safety feelings. They even fail to be morally considered. This project aims to solve this problem by providing moral interaction capability to robots, and realize a symbiotic society between people and robots.

**Seeds**

* HRI (Human-Robot Interaction) techniques
* Robot system (mobile human-like robots with basic navigation modules, sensor network, etc.)
* Field study setting (shopping mall)

**Needs**

* Technologies relevant to intelligent robotics (e.g. localization, people tracking, navigation, and other sensing)
* Technologies relevant to multi-modal interaction (e.g. gesture/posture/activity recognition, sound-signal processing, speech recognition/synthesis, affect-signal processing, synthesis of facial expression, virtual agent)
* Psychology and cognitive science relevant to HRI (Human-Robot Interaction)
Research Theme
A study on skill acquisition mechanism and development of skill transfer systems

Research Outline
This research develops a technology base of skill acquisition/transfer system which copies skills from one person and pastes them to the other. To understand skill acquisition mechanism, we analyse person who have high skills in various fields and abstract an essence of the skills. At the same time, we develop real-time visual/audio/haptic feedback systems of the skills using computer vision/augmented dynamic projection mapping, motion prediction using deep learning, real-time feedback (visual, acoustic, haptic) to athletes or music players, soft-robotic gloves/suits using artificial muscle, augmented reality for sports coaching, augmented reality for rehabilitation, analysis of skills of expert piano players.

Needs
computer vision/deep learning for motion capture/tracking, analysis of skills of sports/music expert using statistic method or machine learning, soft robotics.
Yuji Kawai
(Assistant Professor, Dept. of Adaptive Machine Systems, Graduate School of Engineering, Osaka University)

Research Outline
How biological brain systems induce human intelligence is a big mystery, and understanding of the systems leads to a big potential for application to autonomous intelligent assistants. It is well known that primal deep learning techniques were based on structure of the visual cortex. I am developing brain-inspired computing based on understanding of neural network structure and dynamics of neural activities.

Seeds
I mainly study reservoir computing, which is a kind of recurrent neural networks. I introduced structural characteristics in biological neural networks, e.g., modularity and a small-world property, to reservoir and investigate the relationship among such neural structures, dynamics, and functions. Recently, I proposed embodied spiking neural networks which have an articulator and learn vocalization based on reward signals. This model could efficiently acquire infant-like vocalization and showed several interesting phenomena originated from the spiking neural networks. I believe that such neuromorphic approach will bring us an innovative framework of computation.
In addition, I have developed an explanation method for visualizing classification of deep learning. I am applying it to classification of electroencephalograph signals in expectation of finding of new features in brains of psychiatric disorder, e.g., autism spectrum disorder.

Needs
Our reservoir computing needs more chances of evaluation of the performance. This kind of learner may suitable for multi-task learning, for example, learning for robot control and brain-machine interface. Our explanation method may be also useful in these applications.
Atsushi Nakazawa
(Associate Professor, Graduate School of Informatics, Kyoto University)

Research Theme
Computational and cognitive neuroscientific approaches for understanding the tender care

Research Outline
This project analyzes the skill of the “tender care” and finds the essential elements and models in the care through the computational and cognitive neuroscientific approaches, such as the use of a) wearable and environmental sensing and b) the brain imaging and facial electromyography. On top of these findings, we develop a system that helps learning the tender care skills through quantifying the learners’ behaviors. In the end, we evaluate the effectiveness of the system in actual care scenes.

Seeds
We can provide the know-hows of evaluating the tender-care nursing technique (Humanitude) which is mainly targeting to care for the patient with dementia and to the children of ASD potentially. We can also provide the wearable sensing technique such as first-person vision and tactile sensors for skill-level evaluation.

Needs
We hope to exchange the knowledges regarding 1) the sensing techniques in human communication, interaction and nursing, 2) analysis algorithm of skills, and 3) nursing techniques using informatics. We also want to have collaborative workshops about this topic at somewhere.
Junichi Yamagishi  
(Associate Professor, Digital Content and Media Sciences Research Division, National Institute of Informatics)

**Research Theme**  
VoicePersonae: Speaker identity cloning and protection

**Research Outline**  
Speech is a part of our identities and strongly related to biometrics, speech synthesis, voice transformation, and speech privacy. However, in these fields, research has been conducted individually toward conflicting goals. In this project, we remove the barriers of the fields concerning voice identity, improve the accuracy of speaker characterization modeling technologies, enhance the reliability and robustness of biometric speaker recognition, and further research on new technologies for protection of speech privacy.

**Seeds**  
Our Voice VoicePersonae works on 1) digital voice cloning to mimick someone’s voices, 2) biometrics speaker recognition technology and its countermeasures against spoofing using such the cloned voices, and 3) speaker de-identification. Currently we’re building a large-scale spoofed speech database called “ASVspoof 2019” that includes a lot of paired data of human speech and realistic high-fidelity generated or converted speech for 100 speakers using advanced deep learning techniques such as Wavenet and sequence-to-sequence models. This will be useful for speech biometrics, speech forensics etc. It would be further nicer if we can extend our targeted modality and include both audio and face.

Several months ago an impressive dataset for video forgeries has been released from German (led by Technical University of Munich). The database is called “FaceForensics” and is based on automatic real-time face modification technology called Face2Face approach. This database would become essential for detecting fake videos. At this moment, this kind of databases are being constructed in separated research fields, but, ideally, we should combine our efforts and create a multi-modal database for anti-spoofing and/or forensic research.

Our Voice VoicePersonae can contribute to voice cloning / transformation parts. We can also contribute to image or video forgeries. In fact, papers written by our project members have been used for the purpose of benchmarking in the FaceForensics paper:


Modular Convolutional Neural Network for Discriminating between Computer-Generated Images and Photographic Images  
Hong-Huy Nguyen, Ngoc-Dung Tieu-Thi, Hoang-Quoc Nguyen-Son, Vincent Nozick, Junichi Yamagishi and Isao Echizen  
Proc. ARES 2018, German August 2018

**FaceForensics: A Large-scale Video Dataset for Forgery Detection in Human Faces**  

**Needs**  
NA
Andreas Bulling  
(Professor, Institute for Visualisation and Interactive Systems, University of Stuttgart)

**Research Outline**

I develop data-driven methods as well as ambient and on-body systems to sense, model, and analyse everyday non-verbal human behaviour (e.g. social signals). I specifically focus on gaze and body language as both of these are fundamental for interactions between humans and, as such, also for developing next-generation human-computer interfaces that offer human-like interactive capabilities. I can offer expertise particularly in the areas of computer vision, applied machine learning, gaze estimation/eye tracking, wearable computing/activity and context recognition, as well as multimodal human-computer interaction. I am always interested to learn about new application areas and challenges in everyday user (behaviour) modelling as well as in challenging multimodal datasets that facilitate the development and evaluation of new computational methods.
Research Theme
Engineering Humanoid Robots that Act, Learn, Collaborate and Augment Humans

Research Outline
Humanoid robotics will continue to play a central role in robotics research as well as in understanding intelligence. The talk will introduce our progress towards building integrated 24/7 humanoid robots able to learn from humans and sensorimotor experience, to exploit the interaction with the world and predict the consequences of actions to extend their cognitive horizon. I will argue that a ROBOTICS AI is needed to create robots with human-like abilities and even superhuman performance. Such AI goes beyond the application of machine learning algorithms to datasets and emphasizes the interaction between cognitive abilities and intelligent bodies to generate intelligent behavior.
Research Theme

Knowledge-based robotics: the s*IoT conceptual modelling method for cyber-physical systems

Research Outline

It is augured that intelligent systems will replace human cognitive functions in the digital transformation age. While the concept is not new, scope, scale, and complexity of current innovations call for initiatives to influence the role of humans in the co-creation of society and technology. Thereby, one question is how intelligent systems can augment, supplement, and support human design, knowledge, and planning to provide benefits for society and technology. In particular, knowledge-based robotics (KbR) is the idea to connect machines, robots, and cyber-physical systems (CPSs) with the environment, humans, and economics in the loop, which requires developing innovative artificial intelligence applications. KbR also challenges the traditional notion of conceptual modelling, which is that humans build models of human knowledge and design for human use. While model value can still be gained for human stakeholders through conceptual modelling in the digital transformation age, conceptual modelling is also confronted with the needs and possibilities of intelligent systems. As a consequence, the s*IoT conceptual modelling approach has been proposed. The idea of s*IoT is to connect the traditional notion of conceptual modelling with functional capabilities that can be abstracted from machines, robots, and CPSs. Furthermore, modelling methods and tools have been developed to realize s*IoT. These methods and tools can be used for intelligence augmentation and amplification. To extend research on the specific s*IoT conceptual modelling approach and the more general idea of KbR, functional capabilities that can be abstracted from machines, robots, and CPSs have to be connected to human design, knowledge, and planning. For abstraction, a service oriented architecture is required that realizes low-level properties of machines, robots, and CPSs while fulfilling the role of high-level properties as given by human design, knowledge, and planning. Due to the different partners that such a project requires, a community structure is needed. The motivation for this community structure is to bring together researchers and practitioners in the fields of conceptual modelling, knowledge-based reasoning, agent systems, and so on.

Iván Marsá Maestre  
(Professor, Universidad de Alcalá)

Seeds

Ivan Marsa-Maestre is an Associate Professor at the Department of Computer Engineering, University of Alcalá. He has a network engineering background, and has been working for more than a decade on nonlinear optimization using negotiation techniques, establishing collaborations with top researchers in both fields. He has participated in a number of European and national research projects, and has led three research projects focusing on the use of negotiation and nonlinear optimization techniques for distributed coordination of complex systems, such as computer networks or vehicle management systems. His research group’s interest includes automated negotiation, complex system optimization and cyber security. Therefore, they can bring expertise for providing augmented decision support, specially in negotiation processes, but also in any situation that can be modelled and simulated as a complex network where there are self-interested entities. Finally, they may bring expertise on communication security and efficiency, which may also be critical for augmented intelligence systems.

Needs

* We search for industrial partners which can design and manufacture the hardware devices needed to bring the augmented intelligence vision to fruition. This covers a wide variety of devices, ranging from augmented reality wearables to the fog and cloud infrastructures potentially needed for data reduction and processing.
* We seek for industrial partners in key domains which can benefit from augmented intelligence, such as Intelligent Transportation Systems (ITS) or collective intelligence systems.
Sonja Utz  
(Professor, Leibniz-Institut für Wissensmedien (Knowledge Media Research Center), Universität Tübingen)

Research Outline

I lead the Social Media Lab at IWM Tübingen and my research examines the effects of social media use on a wide range of outcome variables, ranging from emotions, social relationships, stress and well-being to informational benefits in professional contexts. I have for example studied how exposure to social media updates affects envy and well-being or how the regular skimming of social media updates creates ambient awareness, a knowledge of who-knows-what in one’s network, and how this is subsequently related to professional informational benefits. I am especially interested in the question how reliance on digital devices such as smartphones and the permanent connection with the internet and one’s personal network affects people’s cognitive functioning (memory, decision-making, creativity,…), both in positive and negative terms. For example, we often find that people who use social media more frequently report more ambient awareness, informational benefits and social support, but that they at the same time also report more stress or fear-of-missing out/being lost without their smartphone. I am not so much interested in developing augmented intelligence tools, but in studying their effects on people. I can offer sound knowledge on psychological processes. Methodologically, I have a strong focus on quantitative methods: experiments, surveys, longitudinal panel studies.

I would like to extend my work by looking also at big data and other behavioral traces left by users. I also think that it makes more sense to look at how people use the various apps on their smartphones in their daily life instead of focusing on the effects of one specific platform. I need collaborators with expertise in collecting and analyzing smartphone/internet usage data.
Britta Wrede  
(Professor, Uni Bielefeld)

Seeds  
Our research focuses on the analysis of human-robot interactions. As robots are entering our lives in multiple forms the interaction with them becomes more and more important.

One of our goals is therefore to determine models of how interaction protocols are established within the interaction. A further research strand concerns the recognition and modeling of emotions in HRI with one focus on determining disruptions in the interaction flow.

In order to broaden the perspective on evaluation of HRI and to take into account that robots may affect humans’ general concepts about the world, we are now turning towards investigating the effect that HRI has on humans’ behavior outside the concrete interaction situation.

Needs  
In order to address our newly arisen question of impact of HRI on humans’ behavior outside the concrete interaction situation we are looking for (nearly) real-life interactions with a social robot outside the lab.
Elmar Rueckert
(Professor, University of Lubeck)

**Research Theme**
Training spiking neural networks for real robot control applications

**Research Outline**
Robotics is a vastly growing field with enormous potential for autonomous intelligent assistants in everyday tasks. One of the major unsolved challenges however is to compute robust and safe decisions in few milliseconds from a huge stream of uncertain sensory observations.

**Seeds**
In my research, I have developed spiking neural network models for real-time robot control tasks. The neural network can be fully trained through kinesthetic teaching from few minutes of training data and can further self-improve its learned control strategies through reward modulated learning rules. A key feature of the model is the ability to maintain and continuously update multiple action strategies for realtime control to quickly adapt to changing environmental conditions. This rapid adaptation behavior is based on a novel intrinsic motivation learning rule that utilizes individual learning rates for each neuron. The model was tested in motion planning and obstacle avoidance tasks using a lightweight KUKA robot arm.

**Needs**
The model’s potentials need to be further evaluated on different robot platforms with multi-modal sensors. Of particular interest is the integration of high-dimensional visual sensors, event based cameras, torque measurement systems or tactile sensor units. Safety and robustness features should be implemented through exploiting the ‘multiple’ learned control strategies where optimal decisions can be inferred through probabilistic evidence integration. Such risk-aware control extensions can be tested in human robot co-worker scenarios or autonomous driving tasks.
Research Outline

Computer vision has made long strides forward over the past five years. The wide-spread adoption of deep learning has made computer vision tasks that seemed out of reach for a long time tangible, while at the same time computer vision has become one of the driving forces in deep learning research. Strange as it may sound though, the ability to properly exploit textual information available either in the image or about the image to be analysed, is a capacity still missing from many computer vision systems. I was scientifically born and raised within the 50-years old research area of document image analysis, and the “seeds” I can offer to the IAA participants naturally relate on ways textual information can be exploited in computer vision. In parallel, I have an active interest in cognitive science, and in how humans transmit, consume and interact with written information in their environments.

Document image analysis has long strived to create intelligent reading systems, focusing on understanding textual and graphical information presented in image form. Computer vision at large on the other hand, shows an increasing trend towards exploiting multimodal information in various ways. Text is frequently one of the modalities of interest, although rarely this refers to text in image form.

Seeds

The scientific contributions (“seeds”) of my research group lie mainly on deep learning techniques used for scene text understanding and the joint modelling of textual and visual information, covering applications such as word-spotting, self-supervised learning of visual features, cross-modal / multi-modal semantic retrieval of images, and image captioning.

Needs

Expanding my research towards a better Intelligence Augmentation and Amplification I would welcome collaborations in topics (“needs”) such as multimodal learning, human computer interaction (in particular human-document interaction), and natural language processing, as well as the fusion of model-based and function-based machine learning.
Research Theme
On Synergies between HPC and AI

Research Outline
The rising amount of data that needs to be processed in modern systems - from large scale sensor data to feeds from social networks, from simulation results in physical experiments to speech and video data – is providing new analysis challenges. This field, commonly referred to as Big Data, is therefore closely connected to High Performance Computing (HPC), as HPC installations can provide the necessary bandwidth, throughput and compute capabilities to handle this kind of data. They are therefore crucial in turning data into insights, which can then be used to assist in optimization and planning processes.

At the same time, HPC systems themselves have become large data producers as well and provide data feeds on their workloads, power consumption, thermal properties, etc. Gathering, analyzing and feeding this data back to operators is increasingly crucial to achieving efficient operation of such installations, especially as we push HPC systems to new limits.

We are investigating this cycle between HPC systems and data analytics/AI by exploring techniques to use HPC resources to assist in the generation of insights through large scale data analytics, while at the same time using data analytics techniques and AI to optimize and tune HPC systems. In particular, we are interested in scaling analysis techniques and providing the necessary data storage and processing frameworks that can be paired with state-of-the-art learning and analysis algorithms. Further, we are interested in exploring the use of large scale HPC resources, which are mostly centralized, in combination with smaller edge installations as well as cloud based solutions to create seamless data processing and interactive assistance solutions where they are needed.
Research Theme
Data Analytics for Optimizing the Operations of Gas Turbines

Research Outline
Sensor data collection and analysis of large machine installations is becoming increasingly important as a tool to help improve operations and can assist in machine optimization, maintenance and planning of future needs. In the research project „Optimizing gas turbines with the help of Big Data“, which is a collaboration between IfTA GmbH (industry partner) and the Technical University of Munich (university partner) and which is partly funded by the Bayerische Forschungsstiftung, we are investigating such tools and approaches in the area of gas turbines, which form a crucial backbone to the electric grid.

IfTA GmbH has a strong background in monitoring combustion processes in gas turbines and, as one of its core products, delivers the ArgusOMDS monitoring and protection system. This approach, which encompasses both high frequency spectral sensors and an acquisition and on-site analysis system, is installed in almost 500 gas turbines around the world. In the context of the project, we have access to real-world data of gas turbine installations covering around 1000 turbines-days from two turbines and are investigating the use of large scale analytics approaches to improve the analytics capabilities in order to provide interactive assistance for the turbine operators. This includes improvements in the data storage as well as the development of an end-to-end pipeline from data acquisition to data visualization.

Looking forward, we will need an integration of further machine learning approaches into our processing pipeline. In particular, algorithms that deal with anomaly or outlier detection in time series or that can process spectral data are of special interest to us, as are data compression algorithms targeting time series or spectral data. In the long term, we require methods and approaches to efficiently and securely send data to the cloud in order to analyze them there.
Research Theme
Making Invisible Science Visible

Seeds
Learning is known to be a highly individual process affected by learners’ individual previous experience and self-directed action. Especially during laboratory courses in Science, Technology, Engineering and Mathematics (STEM) education, all channels of knowledge construction become relevant: students have to match their theoretical background with experimental hands-on experience, leading to an intensive interaction between theory and experiment.

Realizing augmented reality scenarios with see-through smartglasses allows to display information directly in the user’s field of view and creates a wearable educational technology, providing learners with active access to various kinds of additional information while keeping their hands free. The framework presented here describes the use of augmented reality learning environments in introductory STEM laboratory courses aiming to provide students additional information and real-time feedback while sustaining their autonomy and the authenticity of their action. Based on principles of the Cognitive-affective theory of learning with media (CATLM), we could show that this tool structure students’ hands-on experiences, guides their attention to cue points of knowledge construction and foster conceptual learning.

Our approach offers different kind of learning scenarios/usecases which could be studied by other researchers, too (multicentric studies).

Needs
We need Smartglasses with better usability (lower weight, broader field of view etc.) and more intelligent techniques to understand hands-on AND cognitive learning.
Research Theme
Emotion-based Human-Robot Interaction

Research Outline
Human-machine interaction is a major challenge in the development of complex humanoid robots. In addition to verbal communication, the use of non-verbal cues such as hand, arm and body gestures or mimics can improve the understanding of the intention of the robot. On the other hand, by perceiving such mechanisms of a human in a typical interaction scenario the humanoid robot can adapt its interaction skills in a better way. To function in a complex and unpredictable physical and social environment, humanoid robots, like humans, must have to apply their physical and intellectual resources to realize multiple goals in an intelligent and flexible manner. Two distinct and complementary information processing systems – cognition and emotion enable humans achieving these goals by operating simultaneously. The cognitive system is responsible for interpreting and making sense of the world, whereas the emotion system is responsible for evaluating and judging events to assess their overall value with respect to the human (e.g. positive or negative, desirable or undesirable, hospitable or harmful, etc.). These systems differentiate humans from machines.

The objective of the research is to develop an emotionally intelligent humanoid robot. In order to realize this goal, a multi-level perception system has been developed. It deals with the development of intelligent human-robot interface which is able to use advanced cognitive abilities such as perceiving humans and recognizing hand gestures, body postures, head gestures, mimics, human behavior, identity, etc. Moreover, by using its cognitive abilities, emotion system of a humanoid robot is responsible for high-level interpretation of events such as automatic assessment of human personality, human feedback and prediction of human’s intentions in real time. On the other hand, emotion-based control architecture has been developed which enables a humanoid robot to act/react according to the perceive stimuli from the environment. This architecture takes into account self-motivation, cognitive and emotional abilities of a person and represent it in 3D emotional space called as Arousal-Valence-Stance (AVS) scale. Together with emotion-based control architecture and multi-level perception system, a humanoid robot is enabled to interact naturally and intelligently with a human in human-robot interaction scenario.
Philipp Slusallek  
(Professor, DFKI Saarbrücken)

**Research Theme**  
Understanding the World with AI: Using Synthetic Data to Train and Validate Autonomous Systems

**Seeds**  
Artificial Intelligence (AI) systems that deal with reality need to reliably make accurate decisions even in highly complex and critical situations, in particular when human lives are at stake. However, suitable real training data is often hard to come by, especially for critical situations that hardly ever happen.

Digital Reality is an approach to simultaneously learn models of the real world and use them for the training of AI systems by synthetically generating the needed data via simulations. This approach also allows us to systematically validate AI systems by automatically generating test cases from our models that specifically address critical aspects.

Validation with real data also allows us to continuously identify limitations in the models and adapt them to the dynamic changes in the real world. Here, a specific focus is on open questions in predictive rendering of sensor data, especially for non-optical sensors like radar.

**Needs**
Antonio Krüger
(Professor, Multimodal Interfaces, DFKI)

**Research Theme**
Research on Cognitive Assistants

**Research Outline**
We are interested to develop the basics for multi-modal human-computer interaction and personalized dialogue systems integrating speech, gestures, and facial expressions with physical interaction. In the process, user, task and domain models are used to design dialog patterns that are as natural and robust as possible so as to be understandable, even in group discussions or loud environments. By integrating virtual characters even emotions and socially interactive behavior can be achieved as an output. Chatbots, for example, provide a slim interface to access multimodal dialogue technologies. Our research combines methods from Artificial Intelligence (knowledge representation, machine learning, planning and optimization, user modeling) and Human-Computer-Interaction (empirical user studies, prototyping, art & design methods). Our team of is complemented by team members with a background in cognitive psychology and media, arts & design. We also believe in engineering contributions and thus are building tools for intelligent instrumented environments that we provide as open source to the community.

**Seeds**
expertise in dialogue and user modeling, optimization, virtual characters, and novel interaction concepts for instrumented environments.

**Needs**
we would like to team up with strong expertise in the development of novel hardware sensors, sensor networks, distributed systems and energy efficient computing to develop the next generation of instrumented environments and intelligent user interfaces.
Paul Lukowicz
(Professor, Embedded Intelligence DFKi and TU Kaiserslautern)

Research Outline
The focus of our group is on the interface of the physical and the digital world. The core competence of our group is the design and real world deployment of complex sensor based activity and situation recognition systems and leveraging such systems for intelligent, personalized assistance and services. A need is in the use and analysis of online, multimedia information as a complement of real time sensor data. Currently my group is going from a focus on the individual to group activities and cooperation.
Seeds

We are realizing a context-focused work environment utilizing a combination of a personal, group and
corporate memory (CoMem, a semantic knowledge graph) integrated in the user’s work environment
and office tools. CoMem consists of an ecosystem of applications, connectors (to calendar, address
book, file system, etc.), APIs (e.g., to connect to Wacom’s digital pens) and plug-ins/-out (in browsers,
e-mail tools, as desktop sidebar).

Ultimately, we envision an **Information Butler** anticipating a user’s needs and supporting in
knowledge work by acquiring, combining, distributing knowledge, supporting process steps, proactively
providing information.

We do projects in research as well as industry contexts.

CoMem allows us to provide leveraging document collections and data sources into semantic
graphs, rich evidences for context generation and identification. Using context and knowledge graphs
to derive information need and proactively provide information, context-specific knowledge acquisition,
etc. We do research in mental models, digital forgetting (incl. inhibition, cognitive offloading), semantic
writing, semantic bridges to leverage data sources to semantic graphs.

https://comem.opendfki.de

Needs

Interest in cooperation along the leveraging pipeline from sensors/data to semantic graphs & back from
semantic graphs to the user.

Interest in scenarios such as

- mobile devices for mobile work (e.g., pen & paper/tablet), using semantic graph for
  augmenting the physical world

- office environment with office devices (MFP, interactive whiteboards, meeting support, sensors,
  …) potential cooperation with the Living Lab smart office space (Kaiserslautern)

- education / class room scenarios potential cooperation with the iQL (Immersive Quantified
  Learning Lab) (Kaiserslautern)
Research Theme

The research topics include:

- Learning Computer Vision Systems: Methods of Deep-Learning are combined with 3-D geometry and optimization approaches in order to create advanced vision systems applied to application areas, such as autonomous driving, robotics, intelligent manufacturing and new media.
- Cognitive Augmented Reality: Augmented Reality (AR) systems move from traditional applications (AR manual or revitalization of ruins) to new solutions that have an understanding of the user’s actions, interactions and intentions as well as the given context in order to provide adaptively specific and thus useful supporting information.
- AI-based Body Sensor Networks: The inference of biomechanically based models allow the identification of high quality parameters that are of high relevance for areas such as health (rehabilitation, intelligent orthosis systems) or industrie 4.0 (ergonomic and workflow analysis).

Seeds

- Technologies for Human Monitoring such as visual body tracking (3D kinematics), hand tracking, head tracking inertial-based body tracking, hand tracking, head tracking
- Scene understanding using mainly computer vision (2D and 3D computer vision expertise, e.g. scene analysis, optical flow, scene flow, …)
- Augmented reality system (6 DoF, object tracking, SLAM (in progress))
- Machine Learning, Sensor fusion

Needs

- Human models and possible sensor modalities for capturing those parameters
- Computer vision for IR, heat, multi-spectral cameras
- Work/Activities flow modeling and description (parametrized and to be used to recognition)
- New sensors for capturing and understanding human “states”
Alexander Waibel  
(Professor, Carnegie Mellon University, USA, Karlsruhe Institute of Technology, Germany)

Seeds
The International Center for Advanced Communication Technologies has worked for 3 decades in cooperation with international partners (4 of them in Japan). We have always believed that AI should be in the service of people and its best application is in symbiotic support, assistance, augmentation of humans. Our specific area of research focuses on learning technologies that support all aspects of communication to improve human-machine, human-human, machine-mediated human communication. Specially Neural Nets have been a particular focus of our research since 1986. We developed the "Time-Delay Neural Network" (Waibel et al.), now a.k.a. "Convolutional Neural Network" during scientific exchange at ATR in Japan; it is now at the heart of modern AI systems. TDNN extensions, early RNNs, many derivative neural models were developed since 1991 at our labs at KIT and CMU. Based on such basic research in ML, we deployed first IAA human-machine interaction & communication systems, including:

- Multimodal perceptual input processing (text, speech, images, video, handwriting, images, tactile, body tracking, focus of attention, emotion,...)
- Audio-visual speech (Lipreading)
- Emotion recognition for Dialog Systems and Robots
- Implicit Assistance (CHIL - Computers in the Human Interaction Loop)
- Cross-Lingual Augmentation Systems
- Interpreting Smartphones for tourists, healthcare and relief workers
- Communicators on tablets in Humanitarian and Government Missions
- Road sign interpreters that translate road signs while traveling abroad
- Multimodal interpretation of meta-communication (emotion, gaze..)
- Multilingual subtitling and translation of TV broadcasts/media-content
- Automatic Interpretation of lectures for foreign students
- Symbiotic human & machine interpreters at the European Parliament
- Translation of silent speech

Needs

- Adequate/Pooled Resources for Labs vs Internet Companies:
  - Data, Computing, Funding Support
- Personnel and Training
- Integrating Platforms (Robots, Smart Rooms, Transportation,)
- Fast Transfer Methods (Appstores, Advertising)

Biography
Dr. Alexander Waibel is Professor of Computer Science at Carnegie Mellon University (USA) and at the Karlsruhe Institute of Technology (Germany). He is director of the International Center for Advanced Communication Technologies. Waibel is internationally known for his work on AI, Machine Learning, Multimodal Interfaces and Speech Translation Systems. Among them, he developed the TDNN, (first "Convolutional" Neural Network), early RNN’s and Transfer Learning
approaches. Augmentation System innovations included multimodal interaction and first speech & language translation and simultaneous interpreting systems. Waibel founded more than 10 successful technology companies and supported numerous humanitarian missions with IAA systems.

Waibel is a member of the National Academy of Sciences of Germany and a Fellow of the IEEE. He published extensively (h-index >80) and holds many patents. Waibel received BS, MS and PhD degrees from MIT and CMU, respectively.
Michael Beigl
(Professor, Chair of Pervasive Computing Systems, KIT, Karlsruhe)

Seeds
- Research in Augmented Human, especially tactile and haptic interfaces
- Research in understandable and explainable AI approach
- Research in Co-intelligence of human and AI system
- Smart Data Innovation Lab (SDIL) and Smart Data Solution Center (SDSC) as a basic component and research platform for data, algorithms, tools and technological installations for handling huge data sets and data streams for AI research

Needs
- Cooperation in building tools and systems for IAA
- Cooperation in data exchange and cooperative data recording as input for IAA
- Cooperation to run experiments cross-organisation and cross-country
- Cross-country projects (and project money) for cross-cultural projects in intelligent augmentation
Seeds

Our research revokes around the question of “How to analyze, design and optimize the symbiotic interaction of machines, humans, as well as autonomous agents or robots in context of knowledgeintense processes”. While simulation is a gold standard for designing, optimizing, and managing conventional logistics systems, simulating knowledge-intensive processes additionally requires modelling cognitive as well as social aspects. Our mission is therefore, to contribute in the emerging research field of “cognitive social simulation” by integration of intelligent agents, cognitive modelling, multiagent systems, machine learning, simulation, agent-based modelling, and social simulation. We specialize in a) distributed artificial intelligence, i.e., communication and coordination of autonomous and self-organizing systems, distributed planning and configuration, intelligent software agents, cognitive modelling, distributed knowledge dynamics (learning and forgetting), and b) (agent-based social) simulation, i.e., simulation-based test and verification of autonomous software systems, knowledge-based calibration, validation, and parametrization, automation and methodology of simulation. We apply these technologies in various domains, such as production and logistics, online social media, health care, mobility, environmental governance, and paleoanthropology.

Needs

In current research, our main application domain is health care with focus on elderly care. Here, we see high potential for augmenting and amplifying humans by intelligent processes and IoT devices. We are looking for researchers working on augmenting or amplifying humans in health care. Together we would like to model the technological innovation by means of cognitive social simulations to identify effects of patient bias, e.g., technology aversion, missing motivation, dementia. Doing so, we aim at developing or optimizing regulative and incentive systems. Additionally, we offer (cognitive social) simulation as a data generation method for the design, development, and testing of such technologies. Nevertheless, we are always on the search for experimenting with cognitive social simulation in new domains and applications.
Ralph Bergmann
(Professor, Department of Business Information Systems II, Uni Trier)

Seeds
The main focus of my research group is on experience-based problem solving and decision making by combining and advancing methods from case-based reasoning, analogy, machine learning, and semantic technologies. We aim at developing intelligent information systems that augment human intelligence by proposing solutions to complex problems by reuse and combination of experiential knowledge gained from various sources. In particular, we have strong expertise in applying experience-based problem solving for the synthesis, flexible execution, and monitoring of workflows and processes of different kinds. We developed new methods for workflow synthesis based on reuse of best-practice workflows which are automatically or interactively adapted to specific, individual requests of a user, based on automatically learned adaptation knowledge. Further, we work on the flexible execution of workflows using constraint-based methods in order to allow the controlled deviation in case of unexpected events. We integrate the developed methods in a software framework (called CAKE) and demonstrate it in various domains, including cooking recipes, scientific workflows, as well as construction and deficiency management.

Needs
In future work, we aim to extend and embed our work for the synthesis, execution, and monitoring of processes within cyber-physical social systems (CPSS), i.e., environments in which IoT actuators and sensors, human agents, as well as intelligent services are integrated to implement complex and highly dynamic processes (e.g. industry 4.0 production, medicine and care, agriculture). Major challenges involve the capturing and semantification of complex process execution experience in CPSS environments based on various sensor data. In particular, capturing and interpreting the activities of humans (e.g. using cameras) would be required. Further challenges include the controlled execution of workflows in an environment combining human and machine agents. Thus we need partners with experience in the field of IoT and cyber-physical (social) systems, human computer interaction, as well as activity recognition from images.