Annual Report for Academic Year 2012 – 2013

Informatik 5
Information Systems

Staff

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  - Prof. Dr. rer. nat. Thomas Berlage
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- **Research Associates and Assistants**

  - Muzzamil Aziz
  - Markus Christian Beutel (since 01.06.2013)
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  - Dr. Michael Derntl
  - Dr. Olga Domanova
  - Dr. Vito Evola
  - Sebastian Franken (until 30.9.2013)
  - Sandra Geisler
  - Sevket Gökay (since 01.07.2013)
  - Anna Hannemann
  - Paul Heiniz (until 30.4.2013)
  - Nils Jeners (until 30.9.2013)
  - Fisnik Kastrati (until 31.12.2012)
  - PD Dr. Ralf Klamma
  - István Koren
  - Dejan Kovachev
  - Dr. Milos Kravcik
  - Dr. Karl-Heinz Krempels
  - Dr. Xiang Li (until 5.4.2013)
  - Petru Nicolaescu
  - Dr. Cuong Manh Pham (until 31.5.2013)
  - Zinayida Petrushyna (Kensche)
  - Dr. Khaled Rashed (until 30.4.2013)
  - Dr. Jürgen Rapp
  - Dominik Renzel
Christian Samsel
Christoph Terwelp

• **Technical Staff**
  Tatiana Liberzon
  Reinhard Linde
  Alexander von Wirth (Auszubildender)
  Thomas Paffen (Auszubildender)

• **Student Researchers and Teaching Assistants**

• **Visiting Scientists and Lecturers**
  PD Dr. Christoph Quix
  Chief Social Scientist Marc Smith, Ph.D.
  Dr. Katrien Verbert
  Dipl.-Ing. Eleni Gadolou
  Dipl.-Ing. Georgios Toubekis
  Vladimir Tomberg

• **Cooperation Partners:**
Overview

Today, the field of Information Systems does not include only structured databases, but at least equally important the semi-structured and unstructured data on the web. The Chair of Information Systems addresses both domains, with the management of metadata (data about data) in the kernel of its research interest. Current major themes include mobile web services and metadata model management, but also applications such as personal mobility, metadata life science informatics, and lifelong technology-enhanced learning.

Third-party funding totalling over 3 m€ annually stems from national and European sources. In 2012-2013, the European Integrating Project ROLE on technology-enhanced learning was successfully completed, and the new IP LAYERS was started together with several smaller projects in the field, including the METIS and BOOST projects. In the personal mobility domain, our BMWi lighthouse project eConnect has been complemented by the new BMWi project Mobility Broker, again in interdisciplinary cooperation with other RWTH chairs. Informatik 5 also remained a significant contributor to the RWTH 2020 Excellence Initiative program, as deputy coordinator of the UMIC Excellence Cluster, as co-founder of the SignGes research center within the “Place-to-be” subprogram, and as project participant of the NeuroPierce and Urban Future projects within the HumTec collaboration.

In the Internationalization strategy of RWTH Aachen, the chair continued to run the highly successful international master programs of the B-IT Foundation, and the NRW-funded B-IT Research School. Prof. Jarke concluded his 5-year term as Inaugural Dean of Engineering and IT at the GUtech German University of Technology in Muscat, Oman, but remains connected to it as an Adjunct Professor.

Informatik 5 organized the international Multiconference WEBIST, CLOSER, and SMARTGREENS with over 300 participants in Aachen, in the roles of General and Programs chairs (Dr. Krempels, Prof. Jarke). Members of the Chair also took leading roles as General Chair of the 2013 European Conference on Technology-Enhanced Learning (PD Dr. Klamma), as Program Co-Chair of the international Conference Communities and Technologies (Prof. Prinz), and in a number of other workshops and summer schools. Other important scientific service appointments include the membership of Prof. Jarke as German representative in the CONNECT Advisory Forum (CAF), the top advisory group of the European Commission for ICT research in its programme HORIZON 2020. Prof. Jarke was also elected as a regular member of the acatech National Academy of Sciences and Engineering. We also congratulate Nikou Günemann, Istvan Koren, and Dominik Renzel for competitive best paper and demo awards at BTW 2013. FOKUS Mobile Web Symposium, and the IEEE International Conference on Requirements Engineering.

With three new members (Markus Beutel, Istvan Koren, and Sevket Gökay), the Informatik 5 team retained his strong internationality, though the mix has shifted from its earlier Chinese and Indian domination towards a stronger representation from Eastern and Southeastern Europe. Dr. Christoph Quix was awarded his habilitation degree in summer of 2013, and is now Senior Researcher at Fraunhofer FIT. Xiang Li who had defended his dissertation with distinction in late 2012, joined Google Research Munich in April 2013, and four more dissertations were successfully defended in 2013 by FIT researcher Christian Prause, and by Informatik 5 researchers and B-IT Research School participants Manh Cuong Pham, Khaled Rashed, and Olga Domanova.
Research Projects

Mobile Community Information Systems Research

M2M (Mobile-to-Mobile) Service Networks for future cellular systems

M. Jarke, A. C. Muzzamil
B-IT Research School

Multimedia applications are bandwidth-hungry applications whereas mobile networks are bandwidth-constrained networks. Thus, enabling high Quality of Service (QoS) multimedia services over mobile networks is not straightforward. Additionally, IP addressability of subscriber devices is a fundamental issue in Mobile-to-Mobile (M2M) service networks. The dissertation project investigates a fundamental platform for M2M service networks, where each subscriber device serves high quality multimedia services to other devices on the network with guaranteed QoS. The proposed mobile platform is envisaged to host future M2M services for the future IP networks, such as the IP Multimedia Subsystem (IMS). In 2013, the mobile platform has been extensively tested with the Ericsson IMS and Fraunhofer OpenIMS testbeds. A comprehensive QoS framework has been introduced which has the ability to reserve available network resources for a particular service session in the LTE-Evolved Packet Systems (EPS) and ensure guaranteed quality.

eConnect Germany – Stadtwerke machen mobil

K.-H. Krempe1s, C. Terwelp, P. Heinz, C. Samsel
BMWi Lighthouse Project “ICT for eMobility”

In eConnect, the BMWi lighthouse project in the field of ICT for electromobility, seven regional utilities together with software houses and researchers are developing applications for sustainable personal mobility based on electric energy. The objectives of the project include smart grids for renewable energy, mobility concepts for urban areas, smart parking for
vehicle to grid scenarios, information systems for public transportations, and finally, smart charging for electric vehicles. Informatik 5 coordinates the project activities of the seven participating institutes of RWTH Aachen University. In four workshops with academic and industrial participants, we focused on knowledge acquisition, requirements engineering, and conceptual modelling for mobility concepts in urban and rural areas. For a new mobility concept of the City of Osnabrück, the current public transport situation was analysed and the city master plan was consulted to detect actual conceptual drawbacks and system operation bottlenecks. Near and medium term objectives for urban mobility were defined to improve the public transport infrastructure and mobility efficiency supported by electric vehicles.

The new mobility concept for the City of Osnabrück requires a higher integration of mobile transport systems, e.g. trains, busses, shared e-bikes, shared e-cars, and redesigned mobility points, e.g. integrated bus, e-bike and e-car station, while reducing the usage complexity of this new public transportation system. Representative mobility scenarios were used for use case deduction, requirements analysis for planning and navigation in the new system, and finally, the technical specification of an intuitive smartphone application supporting the user in pre- and on-trip planning and navigation.

### MobilityBroker – Flexible Intermodal Mobility

*K.-H. Krempels, C. Terwelp, C. Samsel, S. Gökay, M. C. Beutel*

**BMWi Collaborative Project**

Aim of the new BMWi project MobilityBroker, started in October 2013, is the first-time combination of all mobility services in a region on a single virtual marketplace. Travellers will be automatically presented with multimodal travel chains combining different mobility services (Bus, Train, Carsharing, Bikesharing, Cab etc) based on their personal preferences. As an interface to this marketplace both a mobile and a web platform will be developed.

### UFO: Urban Future Mobility

*K.-H. Krempels, M.C. Beutel, M. Ziefle (Communication Science), C. Schröder (Linguistics)*

**HumTec Program within RWTH Excellence Concept „RWTH 2020“**

UFO is an interdisciplinary research project on quality of life in city quarters in the context of mobility, city structure and Energiewende. It consists of three subprojects: FuMob (Future Mobility), FuEco (Future Ecosystem) and FuEne (Future Energy). Informatik 5 participates in FuMob and FuEne. FuMob addresses requirements, capabilities and limitations of public communication and information when planning and implementing new mobility concepts. New approaches for planning and realizing infrastructure decision-making will be developed with systematic stakeholder involvement (citizens, decision makers, experts, etc.) in a sustained manner. The tasks of Informatik 5 comprise requirements engineering, analysis of perspectives with relation to mobility chain and designspace, selection of suitable prototypical mobility scenarios and a user-centered, adequate communication and information concept.

FuENE focuses on roadmapping sustainable and environmentally suitable energy turnaround. A comprehensive model and methodology for the realization of sustainable resilient energy systems will systematically integrate social factors (customer perception of energy systems) into the technical, economical and informational process of identification, planning and realization of energy scenarios. Informatik 5 will develop of parameters, strategies and solution spaces along with analysis and modeling of future scenarios.
Virtual Campfire aims to provide professional communities such as researchers’ communities for cultural heritage management an advanced framework to create, search, and share multimedia artifacts with context awareness easily and fast. Virtual Campfire has established a research framework for mobile multimedia management with metadata standards and hybrid tagging approaches, cloud computing for mobile multimedia processing and mobile communities, convergence research on mobile and Web 2.0, social network analysis for mobile communities, and prototyping and engineering of complex community information systems.

On the system level, the scalability and flexibility of our cloud framework for fostering cross-domain mobile multimedia services were demonstrated with approaches to seamless mobile device augmentation with cloud resources (DireWolf framework), cloud-based video processing and enhancement of user experience with mobile video streams.

On the mobile multimedia level, advanced collaborative multimedia applications utilize multimedia metadata standards and real-time communication protocols. Mobile cloud computing strategies at the convergence of Web and mobile endpoints have been applied, and advanced 3D laser scanners and gigapixel image equipment was integrated within professional workflows powered with i5Cloud services.

On the user/community level: validation of the research is conducted in different application domains e.g. in technology enhanced learning, mobile community recommender systems, and distributed user interfaces over a federation of multiple mobile personal computing devices.
applications, data, and heterogeneous platforms, enabling users to plug-in at anytime from anywhere and utilizes storage and computing services as needed at the moment. The goal of our mobile multimedia cloud (i5Cloud) is to provide infrastructure as a service (IaaS) and platform as a service (PaaS) for diverse services and applications in the domain of (mobile) multimedia and large-scale social network analysis. The dissertation project by Dejan Kovachev investigates possibilities to augment the capabilities of weak mobile devices and develop middleware that can seamlessly offload the computing and storage of mobile applications into the cloud.

**Community-centered Semantics for the Detection of Faked Multimedia**

M. Jarke, R. Klamma, K.A.N. Rashed

B-IT Research School

The 2013 dissertation by Khaled Rashed investigated the possibility of combining the power of Web 2.0 techniques and community approaches with capabilities of content-based similarity search and retrieval with the to facilitate fake multimedia detection by means of providing semantics for faked multimedia search and retrieval. To realize these objectives, a study of the social aspect by means of trust built-up over time is coupled to concepts such as incentives engineering and collective intelligence to facilitate fake detection. Gaming with a purpose is used to overcome the cold-start problem. A trust-aware media quality profile is proposed to provide helpful metadata for classifying the media. The combination of content based multimedia and social interaction (trust, rates, and multimedia reputation) can be used as service to provide metadata able to infer semantics of multimedia in term of forgery.
Research in Technology-Enhanced Learning

**EU Integrating Project ROLE: Responsive Open Learning Environments**


EU 7th Framework Programme Large-Scale Integrating Project

ROLE aimed at delivering and testing prototypes of highly responsive personal learning environments, offering breakthrough levels of effectiveness, flexibility, user-control and mass-individualization, thereby advancing the state-of-the-art in human resource management, self-regulated and social learning, psycho-pedagogical theories of adaptive education and educational psychology, service composition and orchestration, and finally the use of ICT in lifelong learning. ROLE permits individualization of the components, tools, and functionalities of widget-based learning environments and their adjustment or replacement by existing Web-based software tools. Learning environment elements can be combined to generate (or mash-up) new components and functionalities, which can be adapted by collaborating learners to meet their needs and to enhance the effectiveness of their learning. Informatik 5 was project vice-coordinator, technical leader and community facilitator.

We coordinated development, hosted an Open Source development infrastructure, released ten versions of the ROLE Software Development Kit and hosted the ROLE Sandbox¹. The ROLE Sandbox received 1.72 Mio API requests from >3900 users in 87 countries indicating the use by both individuals and institutions. Usage concentrates on European countries, but also includes bigger institutions in China and the US.

Furthermore, we elaborated the idea of Social Requirements Engineering in our Requirements Bazaar², which received the prestigious Best Demo Audience Award at the 21st IEEE International Conference on Requirements Engineering (RE’13). The photo shows our demo stand after colored sticker-based audience voting.

Our results on XMPP-based real-time communication and collaboration in widget-based Web applications were advertised and contributed to several well-known Open Source projects and standardization bodies (strophe.js, Apache Rave, XMPP). Our student worker Andreas Guth was elected official maintainer of the strophe.js project.

Dissemination activities included co-organization of the PALE workshop at the UMAP conference, focusing on personalization approaches in learning environments. We have also co-authored two journal submissions that summarize our main achievements in ROLE.

The ROLE project was successfully completed in January 2013. However, many of its results serve as sound foundation for work in follow-up projects. Research and development of Requirements Bazaar and DireWolf is actively continued in the Learning Layers project. Learning Layers completely adopts the Open Source development infrastructure of ROLE. The ROLE Sandbox will continue to be hosted at our chair.

¹ [http://role-sandbox.eu](http://role-sandbox.eu)
² [http://requirements-bazaar.org](http://requirements-bazaar.org)
GaLA: Games and Learning Alliance
M. Jarke, R. Klamma, M. Derntl, M. Kravečik, A. Hannemann
EU 7th Framework Programme Network of Excellence

GaLA gathers the cutting-edge European universities, research centers, developer and education industries from 14 countries on Serious Games. GALA aims to shape the scientific community and build a European Virtual Research Centre aimed at gathering, integrating, harmonizing and coordinating research on SGs and disseminating knowledge, best practices and tools as a reference point at an international level. The other goals of the project are: the support of deployment in the actual educational and training settings; the fostering of innovation and knowledge transfer through research-business dialogue; the development of high-quality didactics on SG by promoting and supporting courses at Master and PhD level.

During the third project year, we took on several important roles in the network. We moderated the creation of the “narrative in serious games” module in GALA’s reference MSc programme framework, organized a workshop at the 1st GALA Summer School on Serious Games in Graz, Austria, and made “Serious Games and Gamification” the main theme of our High-tech Entrepreneurship and New Media lab course for computer science master students. In 2013 the first GALA conference was held in Paris with a presentation about one of the projects in our lab course. In a follow-up Tempus IV project bid we will support several Middle East universities in setting up serious games labs and pathways in their IT curricula.

TEL-Map: Future gazing Technology Enhanced Learning - The Roadmap for the unknown Learning Landscape
M. Jarke, R. Klamma, M. Derntl, M. Kravečik, P. Nicolaescu, R. Uppal
EU 7th Framework Programme Coordination and Support Action

TEL-MAP –completed in March 2013 -- focused on roadmapping and uptake support for fundamentally new forms of learning, via ‘awareness building and knowledge management on the results of EU RTD projects in TEL’ and ‘socio-economic evaluations in education and for SMEs’. We gather information on the current, desired and emerging position of TEL, and on awareness and appropriation (by educators and SMEs) of RTD results in TEL. We codify that information using state-of-the-art knowledge management methods, at three levels of scale: 1) macro (political, economic, social, technological, legal, and environmental), 2) meso (organisation of education and training systems and institutions), and 3) micro (enacted paradigms of learning and teaching). Cutting across these levels of scale is the categorisation of changes as exogenous or endogenous relative to forms of learning and to the TEL community. This provides direct input to TEL-relevant decisions at all three levels, including economic, political, and research discussions.

A high-profile final event on “European Forum on Learning Futures and Innovation” at the Committee of the Regions in Brussels was attended by dozens of TEL project managers, policy makers, and EU representatives to disseminate and discuss the TEL-Map roadmaps, and to think about future avenues in TEL to secure continued public funding. The Informatik 5 MediaBase and several related tools—e.g. the visual topic analytics tool D-VITA (see screenshot below), for which i5 student N. Gholizadeh received the best student paper award at BTW 2013—played a major role in the data mining and analysis activities for roadmapping in the project. The chair will continue to host and maintain the Learning Frontiers portal at http://learningfrontiers.eu
Learning Layers: Scaling up Technologies for Informal Learning in SME Clusters


EU 7th Framework Program Large-Scale Integrating Project

Learning Layers develops a set of modular and flexible technological layers for supporting workplace practices that unlock peer production and scaffold learning in networks of SMEs, thereby bridging the gap between scaling and adaptation to personal needs. By building on recent advances in contextualised learning, these layers provide a meaningful learning context when people interact with people, digital and physical artefacts for faster and more effective informal learning. Learning Layers are based on a common light-weight, distributed infrastructure that allows for fast and flexible deployment in highly distributed and dynamic settings. Collaboration with two representative large-scale regional SME clusters in the Healthcare and Construction industries allows us to involve end-users in system co-design and later scale up the approach to more than 1,000 learners within 4 years. The project will boost the ability of regional innovation systems to adapt to change and thereby remain competitive, on the individual, organisational and regional level.

The project started in November 2012. Informatik 5 leads the Architecture and Integration work package with the goal to coordinate and synchronise technology development tasks. The main
technical objective is to conceive, develop and maintain a distributed, federated architecture for fast and flexible deployment of network communication infrastructure and storage/editing of user-generated multimedia content. Other tasks include the development of layers for digitally enhanced physical artefacts, mobile devices and multimedia and for social semantic networks. Furthermore, we contribute implementations of quality function deployment for choosing the best scalable architecture with respect to project goals. With the help of a technology survey, we identified suitable technologies for the global project infrastructure, including a selection of our prototypes (e.g. i5Cloud, SeViAnno, ROLE SDK).

Together with our partners, we organized the first Layers Developer Camp in September 2013, with 25 RWTH computer science students attending tutorials on Layers technologies contributions to the Layers Open Source repository in a Challenge contest.

**METIS: Meeting Teachers’ Co-Design Needs by Means of Integrated Learning Environments**

M. Jarke, R. Klamma, M. Derntl, R. Uppal
EU Lifelong Learning Programme ICT-KA3 Multilateral Project

METIS brings together partners from higher-education, vocational training, and adult education, with expertise in learning design research. The project goal is threefold:

1. Provide an Integrated Learning Design Environment (ILDE) based on existing free and open source solutions, including authoring tools; co-design support for teacher communities; and deployment of learning designs on mainstream VLEs;

2. Run a series of workshops for teachers using ILDE to train teachers in learning design and the orchestration of ICT-based learning environments according to innovative pedagogies;

3. Disseminate the project's outcomes in the form of workshops for learning design training, and to promote the creation and maintenance of a teacher community.

Our main tasks of in the METIS project focus on the specification and development of the Integrated Learning Design Environment (ILDE), as well as the adaptation of the open-source IMS Learning Design authoring tool OpenGLM to interoperate with ILDE. Additionally, technologies from the earlier ROLE project were adopted to develop the first web-based, collaborative real-time authoring tool for IMS Learning Design (see screenshot below), which was received very well by the METIS community and beyond.

**BOOST (Business PerfOrmance improvement through individual employee Skills Training)**

M. Jarke, R. Klamma, M. Kravcik, M. Derntl
EU Life Long Learning Program Leonardo Da Vinci

The ROLE results will be further developed in a new project called **BOOST (Business PerfOrmance improvement through individual employee Skills Training)**, which is part of the Lifelong Learning Programme. Four companies from different European countries and us plan to integrate a tool for identifying and learning critical business needs with the ROLE approach in order to support vocational education and training in micro enterprises (up to 20 employees). The project started in October 2013 and will run for two years.
The EU Life Long Learning Project TeLLNet supports the development of European Schoolnet (www.etwinning.net) in cooperation with the European Schoolnet, Open University the Netherlands, and Institute for Prospective Technological Studies (IPTS) as one of European Commission Joint Research Centers. Social Network Analysis (SNA) applies graph theories, network analysis methodologies and approaches on social networks to analyze patterns of human communication, cooperation, and other kinds of interaction taking place in business, organizations and the World Wide Web. SNA provides a useful approach to identifying social capital and social structure. This research work is based on both theoretical research and practices.

In 2013, we have successfully finished the project with the public launch of the TeLLNet book in a ceremony at the Media and Learning Conference in Brussels, Belgium (http://service.eun.org/teachers-newsletter/TellNet_Teacher_Networks_web.pdf). The book is targeting at teachers and schools. It deals with the evolving role of the teaching profession and the role of teacher networks in response to changing skills needs in society. It argues that teachers can be the main change agents for reforms of education, provided that they are well supported and enabled to do so. Recently, various teacher networks have emerged at the local and international scale (see the European teacher project collaboration network illustration), and questions around their role in supporting teachers, both in their Initial Teacher Training (ITT) and Continuous Professional Development (CPD), have been raised.

The dissertation project by Zinayiada Petrushyna aims to monitor learning communities on the Web and store their digital traces in the MediaBase warehouse. Multiple learning community dimensions enrich the warehouse with information about types of communities, their patterns, patterns of community users, user competences, and user and community profiles based on user activities. Intelligent analysis of learning communities can be used for refining community cooperation and learning processes. Moreover, communities can be represented in the form of goal-oriented, agent-based models where the focus lies on goals of agents and their roles. These models serve as a starting point for multi-agent simulations of learning communities. The purpose of the simulations is to find the possible developments of learning communities.
2013 marked the 100th anniversary of the arrival of the original bust of Nefertiti (Nofretete) in the Egypt Collection of the Neues Museum Berlin. The broad interest of academic research in this field in the beginning of the 20th century led to the creation of physical gypsum copies of the bust within the museum’s craft workshop, which were sent to institutions across the world. Back in 1924, the Faculty of Architecture of RWTH Aachen University acquired one of the first gypsum copies produced in 1914. The copy is considered to be one of the first copies ever made of the original. According to general belief, the copy was produced without touching the original bust by an artist genuine creative (copying) work.

The project task was to analyze the accuracy of the Aachen copy. For this purpose the copy was measured with a miniaturized projection technique (MPT) also referred to as “white light scanner”. The physical gypsum copy was thus completely digitized and high-resolution 3D data of the object were efficiently generated.

The 3D representation of the Aachen copy was compared with the digital 3D model of the original Nefertiti bust. The comparison revealed deviation of less than 2mm in delicate features and clearly identifiable linear marks on the surface of the copy. These measurements clearly indicate that for the production of the Aachen copy, a moulding cast was used derived directly from the original bust, contrary to long assumed belief (that it has been modelled by the hand of an artist).

The digital reproduction of the physical copy of the Aachen Nefertiti is nowadays in use again for various practical exercises in the field of computer science at RWTH Aachen University. A tool for collaborative near real-time annotation of 3D objects was developed by apprentices of a Software Engineering lecture at the Chair for Informatik 5, for usage among the experts from different fields (art history, museology, architecture, computer science). The project explored the benefits of near real-time collaboration (e.g. shared editing) for annotating 3D objects in a Web browser for reaching consensus and identifying object particularities. Furthermore, in second project, a high-resolution textured variant of the 3D model was generated making use of few colour images of the physical copy as part of a master thesis exploring semi-automatic texture synthesis methods for the representation of complex facial expressions. The digital copy served in this context as a study object of a real world phenomenon for the various experts involved in the research.
Life Science Informatics and Cooperation Systems

SEKT - Spezifische Detektion von einzelnen Keimen in Rein- und Trinkwasser

T. Berlage, J. Bornemeier

BMBF Collaborative Project

The goal of the BMBF project is to detect bacteria in drinking water by filtering the water and microscopically analyzing the filter surface for a small number of bacteria. The work of Informatik 5 is focused on image analysis, the recognition and discrimination of bacteria, which are labeled with fluorescent antibodies or in-situ hybridization. We have established criteria for the specificity of the assays being developed and collected test sets for different settings and different bacteria, in particular E.Coli and Legionellae.

We have developed a strategy for identifying bacteria and for separating their signal from a variety of artefacts, both technical and biological. The strategy is based on multiple steps, from region classification, segmentation to object classification. The classification uses intensity, texture, and shape information.

Toponomics in Cholestatic Liver Diseases

T. Berlage, O. Domanova

DFG Clinical Research Group 217

Transporter protein topology influences numerous cellular processes. As a part of the DFG-funded Clinical Research Group 217 "Hepatobiliary Transport and Liver Diseases (Speaker: Prof. Dr. D. Häussinger, University Düsseldorf), a workflow for an automatic data analysis was developed. In the first phase of the project, an innovative general approach was developed and evaluated. This approach does not need structural recognition of the membranes, which often is a specialized image analysis procedure. Instead, probabilistic sampling of the toponomic area combined with an improved selection strategy applies to a broader range of structures. The new approach was validated to be substantially equivalent to the previous, more specific methods. The research led to a Ph.D. thesis by Olga Domanova defended in October 2013.

In parallel, an approach to statistically evaluate protein colocalization was developed. Furthermore, a first approach was developed to automatically distinguish regions within a large sample based on an organ-scale model.

Virtual Microscopy in Geoscience

T. Berlage, J. Bornemeier, J. Urai (Geology)

RWTH Exploratory Teaching Space (ETS)

An ETS grant was successfully used to establish virtual microscopy in a situated teaching setting. In collaboration with Fraunhofer FIT, an automated scanning microscope has been developed that is able to scan thin sections of rock automatically in multiple polarization angles. A new method was developed to interpolate and cluster the behaviour of individual pixels. The approach was successfully demonstrated with several samples and is now being exploited in automated image analysis to further characterize the mineral observed.
SurgeryTube: Web 2.0 technologies in the training of surgeons

W. Prinz, N. Jeners, S. Franken
BMBF Collaborative Project

SurgeryNet offers an innovative Web 2.0 training platform for surgeons, with a key focus on minimally invasive surgery. The central idea is the combination of daily work processes and the collection of learning content, through a time- and location-independent provision of the latest know-how. SurgeryNet simplifies the creation of case-related online content into the daily work processes and enables the users to share current knowledge.

The online content in terms of videos, 3D-models, pictures, and slide shows can be stored by all users to document their own work, or to serve education and training of surgeons. Thus, the problem of increasing time pressure in the operating room can be mitigated by the training of surgeons with the content of SurgeryNet. Users can comment and discuss the existing content to ask questions and bring in their knowledge.

The popular BSCW platform is utilized to build the basis of the SurgeryNet platform. BSCW provides general purpose document management functions with an HTML interface. During the project, a new interface and new functions will be developed and integrated in the BSCW to create the SurgeryNet platform. SurgeryNet will provide functions of a social community, like a profile and communication features and also picture and video sharing functions. SurgeryNet is open to public access under www.SurgeryNet.de.

Other Research Projects

NeuroPierce and SignGes

M. Jarke, I. Mittelberg (FB 7)

DFG-funded HumTec Initiative within RWTH 2020 Excellence Concept

In a continuation of the successful “Natural Media and Engineering” project of the DFG-funded Humanities and Technologies (HumTec) initiative, a cornerstone of the RWTH 2020 strategy, the NeuroPierce project led by Profs. Irene Mittelberg (Gesture Research) and Klaus Mathiak (Medicine) aims at interdisciplinary research on foundations of gesture-based communication.

Complementary to this fundamental research approach, RWTH Aachen has started a new practice-oriented Center on Sign Language and Gesture Research (SignGes) which mainly aims at supporting the large community of Deaf people and sign-language speakers in their educational and worklife.

Starting with the former SFB 427 (Media and Cultural Communication) from 1998-2008, Informatik 5 and its associated Fraunhofer Institute FIT have continuously supported specific projects within these two initiatives for the past 15 years, with major successes in multimedia web support for vocational training, student assistance, and most recently entrepreneurship, partly also in cooperation with the KIT Center supporting blind and visually impaired students in nation-wide initiatives. In continuation of this decade-long cooperation, Prof. Jarke is therefore present in the advisory board of both initiatives.
**Deployment of a Multi-Agent Simulation Platform for Interdisciplinary Research and Teaching**

*M. Jarke, R. Klamma, M. Brettel (WIN), T. Kron (Institut für Soziologie)*

Forum Informatik Seed Funds

Following up the successfully finished OBIP project we are creating a virtual center for multi-agent simulation together with colleagues from the institutes of engineering and sociology. Goal of the project is the creation and dissemination of knowledge about the multi-agent simulation system Repast within the wider RWTH Aachen University research and teaching community. For this purpose, we are setting up a repository of already existing models and a documentation wiki for the communication of modelling, implementation, and teaching knowledge. In 2013 we created an interdisciplinary lab course which was held in the summer term 2014. A new interdisciplinary master thesis about the simulation of Mafia Wars in Sicily in the 90s has started as a result of the lab.

**SunSITE Central Europe (http://sunsite.informatik.rwth-aachen.de)**

*M. Jarke, R. Klamma, R. Linde*

Since 1995, Informatik 5 is active in the field of internet-based community support, both in terms of research on community and web service tools and in terms of providing infrastructures for scientific communities worldwide. For example, Informatik 5 hosted the first website for the city of Aachen in 1995 and, since the same year, manages one of the most successful public-domain Internet servers in the German science net, SunSITE Central Europe. Supported by Sun Microsystems with powerful hardware and base software, SunSITE Central Europe focuses on scientific community support, including mirrors of some of the most important research literature indexes, workspaces for Internet cooperation, and about 8 TB of open source software. Typically, the SunSITE enjoys around 35 million accesses per month.

As additional scientific publication services, the SunSITE hosts the Central Europe (CEUR) Workshop Proceedings (CEUR-WS.org) with now over 1000 volumes and acts as a mirror for the Dagstuhl Research Online Publication Server.

**i* Wiki (http://istar.rwth-aachen.de)**

*M. Jarke, G. Lakemeyer, R. Klamma, D. Renzel*

Since September 2005, the chair is hosting the i* Wiki, a platform for researchers and users to foster investigation, collaboration, and evaluation in the context of the i* modeling language. In 2011, the wiki has been moved to the SunSITE server for better services to the scientific community.

**Algorithms on Complex Dynamic Networks**

*M. Jarke, R. Klamma, M. Derntl, M. C. Pham, K. Verbert (KU Leuven)*

Social Network Analysis (SNA) is a well-established method in sociology. With the advent of the World Wide Web and growing computational power interests grow in analyzing large sets of network data over time. We apply graph algorithms, dynamic network analysis
methodologies and advanced approaches in Web Science to analyze dynamic patterns of human interaction expressed by traces left large scale information systems. Our annual lecture "Web Science" and seminar course "Web Science" contribute to a sound theoretical basis for student and research work. A couple of prototypes provide support user communities in getting to know their own networks. A research stay of Katrien Verbert from the KU Leuven finalized in the joint publication of a journal paper. The dissertation project of Pham Manh Cuong was successfully defended in 2013.

<table>
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<tr>
<th>The XMPP Experience</th>
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<tr>
<td>M. Jarke, R. Klamma, D. Renzel, D. Kovachev, I. Koren, P. Nicolaescu</td>
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Since 2010, the XMPP Experience project is an ongoing internal project collecting the numerous applications of the Extensible Messaging and Presence Protocol (XMPP) in our officially funded projects (e.g. ROLE) and communicating and contributing the results to the XMPP community. Starting in 2012, we actively presented our work at central XMPP community events such as the XMPP summit and developer rooms at FOSDEM or XMPP meetings during official IETF gatherings. Furthermore, we actively contributed parts of our code bases from the ROLE project to the Open Source project strophe.js, thus sharing our results with a vibrant XMPP developer community. In earlier years, we successfully contributed a set of strophe.js community plug-ins to the official strophe.js community code base. During our appearance at the XMPP HackFest, collocated with this year’s 87th IETF meeting in Berlin, our contributions for WebSocket-based XMPP connections were accepted for inclusion in the official strophe.js core code base. One of our student workers accepted the invitation to become one of the strophe.js official maintainers.

Sharing the notion that XMPP is present in research, but does not yet receive the deserved attention in the research community, we started an initiative with TU Dresden and BTU Cottbus-Senftenberg to strengthen the awareness for XMPP in research work. The collaboration was kicked off in July 2013 with the invited talk “XMPP – The Potential Heartbeat of Global Pervasive Computing” by Dr. Daniel Schuster from TU Dresden, held in the context of the RWTH Aachen University Informatik Kolloquium. Further steps included the collaborative authoring of a survey on XMPP in the research area of pervasive computing, the setup of a federated XMPP network among our institutions and the planning for an aggregator website collecting national research work involving XMPP.

3 http://strophe.im/strophejs/
Other Activities

Service


Matthias Jarke’s major service activities in 2012-2013 included

  - Deputy coordinator, UMIC Excellence Cluster on Mobile Information and Communication, RWTH Aachen University
  - Executive Director, Fraunhofer FIT, Birlinghoven
  - Chairman, Fraunhofer Information and Communication Technology group, and Member of Presidential Board, Fraunhofer Society
  - Founding Director, Bonn-Aachen International Center for Information Technology (B-IT), and Speaker, B-IT Research School
  - Inaugural Dean, Applied Information Technology, GUtech German University of Technology in Oman (until Dec. 2012, afterwards: Adjunct Professor)
  - Member, CONNECT Advisory Forum (CAF) on the HORIZON 2020 Program of the European Commission (since March 2013)
  - Scientific advisory board, Faculty of Informatics, University of Vienna, Austria (until 12/2012)
  - Scientific advisory board, Learning Lab Lower Saxony (L3S), Hannover (until 12/2012)
  - Chair, Scientific advisory board, OFFIS e.V., Oldenburg (until 12/2012)
  - Deputy Chairman, Hochschulrat, FH Köln (re-elected 2013-2017)
  - Member, Program Board, LOEWE Excellence Initiative Hessia
  - Member, CeBIT-Messeausschuss
  - Member, Industrie 4.0 Working Group of BMBF and BMWi Germany (until 4/2013)
  - Member, Working Group on Reference Data Set, Wissenschaftsrat Germany
  - Chairman, ASIIN review group for University of Potsdam and Hasso-Plattner-Institute
  - Member, QANU Evaluation Board, CELSTEC Institute, OUNL Heerlen

- Nils Jeners is member of the executive committee of the Fachgruppe CSCW (Computer-Supported Cooperative Work) der GI (Gesellschaft für Informatik)

- Ralf Klamma is founding member of the European Association on Technology Enhanced Learning (EATEL). He is head of the steering committee of the European Conference on Technology Enhanced Learning (EC-TEL) and steering committee member of the International Conference on Web-based Learning (ICWL). He served as external reviewer for three PhD projects in Madrid (UPM), Brest (France Telecom) and Dublin (TCD).
• Wolfgang Prinz is member of the executive committee of the Fachgruppe CSCW (Computer-Supported Cooperative Work) der GI (Gesellschaft für Informatik).

• Dominik Renzel manages the i* Wiki (http://istar.rwth-aachen.de).

• Thomas Rose acted as reviewer for EU funded projects on “ICT for Energy and Water Efficiency” and “ICT for Low Carbon Economy and Smart Mobility” for the European Commission after serving as evaluation expert for EU Project Proposals on “ICT for Energy and Water Efficiency in Public Housing” in 2010/11.

• Thomas Rose organized the expert panel on power blackouts at Germany’s national conference for majors and county executives (Bürgermeisterkongress), Ahrweiler, April, 2013.

Editorial Boards


• Anna Hannemann was an editor of the Report from Dagstuhl Seminar 12442 „Requirements Management – Novel Perspectives and Challenges“.


• Ralf Klamma serves as associate editor for IEEE Transactions on Learning Technologies (TLT), Springer Journal on Social Network Analysis and Mining (SNAM), and IJTEL. He is section editor for the forthcoming Springer Encyclopaedia of Social Network Analysis and Mining (ESNAM) and editor for the IEEE Special Technical Committee on Social Networks (STCSN). He is editing special issues for MTAP, IJTEL and for the ComSIS Journal. He is editor-in-chief for the SunSITE CEUR and several community information systems like the PROLEARN Academy (www.prolearn-academy.org), the Multimedia Metadata Community (www.multimedia-metadata.info) and the Bamiyan Development Community (www.bamiyan-development.org). He also served as reviewer for World Wide Web Journal (WWWJ), IEEE Transactions on Learning Technologies (TLT), IEEE Transactions on Management of Information Systems (TMIS), Pervasive and Mobile Computing (PMC), Multimedia Tools and Applications (MTAP), Journal of Networks and Applications (JNCA), Journal of Universal Computer Science (JUCS), Educational Technology & Society (IFETS), and Journal of Computer Science and Technology (JCST).

• Dejan Kovachev served as a reviewer for the IEEE Wireless Communications Magazine (WCM), Pervasive and Mobile Computing Journal (PMC), the International Journal on Multimedia Tools and Applications (MTAP) and for the 3rd International Workshop on Information Management in Mobile Applications (IMMoA 2013).

• Milos Kravcik serves on the editorial board of the International Journal of Technology Enhanced Learning and is editing a special issue for it. He is executive peer-reviewer of the Journal of Educational Technology & Society and reviewed also submissions for three

- Petru Nicolaescu served as a reviewer for the International Journal on Multimedia Tools and Applications (MTAP).
- Zinayida Petrushyna is an editor of the special issue on “Learning Analytics” for the International Journal of Technology Enhanced Learning. She also served as a peer reviewer for the Emerald Program: electronic library and information systems journal.
- Wolfgang Prinz is Editor of i-com Zeitschrift für interaktive und kooperative Medien, Oldenbourg Verlag, and of the CSCW Journal, Springer.
- Dominik Renzel serves as reviewer for the International Journal on Multimedia Tools and Applications (MTAP).
- Thomas Rose has been Program Committee member of the workshop for "IT-support of rescue forces", GI conference 2013, Koblenz.

**Conference Organization**

- Michael Derntl served as the dissemination chair at the Eighth European Conference on Technology Enhanced Learning (EC-TEL 2013), Paphos, Cyprus. Additionally he served on the Program Committee of the following events: IEEE International Conference on Advanced Learning Technologies (ICALT 2013, Beijing, China), European Conference on Technology Enhanced Learning (EC-TEL 2013, Paphos, Cyprus), Doctoral Consortium at EC-TEL 2013 (Paphos, Cyprus), International Conference on Web-based Learning (ICWL 2012, Hong Kong), ACM International Conference on Learning Analytics and Knowledge (LAK 2013, Leuven, Belgium), IEEE International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES 2012, Genoa, Italy), 6th International Workshop on Social and Personal Computing for Web-Supported Learning Communities (SPEL 2013, Sinaia, Romania). He also co-organized workshops at the 9th Joint European Summer School on Technology Enhanced Learning (JTEL 2013, Limassol, Cyprus) and at the 1st GALA Summer School on Serious Gaming 2013 (Graz, Austria).
- Sebastian Franken served on the program committee of the 13th European Conference on Computer Supported Cooperative Work (ECSCW 2013), Paphos, Cyprus.
- Matthias Jarke was General Chair of the 3rd International Conference on Cloud Computing and Service Sciences (CLOSER 2013) in Aachen, and Track Chair “IT Artefact” in the ICIS 2013 Conference (Milano). He was also program committee member of the following conferences: SE 2013 (Aachen), REFSQ 2013 (Essen), ER 2013 (Hong Kong), CAiSE 2013 (Valencia), Modellierung 2014 (Wien), and VHB-Tagung 2014 (Leipzig).
- Nils Jeners co-chaired the Workshop „Leichtgewichtige Werkzeuge zur Unterstützung von Kooperation und persönlichem Wissensmanagement“ at the Mensch & Computer 2013, Bremen. He also served on the program committee of the 13th European Conference on Computer Supported Cooperative Work (ECSCW 2013), Paphos, Cyprus.
- Ralf Klamma was general chair of the 8th European Conference on Technology Enhanced Learning (EC-TEL 2013), Paphos, Cyprus, September 17-21, 2013, general chair of the JTEL Summer School in Technology Enhanced Learning, Limassol, Cyprus, May, 2013,
doctoral consortium chair at the 3rd conference on Learning Analytics and Knowledge (LAK 2013), Leuven, Belgium, April 8, 2013, and steering committee representative of the 12th International Conference on Web-Based Learning (ICWL 2013), Kenting, Taiwan, October 6-9, 2013. He also co-organized workshops at the 9th Joint European Summer School on Technology Enhanced Learning (JTEL 2013, Limassol, Cyprus) and at the 1st GALA Summer School on Serious Gaming 2013 (Graz, Austria). He served as program committee member / reviewer for the following conferences: ACM Symposium on Applied Computing (SAC’13), 12th IEEE International Conference on Advanced Learning Technologies (ICALT’13), IEEE American Control Conference (ACC’13), IEEE/FRTRA International Conference on Multimedia and Ubiquitous Engineering (MUE’13), Wirtschaftsinformatik’13, International Symposium on Collaborative Technologies and Systems (CTS’13), Communities & Technologies’13, International Conference on Web-based Learning (ICWL’13), European Conference on Technology Enhanced Learning (EC-TEL’13), Games and Learning Alliance Conference (GALA’13), Personal Learning Environments Conference (PLE’13), International Conference on Ambient Systems, Networks and Technologies (ANT’13), International Conference on Social Computing and its Applications (SCA’13), Conference on Learning Analytics & Knowledge (LAK’13), Workshop Business Process Management and Social Software (BPMS’13), Interactive Computer Aided Learning (ICL’13), DELFI’13, I-KNOW’13, CRIWG Conference on Collaboration and Technology (CRIWG’13), Workshop Computer-based Knowledge & Skill Assessment and Feedback in Learning Settings (CAF’13), Workshop on Text Information Retrieval (TIR’13), Workshop on Personalization Approaches in Learning Environments (PALE’13), Workshop on Business Applications of Social Network Analysis (BASNA’13), International Workshop on Collaboration and Gaming (CoGames 2013), International Workshop on evidenced-based Technology Enhanced Learning (ebTEL’13), Workshop on Data Management in the Cloud (DMC’13).

• Milos Kravcik co-organized 9th Joint European Summer School on Technology Enhanced Learning (JTEL 2013), 3rd Workshop Personalization Approaches in Learning Environments (PALE 2013 at UMAP), and 3rd Workshop on Awareness and Reflection in Technology-Enhanced Learning (ARTEL 2013 at EC-TEL). He was programme committee member of the following conferences and workshops: 12th International Conference on Web-based Learning (ICWL 2013), 8th European Conference on Technology Enhanced Learning (EC-TEL 2013), and its Doctoral Consortium, Workshop on Collaborative Technologies for Working and Learning (at EC-TEL 2013), and Games and Learning Alliance Conference (GALA 2013). He also co-organized workshops at the 9th Joint European Summer School on Technology Enhanced Learning (JTEL 2013, Limassol, Cyprus) and at the 1st GALA Summer School on Serious Gaming 2013 (Graz, Austria).

• Karl-Heinz Krempels was conference chair of the 9th International Conference on Web-Information Systems and Technologies (WEBIST’12) and program chair of the SmartGreens Conference (SmartGreens ‘13) in Aachen. He was program committee member of 8th International Joint Conference on Computational Intelligence (ECTA’13).

• Zinayida Petrushyna was a program committee member of the 8th European Conference on Technology Enhanced Learning (EC-TEL 2013), IADIS e-Learning 2013 and IADIS Multi Conference on Computer Science and Information Systems (MCCSIS 2013), the 3rd International Conference on Social Eco-Informatics (SOTICS 2013) and “ECTEL meets ECSCW 2013” Workshop on Collaborative Technologies for Working and Learning.
• Wolfgang Prinz was Program Co-Chair of the 6th International Conference on Communities and Technologies Conference, C&T 2013. He also served on the program committees of E-CSCW 2013, M&C 2013 and various other smaller conferences

• Dominik Renzel served as PhD volunteer during the 21st European Conference on Information Systems (ECIS 2013). He also organized the Workshop "How to Build & Develop Responsive Open Learning Environments with the ROLE SDK” during the 1st Layers Developer Camp.

• Thomas Rose chaired the workshop on "Planning and Preparing for Emergencies", ISCRAM conference 2013, Baden-Baden, in cooperation with Prof. Stephen Fortier, University of Washington, May 12 – 15. He also organized the workshop on “Operational Preparation for Major Power Blackouts” in Sankt Augustin, November 2012, which attracted approximately 100 practitioners from regional and national rescue and relief organizations.

Software Demonstrations


• “DireWolf - Distributing and Migrating User Interfaces for Widget-based Web Applications”, ICWL 2013, Kenting, Taiwan, October 7, 2013.


• “SeViAnno: Prototyping Apps for Informal Learning: Semantic Video Annotation Scenario “. Ninth Joint European Summer School on Technology Enhanced Learning (JTEL 2013, Limassol, Cyprus), Layers Consortium Meeting (Graz, 2013)


• “REST based Cloud Services deployed within i5Cloud”. Layers Consortium Meeting (Graz, 2013), 1st Layers Developer Camp (Aachen, 2013)
Talks and Publications

Talks


M. Derntl: A dynamic topic model of learning analytics research. LAK Data Challenge 2013, Leuven, Belgium, Apr 9, 2013


A. Hannemann: Community Dynamics in Open Source Software Projects: Aging and Social Reshaping. OSS 2013, Capodistria, Slovenia, Jun 27, 2013

A. Hannemann: Requirements Engineering Discovery in Open Source Software Projects, Dagstuhl Seminar, Dagstuhl, Germany, Oct 31, 2012


M. Jarke: Mobile ICT for Sustainable Mobility. German-Italian Smart City Workshop, Berlin 29.11.2012


N. Jeners, Thoughts on the Next Generation of Lightweight Cooperation Systems (M&C 2013), 09.09.2013, Bremen


R. Klamma: Learning Layers Developer Camp, Keynote, Aachen, Germany, Oct 1, 2013

R. Klamma: Community Learning Analytics - Challenges and Opportunities, Invited Talk, ICWL 2013, Kenting, Taiwan, Oct 7, 2013

R. Klamma: Community Learning Analytics, ICWL 2013, Kenting, Taiwan, Oct 8, 2013

I. Koren: Session Mobility using XMPP, FOSDEM 2013, Brussels, Belgium, Feb 2, 2013

D. Kovachev: DireWolf - Distributing and Migrating User Interfaces for Widget-Based Web Applications. 13th International Conference on Web Engineering (ICWE 2013), Aalborg, Denmark, Jul 8, 2013


M. Kravcik, M. Derntl, R. Klamma: Gamified Mobile Apps for Informal Learning. 1st GALA Summer School on Serious Games, Graz, Austria, Sep 3, 2013


W. Prinz: Next Generation Workplace Media, Enterprise Collaboration & Communication, November 2012, Frankfurt

W. Prinz: Neue Medien und ihr Einfluss auf Lernen und Weiterbildung, 2. Fachtagung Managed Training Solutions, Januar 2013, Köln

W. Prinz: 100 Prozent connected: Verändert das Internet der Dinge unsere Arbeitswelt?, CISCO CIO-Day BYOD und Unified Access, Mai 2013, Hamburg

W. Prinz: Next Generation Workplace Media, AOUG Anwenderkonferenz 2013, Juni 2013, Wien

W. Prinz: Social Media im Unternehmen, CIO Roundtable, September 2013, Duisburg


**Publications**

**Book and Edited Volumes**


**Journal Articles**


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**Conference Papers, Book Contributions, Patents**


**Technical Reports**


Open Source Community Involvement

M. Derntl, R. Uppal: OpenGLM – Open Graphical Learning Modeler. i5 is the current maintainer of the graphical IMS Learning Design tool OpenGLM, which is hosted on SourceForge.net, and further developed within the METIS project to interoperate with the Integrated Learning Design Environment, to which i5 is also contributing on GitHub.

I. Koren: Participation XMPP Hackfest at 87th IETF Meeting, 27 July, 2013. At the meeting\(^4\), various aspects concerning XMPP and research were discussed. Most notably, we promoted our WebSocket plug-in to strophe.js. The activity resulted in the plug-in being integrated into the official strophe.js repository and our student worker being invited to become official maintainer.

I. Koren: House of Quality App in Chrome Web Store. A “House of Quality”\(^5\) app was released on Chrome Web Store in June 2013. The tool following the Quality Function Deployment (QFD) methodology is used within the context of the Learning Layers project to map user requirements to functional requirements that need to be provided by the integrated Layers architecture.

D. Renzel, A. Guth, P. de Lange: ACIS Github Team Page. The ACIS group at Informatik 5 maintains its own team page on GitHub (https://github.com/rwth-acis), thereby aggregating both own (e.g. LAS2peer, wxg) and externally served (e.g. strophe.js) Open Source Software projects.

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\(^4\) http://wiki.xmpp.org/web/Berlin_Hackfest

\(^5\) http://chrome.google.com/webstore/detail/house-of-quality/jembpnanfbdeklbcogaafoelommfmb
D. Renzel, A. Guth: ROLE Interwidget Communication Patch for Apache Rave. After multiple appearances at Apache Rave hosted events, the community invited us to contribute a patch, introducing the Interwidget Communication we developed in ROLE for Apache Rave. The patch was officially submitted to the Apache Rave community in May 2013 and is currently waiting for review.\(^6\)

D. Renzel, A. Guth: Strophe.js – WebSocket Implementation & Community Plug-ins: As result of our continuous interaction with the XMPP community and efforts towards integrating our WebSocket implementation into the official code base of the Open Source project strophe.js\(^7\) our student worker Andreas Guth accepted the invitation to become one of the official project maintainers. Additionally, we contributed a set of strophe.js community plug-ins.

D. Renzel, I. Koren, P. Nicolaescu: Layers Open Developer Library (ODevL). ODevL\(^8\) builds the center of Open Source development activities in the Learning Layers project. The website includes documentation, requirements gathering (Requirements Bazaar), source code repository, issue tracking (JIRA) and continuous integration (Jenkins) processes. JIRA, Jenkins and Requirements Bazaar instances are hosted at RWTH.

**Awards**

N. Günnemann: Best Student Paper Award for the paper “D-VITA: A Visual Interactive Text Analysis System Using Dynamic Topic Mining” at BTW 2013, Magdeburg, Germany. 500 Euro price money was awarded by GI, the German Informatics Society. The paper was an outcome of diploma thesis work on “Dynamic Topic Mining for Visual Analytics on Large Document Collections” in the context of the TEL-Map EU project, supervised by M. Jarke, R. Klamma and M. Derntl.

M. Jarke: appointed as honorary Adjunct Professor on the occasion of his retirement as Inaugural Dean of IT and Engineering at GUtech German University of Technology in Oman

M. Jarke: appointed as member, acatech National Academy of Engineering and Sciences, October 2013.

I. Koren: App Challenge winner at the 3rd Fraunhofer FOKUS Mobile Web Symposium for the app “Multi-Display Maps”. The event was hosted on 14.3.2013 in Berlin. 200 Euro price money was awarded by the Webinos FP 7th Framework Project.

D. Renzel: Best Demo Audience Award at the 21st IEEE International Conference on Requirements Engineering (RE’13) for the paper & demonstration “Requirements Bazaar: Social Requirements Engineering for Community-Driven Innovation” (co-authors: M. Behrendt, R. Klamma, M. Jarke)

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\(^6\) https://reviews.apache.org/r/11421/
\(^7\) http://strophe.im/strophejs/
\(^8\) http://developer.learning-layers.eu
Dissertations at Informatik 5

Khaled Rashed
Title: Community-Centered Semantics for the Detection of Fake Multimedia
Examiners: Matthias Jarke, Harald Kosch (University of Passau), Ralf Klamma
Date: 20 December, 2012
Abstract:
Nowadays, it becomes increasingly difficult to find reliable multimedia content on the web. Detecting the fake and providing semantics that can help searching and retrieving fake multimedia remain unsolved problem which is of growing concern in the Web community. Conventional automatic approaches for detecting fake multimedia lack scalability and inability to capture media semantics by means of forgery. Furthermore, they consider all media modification as a fake which is not true in many online communities. This research aims to find ways to manage multimedia authenticity in open, decentralized systems. We propose a trust-aware community approach for detecting and managing fake multimedia. A general framework of community-based fake multimedia detection systems is developed, where community and automatic techniques can be combined. A Multimedia Quality Profile is developed for multimedia evaluation and semantic classification with one substantial part of estimating media authenticity based on trust-aware community ratings. A corresponding service supports the construction and generation of such profiles. We address several challenges within the proposed framework. The concept of serious gaming is employed in our collaborative fake media detection approach to overcome the cold-start problem and to provide sufficient data powering our Multimedia Quality Profile and expert ranking algorithm. We also present a use case where our community-based fake detection approach can be applicable and a service for trust management that supports this approach. The evaluation reveals that the community members can discover unfair raters in a short time after their participating in the media evaluation process. Finally, we propose an algorithm for searching and ranking experts in the community and trust-aware fake multimedia detection system, ensuring its robustness against Sybil attacks by providing sufficient countermeasures. In different experiments we demonstrate that our approach strategy can be effectively used to detect fake multimedia in collaborative systems.

Manh Cuong Pham
Title: Dynamic Social Network Analysis and Recommender Technologies in Scientific Communities: The Case of Computer Science
Examiners: Matthias Jarke, Wolfgang Neijdl (TU Hannover), Ralf Klamma
Date: 22 March 2013
Abstract:
The Web in general, and the Web 2.0, in particular, have changed the way in which scientific information is created, exchanged and consumed. Online accessible digital libraries bring the access to large collection of scientific literature to the research community. Information sharing and research results dissemination are much faster than before. The large amount of scientific data available on the Web gives unique opportunities and also raises challenges for
understanding the organization and diffusion of scientific knowledge, and the ability to quickly locate information needed to perform research.

The basic interest of this thesis is to study the structure of scientific knowledge domains from a social network view. Techniques developed in knowledge mapping typically focus on purely mental perspectives of scientific knowledge, while ignoring its social aspects. We study the social structures that shape the scientific knowledge domains. We propose a framework based on social network analysis that allows us to analyze knowledge domains and the development pattern of research communities. To demonstrate, we analyze the dynamics of the computer science knowledge domain. We find interesting patterns regarding its interdisciplinary nature, the collaboration behavior and the development of communities in sub-disciplines. The results are useful for research funding agencies, scientific policy management, institution leaders, librarians, collection managers and research community members. Another important aspect of understanding knowledge domains and their behavior, especially research communities, is the community-based recommendation. We propose a framework that takes into account community recommendations for their members. The framework discovers communities from the research interaction between scholars as well as librarial objects (publications, conferences/journals, etc.). The applications and evaluations of this framework in two recommendation problems, community recommendation and talk/collaborator recommendation for conference participants, demonstrate the effectiveness and benefit of communities in supporting their members.

Olga Domanova
Title: Automated Quantitative Analysis Methods for Translocation of Biomolecules in Relation to Membrane Structures
Examiners: Thomas Berlage, Matthias Jarke; Fabian Kießling (FB 10)
Date: 18 October 2013
Abstract:

Distribution of biomolecules in living organisms is of crucial importance, as function and location influence each other. Transport processes are essential to maintain the balance. One of the frequent transport types is translocation, which occurs when biomolecules move from one compartment to another. To study a translocation, images have to be quantitatively analyzed. Such an analysis can currently be performed manually, making the evaluation subjective and slow. Some automated implementations exist, being often too specific and poorly adaptable to other evaluations.

We have developed an automated workflow for the quantitative analysis of translocation. The analysis is based on profiles of biomolecule distribution that are extracted from images. These profiles undergo a selection procedure to eliminate information from damaged biological structures and noise. The selected profiles are characterized by calculation of numeric descriptors. The descriptors are then statistically evaluated for different datasets of images to quantitatively analyze the translocation.

This workflow is objective, robust and fast while it produces statistical results comparable to slow manual analysis. Furthermore, the developed workflow is generally applicable and may be used for other evaluations beyond the analysis of transport processes.
Abstract:
Developers are notorious for their dislike of writing internal documentation. It has few value to them because its benefits are too far away in the future and distributed on the whole team, while the efforts of documenting are burdened on the individual himself. The resulting phenomena have names like free riding or tragedy of the commons. Software is an accumulation of encoded knowledge and a collecting pond for complexity. Its development is more akin to research and evolution than to an agreed path with an established goal. Multiple developers are engaged in an intricate joint endeavor, building on discovery, invention and decision making, flanked by several stakeholders. A developer must constantly learn and relearn the software to be able to adapt it to ever-changing requirements. Instead of being soft and easy to adapt, software is difficult to modify. If knowledge is not preserved in source code, wiki articles, and other documentation, then software development becomes costly even up to the point of a total economic loss.

This research presents CollabReview, which addresses the developers' motivation to invest in internal quality without strict regulation. It re-balances intrapersonal cost-benefit considerations in favor of internal quality using gamification. Personal reputation scores for developers are calculated from ownership-based responsibility and quality ratings for collaboratively written software process artifacts. The scores are tied to social games and rewards to make scores worthwhile to achieve. The implemented prototype of the CollabReview concept mines responsibility information from revision histories, and combines it with manual and automated assessments of artifact quality. The CollabReview concept and prototype were evaluated in several studies including an analytical concept evaluation, technical validations and field experiments. The latter deployed the prototype in knowledge management, agile, open source or distributed consortium projects. It successfully amplified contributions to knowledge management wikis, and improved the readability of source code. The results show that CollabReview leads to better internal documentation and quality of the whole software. At the same time, it leaves developers their freedom to neglect quality when necessary, does not burden them with unnecessary additional efforts, and hence has particular value in self-organizing project environments where code ownership is weak.
Since January 2000, Fraunhofer FIT at Birlinghoven Castle, Sankt Augustin, is associated with RWTH Aachen University by joint appointment of Institute Director Professor Matthias Jarke of Informatik 5. FIT is part of the Fraunhofer ICT Group, a consortium of 18 Fraunhofer Institutes with over 4000 researchers, also coordinated by Professor Jarke.

With approximately 125 researchers, Fraunhofer FIT investigates foundations of sustainable business IT under the three perspectives of human-centered design, high-tech process support, and financial, managerial, and technological risk management. In 2012, the institute operated with a record third-party funding of 8.4 m€, representing a growth of more than 15% over 2011 and almost 80% of its overall budget. About 3.5 m€ came from direct contract research, the remainder from European and national funding agencies. The institute is organized in four research divisions:

- **Cooperation Systems (Prof. Wolfgang Prinz)** focuses on cooperation and innovation management using social media, continuing technology-enhanced learning technologies, and advanced visualization technologies such as augmented reality games. There is a close cooperation with Informatik 5, e.g. by joint participation in EU Integrated Project ROLE.

- **User-Centered Computing (Dr. Markus Eisenhauer)** investigates systems engineering by humans for humans, i.e. a user-centered and participative approach to the design of software-intensive systems, especially Cyberphysical Systems. FIT’s LinkSmart middleware has been highly successful in supporting energy-saving cyber-physical systems e.g. in a production or smart city context; FIT’s Certified Usability Engineer courses are among the most successful of the Fraunhofer continuing education Academy, and the Accessibility and Web Compliance group closely cooperates with the SignGes Center on Sign Languages and Gesture Research to improve the education and job situations of deaf citizens.
Life Science Informatics (Prof. Thomas Berlage) offers rich image-integrated information for the health sector. Applications include high-content high-throughput analysis and other life science big data themes down to the level of individual molecules. As one example, FIT’s Zeta Life Cell Analyzer developed in cooperation with Bayer Healthcare was chosen by the worldwide Bayer top management as one of the three most important research results of 2012.

Risk Management and Decision Support (Prof. Thomas Rose) supports sustainability by evaluating, minimizing, and managing different kinds of risks. One group specializes on managerial and technological emergency management particularly for fire departments by modeling support and new mobile technologies, a second one assists several German federal ministries in financial impact analyses of proposed law changes. The third one, our newly founded project group in Augsburg, offers financial value analyses for top management, combining expected income and cost estimates with precise risk profiles and associated management strategies.

Three of the division leaders (Berlage, Prinz, Rose) have joint appointments as professors at RWTH Aachen. In addition, several renowned colleagues from other universities are linked to Fraunhofer FIT as department co-leaders or consultants: Hans-Ulrich Buhl (Augsburg University), one of the best-known finance informatics professors in Germany, with a project group in financial information management, social informatics specialist Volker Wulf (University of Siegen) with a group focusing on usability issues, and Thomas Hoeren (University of Münster), a well-known leader in the field of media and Internet law.
Since 2003, the B-IT has been pioneering the brain gain of much needed IT specialists from all over the world by offering top-level international master programs in applied informatics. In a unique cooperation between RWTH Aachen University, the University of Bonn, the Bonn-Rhein-Sieg University of Applied Sciences, and the Fraunhofer Center Birlinghoven Castle, these master programs address Media Informatics, Life Science Informatics, and Autonomous Systems, respectively. Currently, students from over 40 countries worldwide are studying in the beautiful B-IT Building on the Rhine River in Bonn-Bad Godesberg. The B-IT is directed by Professors Armin B. Cremers (Bonn), Matthias Jarke (RWTH Aachen and Fraunhofer FIT), and Kurt-Ullrich Witt. Eight endowed professorships are funded from proceeds of the B-IT Endowment, plus matching funds by NRW State.

In the academic year 2012-2013, for the second time in a row a record number of 73 master degrees were awarded, 28 of them in the Media Informatics program which is under the responsibility of RWTH Aachen University. Since 2010, the program is coordinated by Prof. Jan Borchers, one of the endowed professorship holders, and supported by study advisor Dr. Jürgen Rapp. 31 new students were accepted into the program from 277 applicants, 12 of them with prestigious scholarships. We were also happy to observe that about a dozen of our early B-IT graduates have by now already completed a doctorate in one of the participating universities or elsewhere.

Careful placement tracking of the B-IT graduates show that the dual goal of strengthening German business and science by young promising international graduates, and of improving further the linkages to their home countries by returning well-educated graduates for their local commercial and scientific job markets, has been impressively reached. The quality of the program was confirmed in 2012 by re-accreditation of all B-IT Master programs until 2018, which covered not only the German ASIIN but also the new European accreditation label EurInf, which the B-IT programs were the first to achieve within all of Europe. Full details can be found in the B-IT Annual Report 2013 published in www.b-it-center.de.
The B-IT Research School aims to augment the B-IT by structured doctoral education in eight research fields of Computer Science where RWTH Aachen University, Bonn University, and the institutes FIT, IAIS, and SCAI at Fraunhofer Center Birlinghoven Castle have demonstrated critical mass in research excellence. The School has been partially funded by the NRW State Research School Program for the period 2008-2013, with matching funds from the participating universities and third-party funding e.g. from industry. Professors Matthias Jarke (speaker, RWTH Aachen) and Armin B. Cremers (co-speaker, Uni Bonn) coordinate the B-IT Research School, supported by operational managers Getraud Peinel (Fraunhofer FIT) and Alexandra Reitelmann (B-IT Bonn).

In total, 33 scholarships have been awarded by the B-IT Research School, most in 2009 and 2010. Almost 60% come from 12 countries outside Germany, about one third are women. By October 2013, 17 scholarship holders have successfully defended their dissertations (three by women), several more theses have been already submitted. As a nice aside, we can also report 6 babies joining the ranks of the scholarship holders during the last two years.

The training program of the B-IT Research School consists of domain-specific as well as soft skill compact courses, individually tailored for doctoral candidates. Practice phases in the participating Fraunhofer institutes or in industry are also encouraged. The participants in the courses and seminars do not just include the scholarship holders but also other doctoral students within the eight mentioned areas.

Much of the training takes place in the B-IT Building in Bonn, but since early 2012, remodeling of former library space at RWTH Aachen’s Informatikzentrum has also been completed, such that the B-IT Research School can now also offer courses in Aachen.
Since 2008, RWTH Aachen University has helped setting up the first private technical university in the Arabic Gulf region, the German University of Technology (GUtech) in Muscat/Oman. Starting with four bachelor programs in fields of particular interest to the region (geo-sciences, sustainable tourism, architecture, and applied information technology), GUtech is now expanding by further programs in the engineering sector, including the important issues of water management and chemical process engineering. GUtech is led by former RWTH Aachen Rector Burkhard Rauhut.

For the starting period 2008-2012, Professor Matthias Jarke (Information Systems, RWTH Aachen) served as Inaugural Dean of Engineering and IT at GUtech, his main role was quality control and hiring of new faculty using joint search committees between RWTH Aachen University and GUtech; initially he fulfilled also other tasks of a department chair until sufficiently experienced new faculty could take over.

At the opening of the new GUtech building and first student housing in Halban in December 2012, GUtech also celebrated the graduation of its first Bachelor students who had completed the four-year program in the summer. On this occasion, the Inaugural Deans including Prof. Jarke were retired with thanks of the GUtech owners and the Rectorate, and honored with appointments as Adjunct Professors. The IT department is now headed by GUtech Prof. Rudolf Fleischer who had been hired a couple of years earlier.