



DFKI Successful in Smart Data Competition

„INDUSTRIE 4.0 Compatible“
6th Innovation Day at *SmartFactory*^{KL}

DFKI Opens New Test Facility
for Underwater Robots

THESEUS – Intelligent Information Management for the Internet of Things



The THESEUS research program was an initiative of the Federal Ministry for Economic Affairs and Energy (BMWi) and had the aim to facilitate access to information, to network data and create new knowledge, and to create the basis for the development of new services on the Internet (2007-2012).

Under the THESEUS research umbrella, 60 partners from business and science developed new technologies for intelligent information management in the Internet of Things. The access to information is easier, data is merged and networked, and the basis is provided for the development of new services on the Internet.

THESEUS was one of the major programs in the “Digital Germany 2015” initiative and the Federal German government's High-Tech Strategy 2020.

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Cognitive Technologies

Wolfgang Wahlster
Hans-Joachim Grallert
Stefan Wess
Hermann Friedrich
Thomas Widenka *Editors*

Towards the Internet of Services: The THESEUS Research Program

 Springer

The book presents a comprehensive review of the research findings.

The submissions of DFKI researchers:

- **Semantic Technologies for Mass Customization**
Wolfgang Wahlster
- **Core Technologies for the Internet of Services**
Tilman Becker, Catherina Burghart, Kawa Nazemi, Patrick Ndjiki-Nya, Thomas Riegel, Ralf Schäfer, Thomas Sporer, Volker Tresp, and Jens Wissmann
- **A Unified Approach for Semantic-Based Multimodal Interaction**
Markus Löckelt, Matthieu Deru, Christian H. Schulz, Simon Bergweiler, Tilman Becker, and Norbert Reithinger
- **Building Multimodal Dialog User Interfaces in the Context of the Internet of Services**
Daniel Porta, Matthieu Deru, Simon Bergweiler, Gerd Herzog, and Peter Poller
- **Interactive Service Composition and Query**
Simon Bergweiler
- **Intelligent Semantic Mediation, Knowledge Acquisition and User Interaction**
Daniel Sonntag and Daniel Porta
- **Domain-Adaptive Relation Extraction for the Semantic Web**
Feiyu Xu, Hans Uszkoreit, Hong Li, Peter Adolphs, and Xiwen Cheng
- **Mobile Radiology Interaction and Decision Support Systems of the Future**
Daniel Sonntag, Sonja Zillner, Patrick Ernst, Christian H. Schulz, Michael Sintek, and Peter Dankerl
- **Linguistics to Structure Unstructured Information**
Günter Neumann, Gerhard Paaß, and David van den Akker

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Graduates with diplomas: Stefan Appel (Siemens), Sandro Castronovo (John Deere), Kinga Schumacher (DFKI), Christian Seeger (Bosch) pictured with Prof. Johanna Wanka, Federal Minister of Education and Prof. Wahlster during the ceremony at the 8th IT Summit in Hamburg.

IT Summit 2014: Federal Minister of Education Prof. Dr. Johanna Wanka Congratulates Software Campus Graduates

50 Young IT Specialists Complete BMBF Sponsored Leadership Development Program at End of 2014

► At the National IT Summit 2014, many partners – to include founding partners SAP, Siemens, Deutsche Telekom, Robert Bosch GmbH, Software AG, DFKI, KIT, TU Berlin, and TU Darmstadt – were present as Prof. Dr. Johanna Wanka, Federal Minister of Education and Research presented diplomas to several of the first graduates of the leadership development program. Two of them, Kinga Schumacher and Sandro Castronovo, are from DFKI.

DFKI CEO Prof. Wahlster, member of the IT Summit Working Group 6 “Education and Research for the Digital Future” and one of the initiators of the Software Campus, summed up his overall positive conclusion: “I am personally very pleased that the Software Campus in its first year has already proven to be a springboard for successful careers and an accelerator for innovation.”

The career paths after the Software Campus are diverse – whether a management position at an industrial corporation, an entrepreneur, or a responsible role in a research project. 80 percent of the participants see their future in manufacturing. Participants appreciate the trust and cooperation among all nine industrial partners, despite the “War for Talent” to find the best and brightest young experts and executives.

“I could see the enormous progress in my own PhD candidates in the areas of leadership and management skills, which led rapidly to a prominent position in business or research following graduation,” said Wahlster. “The tight networking of participants in the Software Campus with leaders in German industry as well as top scientists in the field of information systems has already brought the success that I envisioned in my first concept of this new promotion tool for IT managers. It was back on June 4, 2010 that I first introduced the idea to the former Minister of Education and Research in the context of a meeting of the Research Alliance. Now we must work together to ensure that this very successful public-private-partnership is able to continue beyond 2017.” The 8th IT Summit in Hamburg has set the proper course.

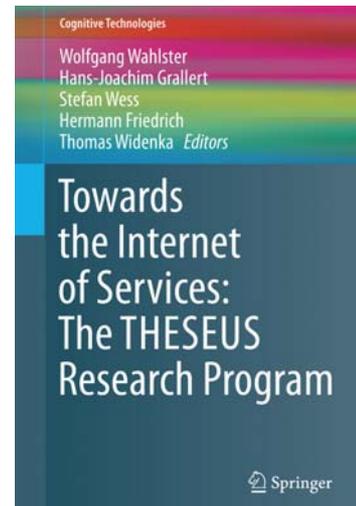
159 Master and PhD students have been accepted into the program of excellence – 27 of these come from DFKI. By the end of 2014, approximately 50 young IT specialists will have successfully completed the Software Campus curriculum. The Software Campus will be accepting qualified applications for year group 2015 beginning in February. The deadline for submitting applications is April 9, 2015. ◀

More information
www.softwarecampus.de/en/application



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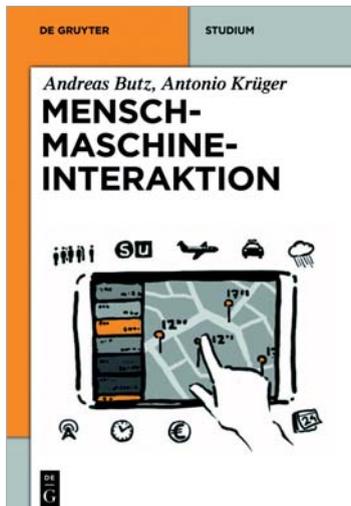
DFKI CEO Prof. Wolfgang Wahlster and Dr. Jeffrey Jaffe, CEO of W3C

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New test tank for robotic research holds 3.4 million liters of saltwater and is now operational at German Research Center for Artificial Intelligence in Bremen.

DFKI Opens Underwater Test Facility for Robots – Unique in Europe

► Innovative marine technology research on 1,300 sqm in Bremen – “An important contribution towards the development of new markets,” said Uwe Beckmeyer, Federal Government Coordinator for Maritime Industries.

DFKI sets a new standard in robotics research: On April 28, 2014, 17 months after laying the cornerstone for the new building in Bremen, Beckmeyer and other honored guests celebrated the opening of the Maritime Exploration Hall. The core of Europe’s unique test facility for submersible robots is a 3.4 million liter saltwater tank. This is where scientists are developing the systems that may be employed in the future for the inspection of ships and pipelines, the exploration of uncharted waters, or the repair of offshore plants like wind parks. Another field of application is the exploitation of underground natural resources and energy reserves from the deep sea. “In an interstate comparison, Bremen is the leader in marine research. A key locational

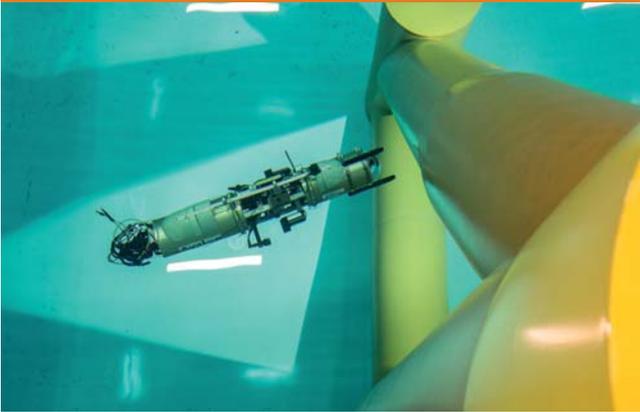
advantage is the rapid market launch of new technologies. The new Maritime Exploration Hall at DFKI Bremen will make important contributions in this context,” said Uwe Beckmeyer, Maritime Coordinator and Parliamentary State Secretary at the Federal Ministry for Economic Affairs and Energy in his welcome address.

Professor Dr. Eva Quante-Brandt, Bremen’s Senator for Education and Research views the expansion of DFKI as a good investment in Bremen’s research landscape: “This test facility, which is unique in Europe has made DFKI a pioneer in marine research technologies. We are investing in our research infrastructure so Germany will be competitive as a technology center in the future.”

Effective immediately, 1,300 square meters are available for testing new robot technologies for use on and under water. The saltwater tank is 23 meters long, 19 meters wide, and 8 meters deep and provides the perfect conditions for conducting research: “Test runs are independent of weather conditions, controllable and observable, and above all, realistic,” explained Professor Dr. Frank Kirchner, site director at DFKI Bremen and Director of Robotics Innovation Center. Additional laboratories complete the technical ensemble of the new facility. These include a pressure chamber, in which components can be tested at pressures up to an equivalent of 6,000 meters below the ocean surface, a virtual 3D test environment, and other separate water tanks.



Grand opening celebration of Europe’s unique test facility, the Maritime Exploration Hall at DFKI: l.-to-r. Prof. Frank Kirchner (Site Director, DFKI Bremen), Prof. Wolfgang Wahlster (CEO, DFKI), Uwe Beckmeyer (Parliamentary State Secretary and Maritime Coordinator at the Federal Ministry for Economic Affairs and Energy), Prof. Eva Quante-Brandt (Senator for Education and Research of the Free Hanseatic City of Bremen), Bernd Sommer (Department of Aerospace Technology Systems and Robotics, DLR Aerospace Management Center), Dr. Heiner Heseler (State Secretary for Economics, Labor, and Ports of the Free Hanseatic City of Bremen), and Dr. Walter Olthoff (CFO, DFKI)



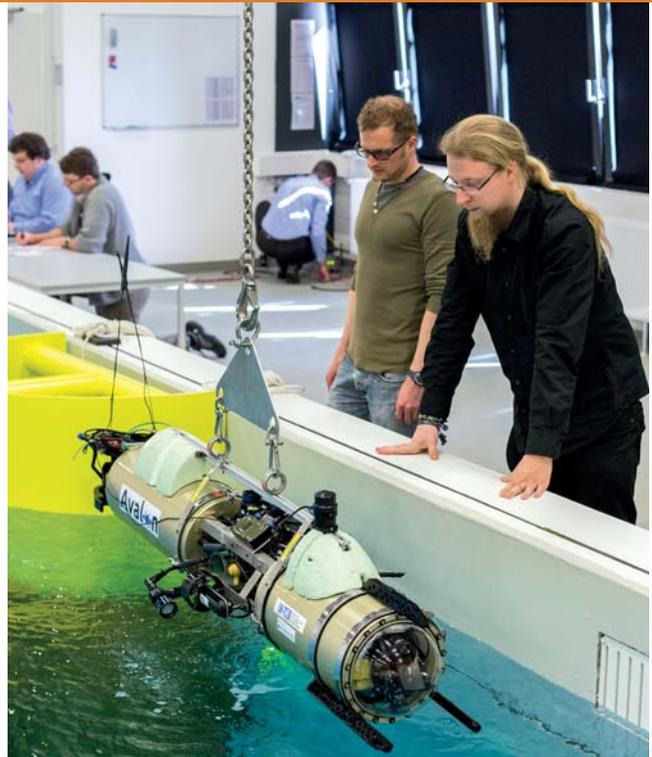
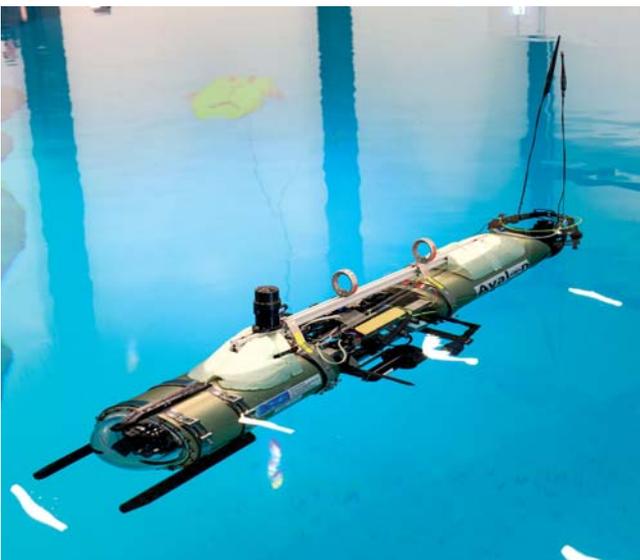
In DFKI's new Maritime Exploration Hall in Bremen, robotic systems are tested under realistic conditions.

The Maritime Exploration Hall expands the laboratory capabilities of DFKI Bremen, which since 2010 have also included a Space Exploration Hall, where robots are developed and tested for deployments in space. Both fields of application have something in common: The harsh conditions that prevail in space and underwater pose special challenges to autonomous robots, for example, weightlessness, limited communications, and restricted visibility. The aim of the Bremen research is to transfer knowledge of space systems, which have been intensively studied since 2006, to marine technologies. "Our existing laboratory capabilities have been expanded by the new saltwater tank, creating a unique research infrastructure," said Kirchner.

Dr. Heiner Heseler, State Secretary for Economics, Labor, and Ports, described the test facilities as a plus for the Hanseatic City: "The maritime and aerospace industries profit substantially from the building expansion and the DFKI research. This is a very good basis for additional, highly qualified jobs in Bremen."

Approximately 3.65 million euros were provided for the new construction by the European Fund for Regional Development (EFRE) and by the state of Bremen. DFKI also co-funded 4 million euros. "It is a paradox that we know more about the planet Mars than about our own deep oceans, which cover 75 percent of the Earth. They may hold incredible wealth for humanity: This is the reason why DFKI decided to invest rigorously in the development of autonomous underwater robots.

Autonomous Underwater Vehicle (AUV) Avalon



With the aid of a crane that belongs to the technical equipment at the Maritime Exploration Hall, the Avalon underwater vehicle is lifted into the saltwater tank.

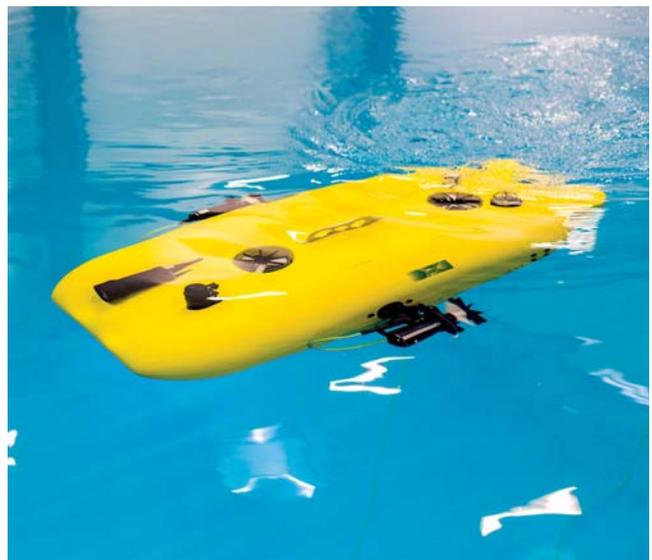
We will ensure that Germany can become the leading provider with superior technology and cost effective production in marine robotics," declared Professor Wolfgang Wahlster, CEO of DFKI. ◀

More information
www.dfki.de/robotics

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Autonomous Underwater Vehicle (AUV) Dagon





Dr. Christian Hammel, Head of the department “Technology & Innovation” at the Technologiestiftung Berlin



Dr. Andreas Goerdeler, Head of the subdivision “Information Society and Media” at Federal Ministry for Economic Affairs and Energy (BMW)

Artificial Intelligence for Big Data, Language, and Education – DFKI Expands Research in Berlin

► To strengthen its presence in the nation's capital, seven years ago DFKI established a project office in Berlin – a successful concept: the idea factory has established itself as an innovation partner for economics and science. In 2014, the research center in Berlin entered a new growth phase.

DFKI is a founding member of the Berlin ICT Labs of the European Union's Institute of Innovation and Technology as well as the Software Campus of the Federal Ministry of Education and Research (BMBF). It has also managed to bring the German-Austrian Office of the World Wide Web Consortium (W3C) to Berlin. The project office has coordinated European networks and collaborative projects, received prestigious awards and helped launch several spin-off companies in the Berlin start-up landscape.

Meanwhile the DFKI Berlin office employs a staff of 40 and, as of this year, is home to three new research groups: Intelligent Analytics for Massive Data managed by Prof. Dr. Volker Markl, Educational Technology managed by Prof. Dr. Christoph Igel, and Mass Text Analytics managed by Prof. Dr. Hans Uszkoreit.

The Project Office will collaborate in the future with the Berlin Big Data Center (BBDC), which was selected in March 2014 by BMBF for funding as one of the two German competence centers in the area of Big Data. Besides working on applications in the field of data analytics, AI researchers in Berlin won two new projects in the Smart Data Technology competition sponsored by the Federal Ministry for Economic Affairs and Energy (BMW). They will be involved in the search for methods to extract information from vast amounts of data that will enable better economic decision making. “The greatest technological challenges in this effort are the sheer volume of data, the complexity of the human

language used to express information and knowledge, and the successful transfer of continuously increasing knowledge to an ever greater number of qualified workers in the future. These challenges are the focus of the new DFKI Berlin research groups,” said Prof. Dr. Hans Uszkoreit, scientific director at DFKI and speaker for the Berlin research establishment. “We will work very closely with commercial enterprises, other research institutes in Berlin, universities, and the responsible government offices.”

DFKI Berlin celebrated the expansion of the Project Office together with 100 highly respected guests from business, research, and government in the CINIQ Center for Data and Information Intelligence on July 14, 2014. The event was opened by Dr. Andreas Goerdeler, head of the subdivision “Information Society and Media” at BMW, who spoke of the special value of DFKI Berlin in the context of achieving the aims of the Digital Agenda.

In his welcome remarks, Dr. Christian Hammel, head of the department “Technology & Innovation” at the Technologiestiftung Berlin, referred to the Project Office as a major player, citing the positive balance and the many technologies and innovations it has brought to Berlin. He also emphasized the importance of DFKI contributions in the field of machine translation, which has greatly benefited the regional economy. ◀

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New DFKI Research Lab “Intelligent Analytics for Massive Data” to Be Headed by Prof. Dr. Volker Markl

► DFKI promotes research on Big Data and Smart Data from the Project Office in Berlin. On March 26, 2014, DFKI and TU Berlin (Technische Universität Berlin) signed an agreement to expand cooperation and pave the way for Prof. Markl, head of the special subject area “Database Systems and Information Management (DIMA)” at TU Berlin, to establish the new DFKI research group.

The “Intelligent Analytics for Massive Data” working group has set itself the task of developing and providing technologies and tools that will make it easy to obtain new findings from large, diverse, and rapidly changing data sets.

The aim is to prepare data from the Internet of Services, the Internet of Things, social networks, or scientific studies in information systems, so that in less time and with fewer staff than previously required, analyses can be accomplished using various perspectives and exploitable statements can be derived. Structured and automated big data is transformed to smart data that can be queried as services on information market places. These supply economic and scientific queries with facts and figures and can be useful as decision aids.

The application fields for Smart Data technologies range from market and trend forecasting to the analysis of production, transportation, or climate data and to further use as business intelligence tools that can support managers in operational decision making. Especially in the decentral, networked, and highly flexible manufacturing processes of INDUSTRIE 4.0, the evaluation of large data sets, captured by sensors in some cases, will be crucial. In the resource optimization of electricity generation a broad database contributes to the improved prediction of peak load times with maximum consumption and helps prevent overcapacity at the power plant.

The work of Prof. Dr. Markl's research group encompasses the entire range of the data value chain: from the information capture and extraction to information integration and storage and further to scalable data processing, interactive analysis and visualization while also accounting for crowd-computing and user feedback. The priorities lie in the areas of data mining and open data as well as in the area of scalable data analysis, which is primarily concerned with the efficient derivation of decisions from huge data sets.

Since 2008, Volker Markl has been chair of the department at TU Berlin. Prior to this job, he led a scientific working group at the Bavarian research center for knowledge based systems (FORWISS) in Munich as well as one at the IBM Almaden Research Center, San José in the USA. Volker Markl earned his doctorate in Munich at TUM (Technische Universität München).



Photo: TU Berlin/PR/Ulrich Dahl

Prof. Volker Markl

Since October 2014, he has served as head of Berlin's Big Data Center (BBDC), one of two Competence Centers devoted to this field established by the Federal Ministry of Education and Research (BMBWF). The BBDC partners Konrad-Zuse-Zentrum für Informationstechnik Berlin, Fritz-Haber Institute at the Max Planck Society, Beuth University of Applied Sciences, and DFKI work on the study, advanced development, and knowledge transfer of Big Data technologies in Germany - all under the lead management of Data Analytics Lab at TU Berlin. ◀

More information
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Matthias Patz (DB Systel GmbH), Dr. Feiyu Xu (DFKI), Michael Merz (PS-Team GmbH & Co. KG)

DFKI Successful in Smart Data Competition Sponsored by Federal Ministry for Economic Affairs and Energy

► DFKI turned in an excellent performance in the technology competition of the Federal Ministry for Economic Affairs and Energy (BMWi) “Smart Data – Innovations from Data.” 13 projects were chosen in the areas of manufacturing, mobility, energy, and healthcare from the more than 130 applications for data analytics submitted in the competition. Overall, DFKI Kaiserslautern and Saarbrücken as well as the Berlin Project Office are participating in five of the selected projects.

The research consortium, to which DFKI Kaiserslautern belongs, beat the competition in the subject fields of industry and energy to win two research projects: “PRO-OPT – Big Data Production Optimization in Smart Ecosystems” and “SmartRegio – SmartRegionalStrategy – Strategic Analysis of Heterogeneous Big Data in an urban environment.”

In PRO-OPT, consortium partners AUDI, Fraunhofer Institute for Experimental Software Engineering (IESE), camLine, and DFKI investigate effective and intelligent solutions for the analysis of big data in decentral, cooperative structures (smart ecosystems) under the lead management of DSA Daten- und Systemtechnik GmbH. Data sets in industrial production are increasingly larger, especially, because of digitization and automation. The data sources are found distributed among various economically independent participants in the ecosystem because, as a rule, the components used are from different manufacturers. General analyses must be broken down for these sources under consideration of access permissions. Big Data strategies should help here to enable such analyses or to design them more efficiently. The solution is being based on the automotive sector, because this occupies a key position in Germany and serves as a strong beacon for other sectors.

DFKI research departments Knowledge Management and Innovative Factory Systems have the task of developing the methods and tools for data modeling in smart ecosystems, data analysis in distributed integrated scenarios, and solutions for the integration of heterogeneous data sources.

The aim of the SmartRegio project is to support decision making, in particular, at small and medium sized enterprises with regional operations which may be significantly influenced by timely information about the status and development of their environment. This is clearly illustrated by the example of regional energy suppliers and grid operators: grid expansion, planning, management, and new service offers depend on demographic and regional economic factors or trends, which are outside the usual field of observation. Market tendencies, for example, like the growing e-Mobility will have consequences for the expansion of the regional power grids.

The project connects YellowMap and Disy, two SMEs that provide geodata and decision support services, with the data integration and platform specialist USU Software, Goethe University Frankfurt and DFKI, in order to implement a platform including exemplary evaluation services. In this way, customers such as regional energy suppliers, can have access to effective data-based, decision support tools. The platform is open for external data sources and third party service providers and should sustainably operate as a joint venture. The legal handling of relevant secure data is ensured. The DFKI Knowledge Management research department implements suitable data mining methods and integrates trend spotting in regional selected social media entries, is responsible for the orchestration of script-based services and ongoing system integration, and also

provides a connection to selected regional distribution grid operators.

The Intelligent User Interfaces department at DFKI Saarbrücken is involved in the Smart Data project “KDI – Clinical Data Intelligence.” In addition to lead manager Siemens, other partners include Charité Berlin, Friedrich Alexander University with the University Clinic Erlangen, Fraunhofer Institute for Integrated Circuits (IIS), and two SMEs Averbis and the Institute for Women’s Health.

The priority goal of this DFKI project is the evaluation of large, complex medical data sets from lab tests, genetic analyses, or clinical studies. Represented in a comprehensive patient data model, this data forms a reference basis for the definition and detection of disease patterns. Of major significance is the consideration of data security and anonymity, or use of pseudonyms, for data sources as the basis in the development of solutions used for the analysis of clinical data.

DFKI is mainly represented with four research subjects: general guidelines, usability, semantic annotation, and user interfaces for semantic searches for specific illnesses like breast cancer and kidney disease.

DFKI Project Office Berlin scored with the projects “SD4M – Smart Data for Mobility” and “Smart Data Web – Data value chains for industrial applications.”

Intelligent Big Data and Smart Data technologies for the mobility sector will be developed in the “Smart Data for Mobility” project. SD4M creates an ecosystem for multimodal smart mobility services on the basis of a software-defined environment for intelligent data management for optimizing utilization, planning, and forecasting of mobility service providers as well as for optimizing individual, flexible pricing and services. DB Systel leads the consortium which includes DFKI as the sole research institute teamed with industry partners Jinit[for digital communication, idalab, and PS Team Germany.

The other Berlin project “Smart Data Web – Data value chains for industrial applications,” combines the concept of data value chains with data and the latest technologies from Web 3.0, Big Data, and INDUSTRIE 4.0 for the first time. These “supply



Dr. Andreas Goerdeler (Federal Ministry for Economic Affairs and Energy), Dr. Daniel Sonntag (DFKI), Dr. Philipp Daumke (Averbis GmbH)

chains” for data and database services enable industry to optimize planning and decision processes through an evaluation of complementary “signals” from the continuously increasing volume of public and private company data. DFKI is the lead manager of the project that includes industry partners Siemens, Neofonie, VICO Research & Consulting, and uberMetrics in addition to the research partners University of Leipzig and Beuth University of Applied Sciences, Berlin.

These new Smart Data projects again confirm the success of the DFKI Berlin office. DFKI Berlin has three claims to optimal positioning in Big Data and Smart Data research: a major research focus on language technology under the leadership of Prof. Dr. Hans Uszkoreit, the new research group Intelligent Analytics for Big Data under the leadership of Prof. Dr. Volker Markl, and its participation in Berlin’s Big Data Center (BBDC).

On September 23, 2014, the projects selected for funding in the Smart Data technology competition were honored and presented to the public at the 44th Annual Conference of the German Informatics Society (GI). ◀

Dr. Ansgar Bernardi (DFKI), Dr. Simon Becker, Achim Büdenbender (both DSA Daten- und Systemtechnik GmbH), Wolfgang Putz (Fraunhofer IESE)



W3C Day 2014 in Berlin

World Wide Web Reaching New Sectors and New Industries

► Besides basic web technologies like HTML5 and CSS, the World Wide Web Consortium (W3C) is increasingly working on the standardization of technologies that enable the connection of industries with the Web. On the occasion of its annual W3C Day on September 10, 2014, the W3C German/Austrian Office organized a series of round table talks at the CINIQ Center for Data and Information Intelligence at the Fraunhofer HHI in Berlin. The purpose was to discuss web technologies and the current and future need for standardization and how it may affect industry with representatives from the German and Austrian manufacturing communities.

In three self-contained round table sessions with more than 30 selected participants, Dr. Jeff Jaffe (CEO W3C), Prof. Wolfgang Wahlster, Ivan Herman and Dave Raggett (both W3C) discussed the potential areas for cooperation that will advance the web standards that are relevant to each of their respective business sectors and are bound to influence them more and more in the future. The sessions were oriented on the general themes “e-Commerce and Web Payments,” “Web of Things and INDUSTRIE 4.0,” and “Digital Publishing and Media.” Besides the participating member organizations IBM, Deutsche Telekom, and Siemens, there were also representatives from other interested firms like Deutsche Bank, Harting, NXP Semiconductors, Springer, Bundesdruckerei, Cornelsen, Giesecke & Devrient, and Zalando. All took advantage of the opportunity to learn about W3C and the platform to share their wishes, needs, and experience in the open discussions. The presence of representatives from BITKOM, DIN, and VDI ensured close coordination with the major national agencies particularly for the subject of INDUSTRIE 4.0.

The lessons learned in the context of W3C Day provide a valuable service to W3C in the development of new, industry-specific web standards. This and other forms of participation in the integrated standardization process by existing and future W3C members is of tremendous importance to the success of the W3C mission: the continuous improvement of the web as an open platform for all users.

The expansion of the W3C standardization activities to these and several other vertical industries presents a variety of complex challenges. As a central pivot point, the Open Web Platform (OWP) provides a means for bringing new industries and sectors into the World Wide Web. Digi-

About the World Wide Web Consortium (W3C)

The World Wide Web Consortium (W3C) is an international community where member organizations, a full time staff, and the public work together on the development of web standards. W3C was founded 20 years ago by the inventor of the Web, Sir Tim Berners-Lee. W3C is supported by four host organizations: MIT in Boston, ERCIM in Sophia-Antipolis, Keio University in Tokyo, and Beihang University in Beijing. The W3C German/Austrian Office is one of 20 regional offices in the world. It has been housed since 2011 at DFKI Berlin.

More information
www.w3.org

tal Publishing is interested, for example, in the use and packaging of HTML5, CSS, and JavaScript for the purpose of distributing e-books and other forms of interactive publications based on standards like “ePub.” Mechanisms and protocols are also needed in regard to web payments so transactions and payment systems can be integrated as generic services in the Open Web Platform making numerous proprietary solutions a thing of the past. A common development platform is needed for the Web of Things and INDUSTRIE 4.0 in order to bridge the gap between the WWW established more than 20 years ago and generic “connected devices,” whether thermostats, home appliances or – in INDUSTRIE 4.0 – a complete manufacturing line. Again, OWP can provide an appropriate and established base technology for this effort. ◀

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Dave Raggett, Prof. Wolfgang Wahlster, Dr. Jeff Jaffe, Dr. Georg Rehm



Prof. Hans Uszkoreit, Head of research department Language Technology



Dr. Ben Gomes, Google Fellow and Vice President Search Engineering

Tech-Talk: Google and DFKI Discuss Current Trends in Search Engine Technology

► Search engines have long ceased to be simple services that supply the user with lists of hyperlinks to documents with possible hits. Rather, current browsers have a tendency to present relevant and targeted information directly, instead of confronting the user with long lists of documents and the task of having to sort through them for their relevance. In other words: Find is the new search!

On August 21, 2014, an event took place in the Berlin offices of Google that was dedicated to these and other ongoing trends in the search engine and knowledge technologies. The afternoon session was kicked off by two lectures. Dr. Ben Gomes, Google Fellow and Vice President of Search Engineering, presented a short summary of the Google search functionality and introduced the latest innovations like the Google Knowledge Graph. Prof. Dr. Hans Uszkoreit, scientific director at DFKI and head of the department of Language Technology, presented current research projects in the field of information and relation extraction. One subject mentioned was a soon to be

launched Big-Data project called “Smart Data Web,” in which a structured source of knowledge is to be created for the German language. Discussion of these and many other topics was continued in the subsequent panel discussion, moderated by Thomas Ramge (from *brand eins*, *The Economist* and others).

Tech-Talk was initiated and organized by Sandro Gianella, Google, and Dr. Georg Rehm, DFKI. ◀

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New Text Book About Human-Machine Interaction

► The majority of our everyday devices already function with information technology. Computers and machines are merging and computer scientists are challenged to design embedded computer systems that can adapt to human use and everyday situations so naturally that they are hardly noticed any longer as a computer.

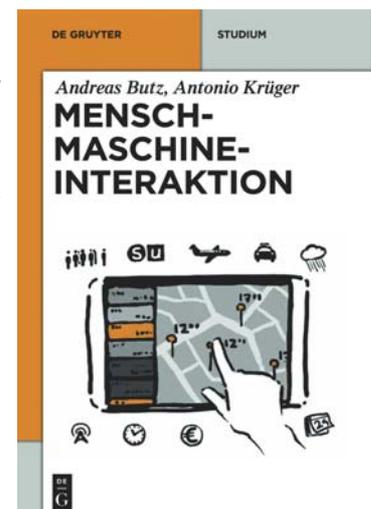
A new, compact text book “Human-Machine-Interaction” by Prof. Dr. Andreas Butz, Ludwig Maximilian University (LMU) Munich, and Prof. Dr. Antonio Krüger, scientific director at the Innovative Retail Lab of DFKI Saarbrücken, provides fundamental knowledge about one of the hottest topics in the field of media information systems. The text is not written merely for students of information technology, but rather for a broader target audience as an introduction to Human-Machine-Interaction. The content and structure of the book is based on an introductory lecture on the subject “Human-Machine Interaction” and conforms to the curriculum for this subject area as proposed by the “Association for Computing Machinery.”

The first part of the book deals with the basics of human sensory perception and information processing. The second section provides the technical basics about the machine or the computer and, in particular, the special rules of user interface design. The third section examines the development of interactive systems, or user centered design. The fourth and final section

gives the reader an overview of application areas like “desktop”, “web”, “touch”, and “mobile interaction” and forms a solid basis for further advanced lectures. The book is accompanied by a website with materials for students and lecturers. ◀

More information
www.mmibuch.de

Broschüre € 29,95
 ISBN 978-3-486-71621-4



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SmartFactory^{KL} Technology Demonstration at DFKI Kaiserslautern

SmartFactory^{KL} Continues Expansion Course

► Now with more than 30 members, SmartFactory^{KL} is growing ever faster. As a research and demonstration system for innovative industrial manufacturing, this technology initiative, established by Prof. Dr. Detlef Zühlke in 2005 has contributed substantially to the importance of the 4th Industrial Revolution in Germany and earned international attention. Scientists at SmartFactory^{KL} and DFKI's department of Innovative Factory Systems are sought after experts in the area of INDUSTRIE 4.0.

At Hannover Messe 2014, in collaboration with an industry consortium of nine partners, SmartFactory^{KL} presented the world's first manufacturer-independent INDUSTRIE 4.0 demonstration unit. The partners each supplied own components and higher-level infrastructure, which were then integrated in a flexible and expandable unit according to defined standards by the technology initiative.

"Like individual Lego blocks, the production modules can be combined and put in the required order, which leads the production process to function in a certain way," explained Prof. Zühlke. "The product itself transports the required data about customer specifications, production process, and priorities, enabling decentralized decision-making by each module." As a consequence, the production unit was a great attraction at the Hannover Messe 2014. "As a result of the great interest, we are pleased that several new partners have joined SmartFactory^{KL} and the industry consortium behind the technology demonstrator," added Prof. Zühlke.

The next scheduled appearance for the SmartFactory^{KL} and DFKI Innovative Factory Systems team is at the SPS IPC Drives trade fair in Nuremberg in November 2014. In Hall 10, Stand 633, you can find the initial research results from the project "INDUSTRIE 4.0 – Fundamental Roadmap for Medium-Sized Manufacturing Firms in Rhineland-Palatinate." The roadmap is intended to sensitize SMEs to the existing issues and to provide them with appropriate capabilities.

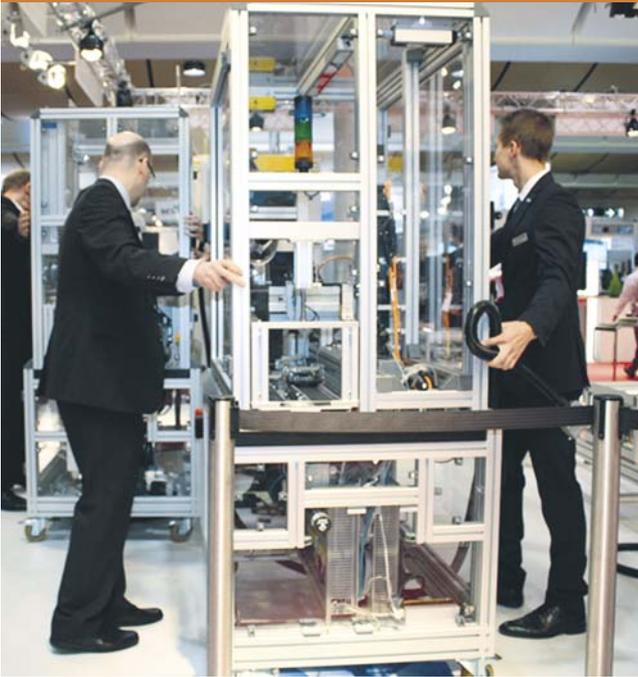
About SmartFactory^{KL} and DFKI

SmartFactory^{KL} is a non-profit technology initiative established in 2005 for the purpose of promoting an intensive network of actors from the industrial and research communities that can initiate and conduct joint research and development. At the core of the initiative is the manufacturer-independent demonstrator and research vehicle SmartFactory^{KL}, which is unique in all of Europe and hosted by DFKI Kaiserslautern. Innovative Information and Communication Technologies (ICT) are tested and further developed here in a realistic industrial production environment. The research scientists at DFKI and the technology initiative SmartFactory^{KL} have contributed pioneering research and development results to the revolutionary concepts of the "Factory of the Future." With nearly a decade of experience and strong continuing partnerships, it is regarded as one of the major co-founders of the INDUSTRIE 4.0 movement.

Next year at Hannover Messe 2015 (April 13-17, 2015), DFKI, SmartFactory^{KL} and project partners will present the advanced demonstrator for INDUSTRIE 4.0 which combines existing as well as some new modules in an optimized overall infrastructure. Come experience the vision and reality of INDUSTRIE 4.0 for yourself in Hall 8, Stand D20. ◀

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Plug'n'Produce – Substituting a production module



Prof. Detlef Zühlke, State Secretary Uwe Hüser

“INDUSTRIE 4.0 Compatible” – 6th Innovation Day at *SmartFactory*^{KL}

► The 4th Industrial Revolution – the merging of modern information technologies with traditional industrial processes – has become a complex topic within the industrial sector. The Innovation Day at *SmartFactory*^{KL} held at DFKI Kaiserslautern on September 18, 2014 clearly showed that determination is needed now to pave the road for the broad implementation of INDUSTRIE 4.0.

Innovation Day is a leading meeting place for industry, business, scientific, and government actors when it comes to detailed discussions about visions and core technologies, and mapping of a solid implementation plan for the factory of the future. In a series of lecture/workshops under the motto: “INDUSTRIE 4.0 – Compatible,” discussions were focused on system demonstrators and how to achieve standards for manufacturer-independent, efficient production processes.

The team of Prof. Dr. Detlef Zühlke, Director, DFKI Innovative Factory Systems (IFS) Department and CEO of *SmartFactory*^{KL} supplied impressive evidence that such paradigms are already available for INDUSTRIE 4.0. Now is the time to implement the concepts tested in the demonstrators and prototype factory systems into actual production technologies and work concepts. This position is one that government, industry, and research all agree on: “It is time to turn vision into practice. In the state of Rhineland-Palatinate, for example, we want our firms to benefit as soon as possible from this development. Precisely because the small and medium sized enterprises often do not have the technological and organizational conditions that exist in large firms,” said Uwe Hüser, State Secretary in the Ministry of Economics, Climate Protection, Energy, and Planning (MWKEL) Rhineland-Palatinate in his opening remarks. MWKEL and *SmartFactory*^{KL} are working on the foundations for an implementation strategy, which should assist Rhineland-Palatinate businesses to improve their competitiveness by the application of INDUSTRIE 4.0 approaches. The midterm aim is to develop a roadmap with the actors in business and research that smoothes the way for the implementation of INDUSTRIE 4.0 in SMEs.” This would likely not be possible without a network like *SmartFactory*^{KL} and DFKI,” said Hüser.

The 4th Industrial Revolution promises the optimization of productivity, quality, flexibility, and working conditions in industrial manufacturing. Over the years, the once visionary slogans have become the basic core subjects, yet the current systems are not by any means at the level of INDUSTRIE 4.0 compatibility. “The first elements could find their way into production in just a few years. However, the truly smart factory will take ten years to become reality,” anticipates Prof. Zühlke. “We must first ensure compatibility and meet the challenges in matters of system security. If all work energetically together in the future, the positive development of INDUSTRIE 4.0 will continue,” said Zühlke in summing up the Innovation Day. “First, establish the standards and then continuously adjust for the future advances. Especially in this research area, Germany must remain a leader and above all, it must act quickly.” ◀

Modular setup of an INDUSTRIE 4.0 manufacturing line



DFKI Supports the Energy Transition

► Start of Research Project PolyEnergyNet

Power supply grids of the future should be effectively organized with an integrated approach. This is the way to ensure better management of power fluctuations in the grids and better protection against natural disasters or cyber-attacks.

PolyEnergyNet – resilient poly-grids for a secure energy supply – performs research on highly resistant local grids with multiple forms of energy, develops and implements demonstrators, and plans the pilot phase. Beyond the electricity grid as the “lead grid,” the components include heat and gas grids for all the different generators, storage, and consumers. An ICT system supports the monitoring and management of the overall system, which is called a poly-grid.

Such grids are characterized by robust operations that can respond to the fluctuations in supply from decentralized, renewable energy sources as well as to unforeseen events including hacker attacks. The aim of the project is to create a suitable data infrastructure that will permit emergency operations - even under critical grid conditions - to be maintained within a local power grid or route or, at least, to quarantine some section until re-integration to the full grid system becomes possible.

The focus of PolyEnergyNet is to develop a holistic system that is tolerant of malfunctions in individual sub-sections that function independently from one another. Real time data is captured and evaluated in each subsystem. In this way, external attacks or critical conditions within the poly-grid can be rapidly identified, sealed off, and corrected in just a short time.

DFKI has already played a major role as a research partner in the PeerEnergyCloud project, which studied the intelligent use of alternative energies through cloud solutions and energy trading between neighbors. In PolyEnergyNet, with its expertise in the areas smart grids, smart metering, and AI methods, DFKI accepts the challenge of merging the data captured from the individual sub-components (local grid transformers, smart meters, control centers, etc.). On the basis of these values, calculations can be performed using machine-learning methods, which are then used in forecasting.

The PolyEnergyNet project is sponsored by the Federal Ministry for Economic Affairs and Energy (BMWi) and is funded for a period of more than three years. It is a Software Cluster project and the partners include: DFKI, KIT (Karlsruhe), Technische Universität Berlin, Scheer Management (Saarbrücken), Stadtwerke Saarlouis, Technische Universität Darmstadt, [ui!] - The urban institute® (Chemnitz), VOLTARIS (Maxdorf), VSE Verteilnetz (Saarbrücken) and B.A.U.M. Consult (Munich).



Photo: Saarland State Representative Office in Berlin

First informal exchange and visit to LIESA in Berlin (l. to r.): Christian Petry (SPD), Member of Federal German Parliament; Prof. Dr. Wolfgang Wahlster, CEO DFKI; Peter Altmaier (CDU), Federal Minister and Head of the Federal Chancellery; Dr. Ralf Levacher, CEO Stadtwerke Saarlouis; Johannes Hauck, Hager Electro.

LIESA Initiators Meet Politicians and Energy Experts in Berlin

Beyond this specific project, DFKI is also involved in Saarland's State Initiative for Energy Innovation (LIESA). This association is a network of the major actors dedicated to the advancement of “Energy State Saar” and the energy transition. In this context, on September 22, 2014, in the Saarland State Representative Office to the Federal German Government in Berlin LIESA hosted an information event for high ranking representatives from government, business, and research to discuss the latest concepts for the integration of the areas of electricity, heat, and e-mobility. ◀

More information
www.polyenergynet.de



PolyEnergyNet



Software-Cluster

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Example of an INDUSTRIE 4.0 manufacturing process on the RES-COM demonstrator

Conserving Resources with Intelligent Production Processes – Successful Conclusion to RES-COM Research

► The research project RES-COM (resource conservation through context-activated machine-machine communication) studied industrial manufacturing processes for a period of three years to learn how they could be designed to be highly configurable, with decentralized control and optimum resource-efficiency (economical and environmental).

RES-COM was funded under the ICT 2020 research initiative of the Federal Ministry of Education and Research (BMBF) and functioned as a forerunner project and innovator for ongoing activities in the future-oriented project “INDUSTRIE 4.0” in Germany.

In this future form of industrial production, the rigid centralized control of traditional manufacturing is replaced by the innovative, decentralized manufacturing architecture of cyber-physical production systems. Designed with sensor systems and wireless networks, the system components themselves control manufacturing, identify complex events and critical states in the manufacturing processes, react to them, and subsequently, adjust plans for the downstream activities in the smart factory. Such architecture requires the “Internet of Things” for industrial production, in which individual parts of the product are explicitly identifiable and can be virtually represented. The key technologies have already been developed in the collaborative project SemProM.

Resource optimization is another integrable parameter in this kind of adaptable production process. The responsible use of limited natural resources and raw materials as well as a reduction in CO₂ emissions is a social challenge as well as an environmental and economic imperative. The future implementation of efficient conservation of resources like energy, water, air, and valuable raw materials will be software-controlled and context-activated through technical communication among the various IT systems. DFKI presented project results at the official project close on June 26, 2014 in the historic administration building of the Siemens plant at Rohrdamm in Berlin to representatives of BMBF and DLR (German Aerospace Center).

Welcomed guests included Dr. Jeffrey Jaffe, CEO of W3C, and other participants of a workshop of the World Wide Web Consortium (W3C) on the standardization of web technologies for the Internet of Things which took place at the same time. Project partners Siemens, SAP, IS Predict, 7x4 Pharma, Harting and Karlsberg demonstrated a typical INDUSTRIE 4.0 assembly process that applies the basic technologies of cyber-physical systems and the Internet of Things.

DFKI was involved as lead manager through its Intelligent User Interfaces and Innovative Factory Systems departments. Both of these research departments develop core technologies like the active digital product memory and semantic orchestration of service-oriented production processes, in addition to application driven components such as Plug'n'Produce for dynamic structural adaption, automatic recognition of intention in user actions in a factory environment, and intelligent data access from mobile devices.

DFKI continues its research in these areas in the follow-on project SmartF-IT, which is concerned with the next generation of intelligent IT systems for managing complexity in planning, operation & maintenance, and fault management in cyber-physical production systems in networked smart factories. ◀

More information
www.rescom-projekt.de
www.semproj.org
www.smartf-it-projekt.de

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Prof. Wolfgang Wahlster, Dr. Erasmus Landvogt (BMBF), Dr. Jeffrey Jaffe, CEO W3C



Sociovestix Labs – Sustainable Investment Decisions with Intelligent Analysis Methods

► The financial markets are changing. In deciding where to invest their money, large investors like mutual funds or pension funds are increasingly looking at environmental, social, and ethical issues. Sociovestix Labs Ltd. is a relatively new startup that develops methods to help identify relevant companies and evaluate their sustainability.

The company, founded in 2012 by members of the DFKI staff and the University of St. Andrews, UK, was invited to introduce its technologies at the “Research, Innovation and Stewardship 2014 Conference” at Bloomberg in New York, which was organized as part of the UN-Initiative PRI (Principles for Responsible Investment) - the ultimate accolade for an aspiring young startup.

Sociovestix Labs analyses social media channels, financial data, and data from rating agencies to assess company business patterns, image, and reputation and generate insight based on environmental, social, and governance factors. At the same time, these sources are used as a mirror of society to indicate the attention focused on the company in terms of social or environmental factors, for example, climate change, human rights, or child labor.

Dr. Damian Borth, DFKI researcher and co-chairman of Sociovestix Labs, emphasized the extraordinary interdisciplinary nature of the startup: “Our technologies connect the world of pattern recognition and machine learning with that of financial analysis and investment strategy. We call this new and exciting field ‘Financial Data Science.’ This holds enormous new assessment possibilities for the sustainable investment process.”

Prof. Dr. Andreas Dengel, site director for DFKI in Kaiserslautern and scientific director of the Knowledge Management department sees great potential in the company: “The intelligent analysis of Big Data, that is, very large volumes of data, represents an important basis of information for making strategic business decisions. Sociovestix Labs provides evidence of how, with the technologies of knowledge management and system-



Dr. Damian Borth presents Sociovestix Labs

atic information extraction, the identification and evaluation of sustainable enterprises can enable better economic decision-making.”

To emphasize its sustainable aims, Sociovestix is deliberately organized as a “social enterprise,” which is a form of business organization in Great Britain for companies that apply social as well as commercial strategies. A social objective is, among other things, to give social groups a voice in traditional and new markets. This aim is achieved by communicating their sustainability concerns to both conventional shareholders as well as socially responsible investors.

The company is managed by Dr. Damian Borth (UC Berkeley & Int. Computer Science Institute, Berkeley) and Prof. Andreas Hoepner (ICMA Center, Henley Business School, University of Reading, UK) and the company headquarters is in Great Britain. Permanent offices are also maintained at DFKI Kaiserslautern, so in the future there will always be a direct link to the cutting-edge research in the field of innovative software technology. ◀

More information
www.sociovestix.com
www.unpri.org
www.dfkf.de

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Photo: Katie Gilbert, UN PRI Events



Photo: MEYER WERFT GmbH/Johanniter-Unfall-Hilfe e.V.

Sensor suit detects stressful movements. The instrumented garment is being tested for use by welders, shipyard workers and emergency rescue teams.

Sensor Suit Protects Workers Against Strain

The collaborative project “SIRKA” is testing integrated miniature sensors to measure the activity of welders and paramedics during their everyday work routines and to warn them of critical behavior patterns – BMBF has funded the project with one million euros.

► Physically demanding occupations that include highly stressful movements pose a significant risk of muscular-skeletal disorders that normally manifest themselves later in life. The launch of the research project SIRKA (“Sensor Suit for Individual Feedback on Physical Activity”) should help in the development of a sensor suit that can identify overexertion and propose alternative procedures and patterns of movement. The concept: Integrated miniature sensors measure the movements of the wearer and call immediate attention to adverse movements. The development team at Budelmann Elektronik in Munster, Germany is testing the sensor suit with welders, shipyard workers, and emergency rescue teams.

This collaborative project is funded with 1.1 million euros by the Federal Ministry of Education and Research (BMBF) under the framework of its research funding priority “Human Computer Interaction in Demographic Change.” The total funding for the two-year project is about 1.88 million euros. Seven partners from the German industrial and research landscape are working closely together on the project. In addition to lead manager Budelmann Elektronik, other partners include: Rofa Clothing in Schüttorf, MEYER WERFT in Papenburg, Johanniter Ambulance Service in Berne, DFKI-Bremen, OFFIS - Institute of Information Technology in Oldenburg, and the Osnabrück University of Applied Sciences.

Two-step Application: Diagnosis and Correction

The suit should be used in a two-step procedure. The diagnostic function comes first in order to produce a detailed record of the movements. Company doctor, physiotherapist, and user analyze the data together to arrive at a conclusion for initiating preventive and rehabilitative measures. For example, critical movement patterns can be replaced by others or avoided entirely through the use of tools or other aids. The collection and analysis of data is performed taking data protection into account. In a second step, the suit helps to implement the findings of step one. By means of an acoustic warning signal, the suit tells the wearer when a stressful movement occurs. As a result, the trained wearer is aware of the risky behavior and has the possibility to correct it. Furthermore, the cumulative daily loads can be recorded for self-monitoring purposes.

After a successful conclusion of the project, the sensor suit may find application in other occupational fields. In the future, workers can have protection in the performance of their jobs, without feeling restricted. ◀

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DFKI Professor Hertzberg Honored with Highest European Award for Artificial Intelligence

► On August 20, 2014, Joachim Hertzberg, scientific director at DFKI Osnabruck, was presented with the ECCAI Fellowship. The European Coordinating Committee for Artificial Intelligence (ECCAI) honored Prof. Dr. Hertzberg for his outstanding service to science.

The Fellows program recognizes top scientists who have made significant, sustained contributions to the field of Artificial Intelligence. "I am very pleased with this recognition from the scientific community in Europe: This once again emphasizes and ennobles our work in European research projects," said Joachim Hertzberg at the conclusion of the ceremony.

The computer scientist has a Ph.D from Bonn and habilitated in Hamburg. Prior to assuming the professorship for knowledge based systems at Osnabruck University in 2004, he was employed at non-university research institutes like GMD (now, Fraunhofer Society for Applied Research, FhG). Since 2011, he has also served as head of the Osnabruck branch of the DFKI Robotics Innovation Center located at Osnabruck University. Hertzberg's expertise is the plan-based control of robots: He studies the question of how to enable goal directed actions in autonomous robots over long periods of time under changing environmental conditions. One field of application involves independently working agricultural machinery and how to achieve autonomous and smooth cooperation at harvest time in the fields.



Overall, six DFKI scientists have received this coveted honor since the founding of the institute in 1988. Professor Dr. Wolfgang Wahlster, head of DFKI and an ECCAI Fellow himself since 1999, is pleased with the latest recognition: "This explicitly underscores once again the leading position of DFKI scientists in AI research. No other research center in Germany has produced more ECCAI Fellows." ◀

More information
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DFKI Fellowship for Prof. Dr. Horst Bunke

► On September 30, 2014, Prof. Dr. Horst Bunke retired as member of the Scientific Advisory Board (SAB) of DFKI after more than 15 years of service. Since 2008, Prof. Dr. Bunke has chaired the panel of international experts that semi-annually reviews the progress of publicly funded DFKI projects. The newly designated chairperson is Prof. Dr. Markus Gross.

At his official farewell ceremony, Prof. Bunke was named a DFKI Fellow. The highest honor awarded by DFKI is given to internationally renowned scientists and important sponsors who have contributed in an extraordinary manner to the German research center.

DFKI CEO Prof. Dr. Wolfgang Wahlster praised the outstanding work of Prof. Bunke: "My colleague, Horst Bunke served with his vast knowledge and experience in pattern recognition not only as an excellent mentor for our funded projects, but also with his broad international network as an ambassador of

DFKI, who during his many stays at the world's top research institutes always represented the accomplishments of DFKI in the most positive light." As a member of the SAB, Prof. Bunke guided 14 projects as mentor, chaired 14 Advisory Board meetings and audited more than 60 projects. Until his retirement in 2011, the professor for computer science was Chair of Computer Vision and Artificial Intelligence at the University of Bern.

Prof. Dr. Markus Gross New Chairperson of the DFKI Scientific Advisory Board

Prof. Dr. Markus Gross has been a member of SAB since 2009 and, like his predecessor, is acknowledged as an internationally recognized scientist in the field of computer engineering. He is a full professor for computer science at ETH Zurich, Dean of Computer Graphics Laboratory, and also, Director of Disney Research in Zurich. ◀



Prof. Wahlster (left) presents certificate of DFKI Fellowship to Prof. Bunke



The new chair of the SAB, Prof. Gross, thanks his predecessor

Forschungsverbund Campus „Automatisierung und Digitalisierung“



Contract signature in Munich: Prof. Dr. Bernd Huber (President LMU), Dr. Wolfgang Heuring (Director, Siemens Research), Prof. Dr. Claudia Eckert (Fraunhofer AISEC), Prof. Dr. Wolfgang A. Herrmann (President TUM), Dr. Walter Olthoff (CFO and member of executive management at DFKI), Klaus Helmrich (Director and CTO Siemens AG)

DFKI Partners in Digital Revolution Research Network “Automation and Digitization Campus”

► Partners from the industry and research communities are cooperating in a new kind of joint research network to study the future-oriented fields of “Automation and Digitization.” Siemens is the first company to join with universities and institutes to form a research network that follows a new integrated approach to combine the best competencies and to enable comprehensive process and systems innovation.

The research collaboration on “Automation and Digitization” started in July 2014 with partners: Technical University of Munich (TUM), Ludwig Maximilian University of Munich (LMU), Fraunhofer Institute for Applied and Integrated Security (AISEC), and DFKI.

Within the network, researchers work together on the software and technologies for automation and digitization in manufacturing as well as for the Internet of Things, Cloud platforms, IT security, and Smart Data.

The research results from the campus for “Automation and Digitization” are to be further developed to bring products to market. The research network solicits partners from around the world for its international projects, which makes it highly interesting for companies as well as for universities and institutes. At the same time, extensive doctorate and post-doctorate programs are planned in which up to 100 PhD candidates train together. In this way, the campus makes a substantial contribution to strengthening Germany as an economic and scientific center.

DFKI has been researching innovative concepts for production in the digital economy for some time. “INDUSTRIE 4.0 brings the Internet of Things into the factories. DFKI has been instrumental in shaping the scientific basis for INDUSTRIE 4.0 and was the first to demonstrate its practical application in the “Smart Factory,” said Prof. Dr. Wolfgang Wahlster, CEO of DFKI and one of the initiators of INDUSTRIE 4.0. “Only through co-

operation with leading industry partners like Siemens will it be possible now to create the conditions for implementation in routine factory operations and to make Germany the leading supplier of digitization for the manufacturing industry.”

DFKI and Siemens are already developing two sub-projects within the framework of the “Automation and Digitization” campus. Networked production processes and assembly activities pose many technical challenges for the interaction of autonomous cyber-physical assembly modules, which consist of many different components in their own right. The “Semantic Technologies for Future Automation Systems” project is dedicated to the organization, management, and administration of networked cyber-physical assembly modules and internally used components by means of semantic technologies.

The other one is “Technology Analysis of Digital Twin Models,” which is concerned with the virtual representation of products. The digital twin takes over the communication of a product with all the relevant manufacturing processes on the basis of a standardized semantic data exchange. This could be the separate components of a cyber-physical assembly unit, the selected conveyance, the refrigeration unit in the warehouse, or even the human who performs the quality management. ◀

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► DFKI Interview – Dr. Jan Albiez

Dr. Jan Albiez is a research scientist at the DFKI Robotics Innovation Center (RIC) in Bremen. Currently, he is supporting the development of the Brazilian Institute for Robotics in Salvador da Bahia, which is modeled on RIC.

What is the potential application of your research?

The focus of my research in Bremen and now also in Brazil is on the employment of intelligent robots in extreme environments, specifically underwater. The range of potential applications stretches from the scientific exploration of the ocean systems to sustainable exploitation of marine resources. Intelligent robots can make an important contribution to better understanding, protecting, and using the world's oceanic systems.

When did your interest in Artificial Intelligence begin and how have AI processes changed since that time?

After an internship dealing with the control of walking machines, I landed head-over-heels as a student research assistant in the exciting field of robotics and artificial intelligence at the Research Center for Information Technology (FZI) at the Karlsruhe Institute of Technology. Since that time, probabilistic algorithms have taken hold in robotic-AI. Meanwhile, we no longer define states, representations, and decisions with precision, but rather factor in some “free play.”

What are the greatest challenges and opportunities for AI systems?

In my opinion, robotics overall is an enormous field of application for AI. A robot has a physical presence and acts as part of an environment, which means a great increase in complexity and higher reliability requirements. The algorithms that enable a robot to reliably identify a situation, analyze it, and then react accordingly have yet to be developed and implemented in the system applications.

What do you enjoy doing when you are not working as research scientist?

I like to spend my free time outdoors, preferably on or in the water, and always with my camera ready. I like scuba diving and sailing, both things that I can easily do here in Brazil.

Do you see any parallels to your professional work?

I enjoy working on projects that take the robot out of the lab and into real conditions, in the outdoors or in water. These application areas coincide with my preferred leisure environments.

What are your current projects?

I am supporting the establishment of an Autonomy lab at the Brazilian Institute of Robotics (BIR), lead the technical part of the first BIR project “FlatFish,” and I present lectures on the subject of autonomous robots. The aim of FlatFish is to develop an autonomous underwater vehicle (AUV), which can inspect an off shore oil production unit on the sea floor with the aid of a docking station while making independent decisions. The project is being performed in close coordination with the Bremen RIC, where both prototype robots are built.

The job in Salvador involves test and evaluation of AUVs at sea and the coordination with BG Group, the customer in Rio de Janeiro. In addition to the great technical challenges, I find the most interesting aspect is the close cooperation with the off-shore industries. This, in particular, is an area that can be accomplished and greatly improved with the help with robotics and AI.

During a visit to Salvador da Bahia in June 2014, Federal Chancellor Dr. Angela Merkel met with representatives of SENAI CIMATEC (Center for Integrated Manufacturing and Technology). Dr. Jan Albiez (third from left), RIC, presented the scientific cooperation with the Brazilian Institute of Robotics (BIR).



Photo: Guido Bergmann, BPA

► Alliance for Next Generation Language Dialog Systems: Partnership with Nuance

In 2014, Nuance Communications of Germany acquired shares in DFKI to become our 17th industry partner. This expands the circle of prestigious DFKI partners, institutionalizes the long-term cooperation with Nuance, and facilitates the transfer of innovative research to the economy. Nuance intensified the cooperation with the scientific community and strengthens the future perspectives of its technology product portfolio.

► Volker Markl is One of Germany's "Digital Brains"



An initiative of the German Informatics Society (GI) appointed a jury to select the men and women who represent Germany's new generation of digital "makers and shakers." Prof. Dr. Volker Markl, head of the research group Intelligent Analytics for Massive Data at DFKI and the special subject area Database Systems and Information Management (DIMA) at TU Berlin is one of them. In defending the selections, the jury highlighted Markl's versatility and recognized not only his work in the research field of analysis and processing of huge volumes of data and their successful transfer to application, but also his consultancy work with the issues of Big Data for the European Commission, several federal ministries, numerous start-ups and other companies.

More information

www.digital-ist.de/aktuelles/das-sind-deutschlands-digitale-koepfe.html

► Best Paper Award for Professor Markl

Prof. Dr. Volker Markl, head of DFKI research group Intelligent Analytics for Massive Data and his team were honored with the Best Paper Award for the paper: "M4: A Visualization-Oriented Time Series Data Aggregation" at the 40th International Conference "Very Large Data Bases 2014" (VLDB2014) in Hangzhou, China.

► Best Paper Award for Swoozy – UBICOMM

DFKI researchers Simon Bergweiler and Matthieu Deru received the Best Paper Award at the 8th International Conference on Mobile, Ubiquitous Information Processing (UBICOMM) in Rome for their submission "Swoozy – An Innovative Design of a Distributed and Gesture-based Semantic Television System." Swoozy is an interactive TV system that enables the search for information related to current programming direct directly from the TV screen.

More information

www.swoozy.de

► DFKI and ESA Sign Memorandum of Understanding



Photo: Press office of the Senator for Economics, Labor, and Ports

DFKI Robotics Innovation Center and the European Space Research and Technology Center (ESTEC) of the European Space Agency (ESA) have signed a Memorandum of Understanding, which documents their agreement to cooperate in the training of young scientists and the reciprocal use of their research infrastructures. The agreement concluded during a delegation visit initiated by Bremen's Senator for Economics Martin Günthner, includes future cooperation on space research projects as well as field trials on earth for the evaluation of new space technologies.

Bremen Senator Martin Günthner watches ESA Director Franco Ongaro and DFKI Professor Frank Kirchner (front right) sign the memorandum of understanding

► Euro Space Day – The Potential of European Space Travel for Saar-Lor-Lux

The Saarbrücken Regional Association organized "Euro Space Day" on October 22, in cooperation with ESA in the palace of the state capital. In combination with an entrepreneur trade fair, the key attraction unique in all of Germany was the public live-video link to German astronaut Alexander Gerst in the International Space Station. The aim of the event was to provide impetus to regional companies and universities to cooperate with ESA and the aeronautics and space sector as a whole. In presenting the Robotics Innovation Center located in Bremen, DFKI also provided a model of the biologically inspired, walking robot Scorpion and participated in a panel discussion on the potential of space flight for the coming decades.

► Long Night of Industry in Saarbrücken and Kaiserslautern

On October 16, 2014, DFKI Saarbrücken opened its doors for the "Long Night of Industry" and showed interested members of the public prototypical and production-related systems with strong application potential. The "Long Night of Industry" in Kaiserslautern took place on November 6, 2014. Highlights on display included various Augmented Reality (AR) technologies, digital pens and electronic paper, and the SmartFactory KL demonstrator system for INDUSTRIE 4.0 compatible manufacturing processes.

More information
www.langenachtderindustrie.de

► Reinhard Karger New President of the German Society for Information and Knowledge (DGI)

In May 2014, the DFKI corporate spokesman was elected to succeed Prof. Dr. Stefan Gradmann by a large majority of the members at the General Meeting, convened at the end of the the 3rd DGI Conference.



More information
www.dgi-info.de

DGI Executive Board: Reinhard Karger, Barbara Reißland, Clemens Weins, Elgin Jakisch, Dr. Luzian Weisel, Peter Genth.
 Not pictured: Matthias Staab, Prof. Dr. Stefan Gradmann, Alexander Botte

► Research Department ASR Introduced the Latest Trends in Visualization to Representatives from the Plant Engineering and Construction Industry

On July 8, 2014, DFKI's Agents and Simulated Reality Labs (ASR) hosted the 7th meeting of the Working Group on Trade Fairs and Marketing of the VDMA professional associations for Fluids and Power transmission. For VDMA member companies with international operations, the current visualization technologies from DFKI provide a critical value added for future oriented industries or trade fair concepts.

More information
<http://viscenter.dfki.de>, Contact: Silke.Balzert@dfki.de

► International Symposium on Pervasive Displays 2015 at DFKI Saarbrücken



On June 10-12, 2015, the 4th International Symposium on Pervasive Displays (PerDis) will be held at DFKI Saarbrücken. This still relatively young symposium brings together researchers from diverse areas that deal with the challenges and opportunities presented by public and semi-public displays. Last year PerDis was hosted by the University of Copenhagen and the year before in California on the Google Campus. General Chairs of the fourth symposium in Saarbrücken were Prof. Dr. Antonio Krüger and Dr. Sven Gehring from Innovative Retail Lab.

More information
<http://pervasivedisplays.org/2015>, Contact: Sven.Gehring@dfki.de



DFKI Service Offering

As an internationally renowned Center of Excellence for innovative software systems based on Artificial Intelligence (AI) methods, DFKI is offering the following services with more than 25 years of experience in basic and applied R&D:

- ▶ Technology transfer of the award-winning research results of DFKI
- ▶ Innovation coaching and start-up consulting in the Public-Private-Partnership sector
- ▶ Individual design, development and implementation of innovative application solutions
- ▶ Market studies, expert surveys, feasibility analysis and empirical user studies
- ▶ Component development with AI-functionality, enhancing the performance of complex software systems
- ▶ Scientific advice on the selection and implementation of complex software solutions
- ▶ Customization, implementation, deployment and maintenance of our AI-solutions
- ▶ Scientific evaluation and benchmarking of software solutions
- ▶ Application-oriented basic research
- ▶ Independent assessment of IT-security and privacy
- ▶ Technology workshops, training and practice
- ▶ Scientific monitoring of data collections and their evaluation
- ▶ Business engineering: Process analysis and development
- ▶ Innovation coaching and turnaround management
- ▶ Strategic and technical due diligence consulting for companies in the ICT sector
- ▶ Technical and organizational support for the standardization in the IT sector (Including W₃C, ISO)
- ▶ Design, construction and operation of Living Labs



Kaiserslautern Site



Saarbrücken Site



Bremen Site



Project Office Berlin

German Research Center for Artificial Intelligence

Company Profile

- ▶ **Established**
1988
- ▶ **Legal Form**
Non-profit organization
(public-private partnership)
- ▶ **Executive Board**
 - ▷ Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster, CEO
 - ▷ Dr. Walter Olthoff
- ▶ **Supervisory Board**
 - ▷ Prof. Dr. h.c. Hans-Albert Aukes,
Chairman
 - ▷ Dr. Susanne Reichrath, Representative of
Saarland's Minister President for Higher
Education, Science and Technology,
Vice Chairwoman
- ▶ **Locations**
Kaiserslautern (registered office), Saarbrücken,
Bremen, Berlin (project office). Further opera-
ting sites in Osnabrück and St. Wendel
- ▶ **Shareholders**
Airbus, BMW Group Forschung und Technik
GmbH, CLAAS KGaA mbH, Daimler AG, Deutsche
Messe AG, Deutsche Post AG, Deutsche Telekom
AG, Empolis Information Management GmbH,
Fraunhofer Gesellschaft e.V., Harting KGaA, Intel
Corporation, John Deere GmbH & Co. KG, KIBG
GmbH, Microsoft Deutschland GmbH, Nuance
Communications Deutschland GmbH, RICOH
Company, Ltd., SAP SE, Software AG, University of
Kaiserslautern, Bremen University, Saarland
University, VSE AG
- ▶ **Equity Holding**
Center for the Evaluation of Languages and
Technologies Srl (CELCT), Trento - Graphics-
Media.net GmbH, Kaiserslautern - Ground Truth
Robotics GmbH, Bremen - SemVox GmbH, Saar-
brücken - Yocoy Technologies GmbH, Berlin

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Intelligent Solutions for the Knowledge Society

▶ The German Research Center for Artificial Intelligence (DFKI) was founded as a non-profit Public-Private-Partnership (PPP) in 1988. Today, it has research facilities in Kaiserslautern, Saarbrücken and Bremen, a project office in Berlin and branch offices in Osnabrück and St. Wendel. DFKI is the leading research center in Germany in the field of innovative commercial software technology incorporating the methods of Artificial Intelligence.

Based on application oriented basic research, DFKI develops product functions, prototypes and patentable solutions in the field of information and communication technology. Research and development projects are conducted in fifteen research departments, nine competence centers and six living labs. Funding is received from government agencies like the European Union, the Federal Ministry of Education and Research (BMBF), the Federal Ministry for Economic Affairs and Energy (BMWi) and the German Federal States as well as from cooperation with industrial partners. A committee of internationally renowned experts (Scientific Advisory Board) audits the progress and results of state-funded projects semi-annually. In addition, every five years BMBF evaluates DFKI. The most recent assessment was successfully concluded – again with very positive results.

Besides the state governments of Rhineland-Palatinate, Saarland, and Bremen, numerous renowned German and international high-tech companies from a broad spectrum of industry are represented on the DFKI supervisory board. The DFKI model of a non-profit public-private partnership (PPP) is recognized nationally and internationally as a model corporate structure in the area of leading edge research.

DFKI is actively involved in numerous organizations representing Germany as an excellent location for cutting-edge research and technology. DFKI enjoys an excellent reputation far beyond the country's borders for its academic training of young scientists. At present, 425 highly qualified researchers and 323 graduate students from more than 60 countries are contributing to more than 300 DFKI research projects. DFKI serves as a stepping stone to leading positions in industry or successful careers as founders of spin-off companies. Over the years, more than 60 staff members have been appointed professors at universities in Germany and abroad. ◀

Research & Development

▶ Scientific Directors and Research Departments

Kaiserslautern Site

- ▶ Prof. Dr. Prof. h.c. Andreas Dengel: Knowledge Management
- ▶ Prof. Dr. Paul Lukowicz: Embedded Intelligence
- ▶ Prof. Dr.-Ing. Hans Schotten: Intelligent Networks
- ▶ Prof. Dr. Didier Stricker: Augmented Vision
- ▶ Prof. Dr.-Ing. Dr. h.c. Detlef Zühlke: Innovative Factory Systems

Saarbrücken Site

- ▶ Prof. Dr. Josef van Genabith: Multilingual Technologies
- ▶ Prof. Dr. Antonio Krüger: Innovative Retail Laboratory, St. Wendel
- ▶ Prof. Dr. Peter Loos: Institute for Information Systems
- ▶ Prof. Dr. Philipp Slusallek: Agents and Simulated Reality
- ▶ Prof. Dr. Hans Uszkoreit: Language Technology
- ▶ Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster: Intelligent User Interfaces

Bremen Site

- ▶ Prof. Dr. Rolf Drechsler: Cyber-Physical Systems
- ▶ Prof. Dr. Frank Kirchner: Robotics Innovation Center
- ▶ Prof. Dr. Joachim Hertzberg: Robotics Innovation Center, Branch Office Osnabrück

Project Office Berlin

- ▶ Prof. Dr. Volker Markl: Intelligent Analytics for Massive Data
- ▶ Projects and cooperation in the German capital region

▶ Living Labs

Testing, evaluation, and demonstration of innovative technologies in comprehensive application scenarios
Advanced Driver Assistance Systems Living Lab, Bremen Ambient Assisted Living Lab, Innovative Retail Lab, Robotics Exploration Lab, Smart City Living Lab, Smart Factory Lab

▶ Competence Centers

Coordination of research activities in particular areas
Ambient Assisted Living, Case-Based Reasoning, Computational Culture, Human-Centered Visualization, Language Technology, Multimedia Analysis & Data Mining, Safe and Secure Systems, Semantic Web, Virtual Office of the Future

Key Figures

- ▶ **Annual Budget 2013**
€ 38.2 million
- ▶ **Total Assets 2013**
€ 123.2 million
- ▶ **Employees**
425 professional staff, 323 graduate student staff

Scientific Excellence and Transfer

▶ International Scientific Advisory Board

- Bi-annual evaluation of publically funded projects
- ▶ Prof. Dr. Markus Gross, ETH Zürich, Switzerland, Chairman

▶ Leading-Edge Research

- DFKI is the only German institute for computer science to participate in each of the three leading-edge research clusters
- ▶ Cluster of Excellence “Multimodal Computing and Interaction” funded by the German Research Foundation (DFG)
- ▶ Leading-Edge Cluster “Software Innovations for the Digital Enterprise” funded by BMBF
- ▶ European Institute of Innovation and Technology - Information and Communication Technology Labs (EIT ICT Labs)

▶ Networks of Excellence

- At present, DFKI is a coordinator or core partner in four European Networks of Excellence

▶ Promoting Young Talent

- DFKI is a founding member and core partner of the Academy Cube and the Software Campus to promote managerial talent in the IT industry

▶ Academic Chairs

- More than 60 former staff members have been appointed professors at universities in Germany and abroad

▶ Spin-offs

- Over 60 spin-off companies have created approximately 1,700 highly skilled jobs

Committees and Academies

DFKI is represented by its scientific directors on numerous committees and academies

▶ Scientific and Government Committees

- Research Alliance of the German Federal Government, Feldafinger Kreis, Münchner Kreis, Advisory Board of the Future Internet Public-Private Partnership Programme of the European Union (FI-PPP), Coordinator of the European Alliance Multilingual Europe Technology Alliance (META-NET), Management Board of the International Computer Science Institute in Berkeley, Chair of the German Informatics Society (GI), National Institute of Informatics (NII, Tokio), and others

▶ Business Committees

- International SAP Research Advisory Board, Governance Board Intel Visual Computing Institute, Advisory Board NEC Computers and Communication Innovation Research Lab, and others

▶ Scientific Academies

- Royal Swedish Academy of Sciences, German National Academy of Sciences Leopoldina, Berlin-Brandenburg Academy of Sciences, Academy of Sciences and Literature, National Academy of Science and Engineering, European Academy of Sciences, and others

Intelligent Solutions for the Knowledge Society

- ▶ Knowledge Management and Document Analysis
- ▶ Virtual Worlds and 3-D Internet
- ▶ E-Learning and e-Government
- ▶ Development of Provably Correct Software
- ▶ INDUSTRIE 4.0 and Innovative Factory Systems
- ▶ Smart City Technologies and Intelligent Networks
- ▶ Information Extraction from Text Documents
- ▶ Intelligent Web Retrieval and Web Services
- ▶ Multi-agent Systems and Agent Technology
- ▶ Multimodal User Interfaces and Language Understanding
- ▶ Visual Computing and Augmented Vision
- ▶ Mobile Robotic Systems
- ▶ Shopping Assistance and Intelligent Logistics
- ▶ Semantic Product Memories
- ▶ Safe and Secure Cognitive Systems and Intelligent Security Solutions
- ▶ Smart Data – Intelligent Analytics for Massive Data
- ▶ Ambient Intelligence and Assisted Living
- ▶ Driver Assistance Systems and Car2X Communications
- ▶ Cyber-physical Systems
- ▶ Multilingual Technologies
- ▶ Wearable Computing



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