

10 YEARS B-IT FOUNDATION

Annual Report  
**2012**

**b-it** Bonn-Aachen  
International Center for  
Information Technology



Helmut Dockter

## FOREWORD BY THE CHAIRMAN OF THE B-IT FOUNDATION

Ten years ago, in October 2002, the late Vice Minister Hartmut Krebs (North Rhine-Westphalia) and former Vice Minister Uwe Thomas (Federal Ministry of Research BMBF) chaired the first endowment meeting of the Bonn-Aachen International Center for Information Technology (B-IT). After two years of intense preparations, the endowment board made groundbreaking strategic decisions for a successful start of this pioneering attempt to return to brain gain from leading international undergraduate programs:

- the assignment of the attractive B-IT building on the banks of the River Rhine, next to the former Chancellor's Office and Bundestag buildings
- the offering of eight endowed professorships, jointly funded by proceeds from the inaugurating B-IT endowment from Bonn-Berlin compensation funds, and matching state funds
- a major BMBF start-up equipment grant for the professorships and the B-IT building
- the signing of unique novel cooperation contracts for the first joint central institute of two NRW universities, and for their cooperation with the Bonn-Rhein-Sieg University of Applied Sciences and the Fraunhofer Institute Center Birlinghoven Castle.

In hindsight, this meeting has pioneered a truly impressive number of national strategies that have emerged during the following years, such as the internationalization of master programs as part of the Bologna treaty, the strategic cooperation of state-led universities with federally owned large-scale research institutions and with Universities of Applied Science, including a focus on applied and industrially oriented IT research (as e.g. now in the Software Campus initiative).

This annual reports documents once again that the results have been very impressive. The B-IT endowed professors continue to be highly successful in research grants, scientific output, and international visibility. Students from over 50 countries worldwide have graduated from B-IT. Many of the early graduates have already followed up with excellent doctoral dissertations and started attractive research careers in Germany and abroad; others have achieved leading positions in industry or even started their own companies. The high applicant numbers from very good places, and the attractive scholarships gained by many new students, show that the success continues.

The government of North Rhine-Westphalia would like to thank B-IT directors, faculty, and students for their successful work, and wish all the best for the next ten years.

**Helmut Dockter**  
Vice Minister of Innovation, Science and Research NRW, Chairman, B-IT Foundation Council

## REPORT BY THE SCIENTIFIC DIRECTORS

This fall, we recall the start of the B-IT Foundation in October 2002 which has since enabled a major step forward in top-quality international IT master and PhD education in the Aachen-Bonn-Cologne region. As the placement lists in this report once again demonstrate, this has been enthusiastically greeted by employers from industry and science. The report also shows that the B-IT endowed professorships have meanwhile set up financially highly successful and scientifically internationally visible research groups, which are among the international leaders in their respective fields. In terms of education, we have not just looked at the "high end" of doctoral education, through the B-IT

Research School, but also convene national meetings of promising young student researchers in the annual GI Informatics Days. Numerous events for young highschool students, intended to entice them for studies in computer science and its interdisciplinary applications, again drew several hundred participants.

In the academic year 2011-2012, the success of master students reached a new peak with 66 graduates. More than twenty earlier graduates have already achieved doctoral degrees, eight funded by scholarships from the B-IT Research Schools. In this tenth anniversary report of the B-IT Foundation, we emphasize what some of our early B-IT graduates have meanwhile accomplished, ranging from fairly senior research positions to successful entrepreneurship. It is a special pleasure for us to see that the international B-IT alumni community remains active well beyond graduation, since 2011 supported by a very active Facebook presence.

None of this would have been possible without the continuous support by the B-IT Foundation under the leadership of State Secretary Helmut Dockter, Managing Director Hans Stender, Stifterverband representative Renate Zindler, and International Advisory Board president Gerhard Barth. Many thanks also go to our master program coordinators Jan Borchers, Jürgen Bajorath, and Gerhard K. Kraetzschmer, and the study advisors. Most importantly, of course, we thank our enthusiastic faculty and students, and wish them all the best for their lives and careers!

**Armin B. Cremers,**  
University of Bonn  
**Matthias Jarke,**  
RWTH Aachen University and Fraunhofer FIT  
**Kurt-Ulrich Witt,**  
Bonn-Rhein-Sieg University of Applied Sciences

## THE INTERNATIONAL ADVISORY COUNCIL OF B-IT

RWTH Aachen University, University of Bonn, Bonn-Rhein-Sieg University of Applied Sciences, have, in cooperation with the Fraunhofer Board of Management, established an International Advisory Council. Its mission is to ensure the relevance of B-IT's educational efforts for careers in the business world, to monitor B-IT's international competitiveness, and to foster B-IT's development by giving recommendations and guidelines. The rectors of the participating universities have appointed Prof. Dr. Gerhard Barth as Founding President; Barth is well known as founder of the German AI research institute DFKI, as top manager in companies such as Daimler-Chrysler, Alcatel, and Dresdner Bank, and more recently as partner in a consultancy firm. In addition, the council includes four internationally renowned representatives from academia:

- Prof. Dr. Gerhard Fischer, University of Colorado, Boulder
- Prof. Dr. Ossama Khatib, Robotics Lab, Stanford University, Palo Alto
- Prof. Dr. Thomas Lengauer, Max-Planck Institute for Informatics, Saarbrücken
- Prof. Dr. Hermann Maurer, Media Lab, University of Graz



**Prof. Dr. Armin B. Cremers**  
*University of Bonn*



**Prof. Dr. Matthias Jarke**  
*RWTH Aachen University  
and Fraunhofer FIT*



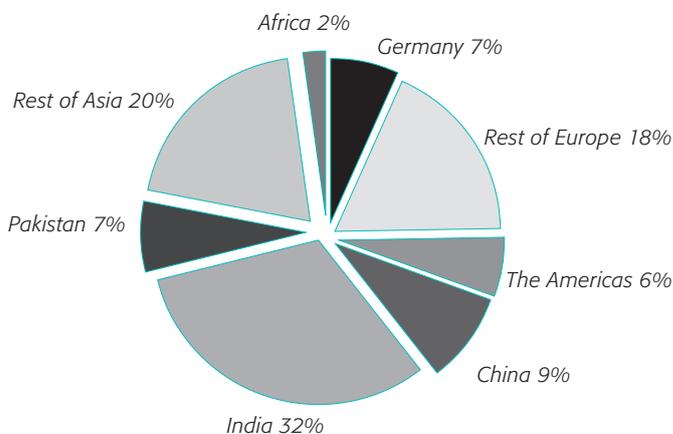
**Prof. Dr. Kurt-Ulrich Witt**  
*Bonn-Rhein-Sieg University  
of Applied Sciences*



## B-IT in Profile

The southwest of North Rhine-Westphalia is one of the largest, most vibrant locations in the European media and telecom industry. It is also one of the most innovative and fast-growing biotech regions in Germany, and there is much interest in the emerging fields of mechatronics and robotics. To make it the optimal place to study for professional work in these fields, the Bonn-Aachen International Center for Information Technology (B-IT) has been established as a joint venture of RWTH Aachen University, University of Bonn, Bonn-Rhein-Sieg University of Applied Science (BRSU) and the research institutes of the Fraunhofer Institute Center Birlinghoven Castle.

B-IT offers highly selective International Master Programs in Applied IT, as well as summer / winter schools for qualified undergraduate computer science students. Most courses take place in the beautiful B-IT building next to the former office of the German Chancellor on the banks of the River Rhine in Bonn. Admission to the B-IT Master Programs is linked to, and conditional upon, placement in research lab courses at the participating Fraunhofer institutes. Students in good standing are offered financial support during these lab courses.



Home Countries of B-IT Students.

The B-IT Universities Institute offers English language Master of Science (M.Sc.) programs in Media Informatics and Life Science Informatics, whereas the University of Applied Sciences offers a Master Program in Autonomous Systems. The Master Programs prepare students for successful international careers that require technical excellence and leadership, creativity and the ability to innovate. B-IT master programs are distinguished by their international orientation (structured according to the European ECTS standard), their focus on IT competence, and the deep integration of teaching and research.

A second goal of B-IT is the optimization and acceleration of existing undergraduate computer science curricula at Bonn University and RWTH Aachen University for selected top students. B-IT's International Program of Excellence (IPEC) pursues this goal by compact course modules delivered in summer and winter schools during the semester breaks. The B-IT Research School offers doctoral training with partial financial support from NRW state.

For the participating universities, the B-IT programs have also helped pave the way towards a smooth transition from the traditional German diploma system to the Bachelor-Master system following the Bologna accord; for example, the B-IT master programs were the first to be accredited within the participating universities in 2004-2005, and re-accredited in 2010-2011. The success of the B-IT programs is also demonstrated by a very good placement record, both in science and industry.

B-IT is financially supported by a 56 M€ Foundation initiated through the Bonn-Berlin program of the German federal government, as well as by matching NRW state funds. The B-IT Foundation was officially set up in October 2002, and a cooperation treaty was signed by the Rectors of the participating universities and the Fraunhofer Society.

## STUDENT WELCOME PARTY

A student Welcome Party was organized on 26 October 2011 to welcome students from all over the world who have joined B-IT programs. This has meanwhile become a very popular event: Incoming students are looking very much forward to it. Around 100 incoming students attended the gathering.



### OFFICERS

#### Founding Scientific Directors

*Prof. Dr. Armin B. Cremers,*

University of Bonn

*Prof. Dr. Matthias Jarke,*

RWTH Aachen University, Fraunhofer FIT

*Prof. Dr. Kurt-Ulrich Witt,*

Bonn-Rhein-Sieg University of Applied Sciences

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(RWTH Aachen University), Media Informatics

*Prof. Dr. Martin Hofmann-Apitius*

(Fraunhofer SCAI), Life Science Informatics

*Prof. Dr. Gerhard K. Kraetzschmar*

(Bonn-Rhein-Sieg University of Applied Sciences), Autonomous Systems

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Bonn-Rhein-Sieg University of Applied Sciences

*Dr. Thomas Bode,*

*Dr. Stefan Lüttringhaus-Kappel,*

University of Bonn

*Dr. Gertraud Peinel,*

Fraunhofer Institute for Applied Information Technology FIT

*Dr. Jürgen Rapp,*

RWTH Aachen University

*Dr. Alexandra Reitelmann,*

University of Bonn

#### International Advisory Board

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Founding President

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Vice Minister of Innovation, Science and Research NRW

Chairman, B-IT Foundation Council

*Hans Stender (Secretary)*

Chancellor, Bonn-Rhein-Sieg University of Applied Sciences

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*Prof. Dr. Hartmut Ihne*

Rector, Bonn-Rhein-Sieg University of Applied Sciences

*Wolfgang Griebel*

President, Bonn / Rhine-Sieg

Chamber of Commerce

## 10 Years B-IT Foundation



*Dr. Uwe Thomas, former State Secretary Federal Ministry of Education and Research*

### **“B-IT, HIDDEN CHAMPION IN IT SCIENCE EDUCATION”**

In the first three years of the last decade, the B-IT Foundation was one of the first puzzle stones in a new German initiative for creating internationally competitive university studies and research. What were the main expectations behind B-IT, readily taken up by well-known scientists in the ABC region, the Government of North Rhine-Westphalia and the Federal Ministry of Education and Research? When you study the various international rankings of universities world-wide, you may find no German institutions in the forefront. A particularity of German science bears some responsibility for this situation, namely the separation of large parts of public research from research in universities. This has been fully understood in 2006 when the so-called Excellence Initiative started, which brought university education and research in a much closer relationship with large German research organizations outside of universities. In fact, B-IT has been a forerunner in this direction.

The basic idea behind B-IT was, that students of a new small but excellent university insti-

tute, supported by universities of the region and the Fraunhofer Society, should find excellent conditions for Master and perhaps doctoral studies and for courses rightly designed for highly qualified students. So first we wanted to establish a center, bringing together the regional resources of universities, (including a German University of Applied Science) with an important research organization outside of universities. Second there should be a rigorous selection of students in qualifying for the B-IT. Third it should be internationally attractive, since we believe that bringing together excellent students, who may qualify later for leadership in research, education and industry, is a means to establish lifelong friendships and foster common interest. All three expectations have been met over-whelmingly by those people who run and enjoy B-IT in one of the most beautiful regions of Germany. Congratulations for this success story to all those who contributed to it.

In the beginning of B-IT, a fourth objective had been discussed, which may be of interest to all those, who believe in further developing B-IT. IT is a very particular field of science, in which highly talented young people start to learn more and more in an informal manner, when they are still in school age and before entering university. It might become an additional objective of B-IT, to offer for the best of them courses which bring them faster to theories and applications of information technology without delay and through special support.

Finally, I wish B-IT that its achievements become even more visible nationally and internationally. The “Hidden Champion in IT Science Education” may become in the near future a well-known example of how new strategies for excellent education and research in theory and application of IT can work out, at the same time fostering international friendships which last for life.

## THE B-IT CHAIR FOR MEDIA INFORMATICS AND HUMAN-COMPUTER INTERACTION: A SUCCESS STORY IN HIGHLIGHTS

In 2003, Professor Jan Borchers accepted the newly founded B-IT-endowed Chair for Media Informatics and Human-Computer Interaction, after previous faculty appointments at ETH Zurich and Stanford University. Since then, the group has grown to currently 13 scientific staff. The group's 3.5 PhD positions funded by B-IT have thus almost quadrupled – a good return on investment. This growth was made possible through an exceptional acquisition of third-party research funding by the group beyond its B-IT endowment, starting in 2007 and growing significantly since.

Scientific excellence, however, cannot be measured by funding alone. The publication history of the group has been similarly remarkable. Since founded in 2003, it has become Germany's best-published research institution in terms of archival publications at the Conference on Human Factors in Computing Systems (CHI), the premier international annual conference on Human-Computer Interaction according to, e.g., Microsoft Academic Search. The group has held this pole position continuously for the last five years.

Another measure of success is visibility both within and beyond the academic community. Professor Borchers and his team pioneered the topic of Personal Fabrication in Germany, establishing the country's first Fab Lab in 2009 where visitors can experience the potential of personalized digital fabrication technologies such as 3D printers and laser cutters, and its implications for the future of Human-Computer Interaction. This lab has created a tremendous echo in the national

press, with regular appearances in newspapers, on radio, and on TV at the national level.

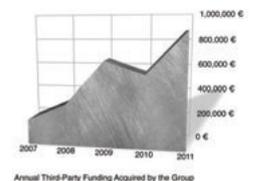
The group has also established the Aachen local event of the annual World Usability Day, as well as local chapters of the international Dorkbot (arts / engineering) and Cocoaheads (developer) initiatives with monthly meetings.

In teaching, Professor Borchers led the initiative to join the world's leading universities on Apple's free iTunes U platform as one of Europe's first six institutions, his classes have been leading the German iTunes U charts, and the department's students nominated him as Computer Science Teacher of the Year in 2010. The group has also made its mark internationally in a series of successful public interactive exhibits, e.g., for the House of Music Vienna, the Children's Museum Boston, and for the German government at the World EXPO 2010 in Shanghai.

The continued support of the B-IT foundation have allowed the B-IT universities to deflect an international faculty position offer extended in 2009, and the group just moved into its new and expanded facilities in 2012.



Prof. Dr. Jan Borchers,  
Media Computing



Annual third-party funding  
acquired by the MI group.



Silhouettes: An interactive gesture-based installation for the EXPO 2010 in Shanghai.

## Events and Visits



From left to right: B-IT Research School member Professor Sven Behnke, Professor Oussama Khatib, B-IT Directors Professor Armin B. Cremers and Professor Kurt-Ulrich Witt.

### STANFORD PROFESSOR KHATIB DELIVERS KEYNOTE LECTURE IN CROWDED B-IT LECTURE HALL

B-IT Scientific Advisory Board Member Professor Oussama Khatib, Artificial Intelligence Laboratory, Stanford University, delivered a lecture about "Human-Friendly Robotics" on November 29, 2011. In his seminal talk, he motivated the research for human-friendly robots and included a comprehensive state-of-the-art overview of current research. The lecture was concluded by an outlook to future research in the field and how the research of human-like robotics provided deeper insights into the human musculo-skeletal system.



### B-IT DIRECTOR JARKE RECEIVES FRAUNHOFER MEDAL AND BECOMES GI FELLOW

B-IT Director Matthias Jarke was awarded the Fraunhofer Medal on the occasion of his 60th birthday. During the 2012 meeting of Fraunhofer FIT's Board of Curators, Fraunhofer Chief Personnel Officer Dr. Alexander Kurz presented Prof. Jarke with the medal in recognition of his outstanding services to Fraunhofer, including the founding of B-IT and of the B-IT Research School. In September 2012, Prof. Jarke was also elected as one of two new Fellows of the GI German Informatics Society. GI holds its annual Informatics Days for the best master students in the B-IT Building every year since 2006.



At the reception after the meeting of the rectorate and the university council: (from left to right) Dr. Haas, chairman of the university council of the University of Bonn; B-IT Director Professor Jarke, B-IT Director Professor Cremers, Dr. Lutz, Chancellor University of Bonn, and Professor Sandmann, Dean Faculty School of Law and Economics at University of Bonn.

### MEETING OF THE UNIVERSITY COUNCIL AT B-IT

The rectorate and the university council of the University of Bonn gathered in B-IT on June 4, 2012. B-IT directors were invited to present B-IT and its three successful master programs to these two high-ranking committees. After the meeting with the rectorate and the university council, headed by Dr. Jörg Haas, a reception was organized to meet the other important committee of the University of Bonn.

### THE ABC OF LIFE SCIENCE INFORMATICS

The ABC of Life Science Informatics symposium gathers researchers from industry and academia to exchange views and ideas about current research. The event is meanwhile well established and saw on November 25, 2011, research representatives from Bayer Healthcare, Bayer Technology Services, the Universities from Aachen and Bonn, including the University of Applied Sciences in Remagen as well as Max-Planck Institutes and Fraunhofer working in the field. The well attended annual meeting at B-IT is heralded as excellent platform of research exchange.

### YUBOT HACKATHON

In December 2011 B-IT hosted the "Yubot Hackathon", organized jointly by Locomotec Stuttgart and BRSU. This provided the participants with the opportunity of programming the latest omni-directional mobile platform with five degrees-of-freedom manipulator. 15 students from Germany, Pakistan, India, Bangladesh and Mexico participated in this event in three teams. The participants had to solve a variant of the Tower of Hanoi problem with the help of the robot. One team with three participants from BRSU then presented their results at "eu Robotics Challenge 2011" in London.

## KAISA NYBERG AT B-IT

Kaisa Nyberg, expert in mobile security and coauthor of a famous book on UMTS security, visited B-IT on January 20, 2012. Her career in Cryptography spans over more than 15 years, starting with the Finnish Defense Forces. She has been with Nokia since 1998 and is responsible for cryptographic techniques in cellular and wireless security. She also holds a professorship at the Helsinki University of Technology. Prof. Nyberg presented her work and views on theoretical and practical properties of most commonly used cryptographic protocols for ad hoc key agreement between wireless devices, commonly also called pairing protocols. It was a fascinating experience for the B-IT Research School audience.

## NANJING UNIVERSITY OF SCIENCE AND TECHNOLOGY VISITS B-IT

A delegation from Nanjing University of Science and Technology (NUST) visited B-IT on June 13, 2012. On this occasion the existing memorandum of understanding was confirmed by Professor Armin Cremers and NUST Vice President Professor Linfang Qian to continue and even intensify the mutual exchange. Daniel Speicher gave an impressive account of a successful exchange project on the level of teaching (the Agile Lab at NUST and at B-IT) and research exchange. Delegation members took a deep interest in the successful organization and functioning of B-IT as an institute across universities and research institutions.

## BONN MEDIA CLUB (BMC) VISITS B-IT

The Bonn Media Club (association of journalists based in Bonn) visited B-IT on July 5, 2012, and held their annual summer party at this occasion in B-IT gardens. This gave Professor Cremers the opportunity to present the institution, its three successful master

programs and to provide the journalists with an outlook to the "knowledge society" and how applied computer science contributed to it. This is a topic that substantially refers to the work of media professionals.

## BRSU BECAME FOUNDING MEMBER OF EUROBOTICS AISBL

On September 17, 2012, BRSU became the founding member of euRobotics aisbl, a Brussels-based non-profit association for all stakeholders in European robotics. BRSU stood out as the only university of applied sciences among the 19 companies and 16 academic research partners who founded this association. Prof. Dr. Gerhard K. Kraetzschmar, MAS professor at the computer science department of BRSU, was elected as one of the eleven representatives of academic research onto the Board of Directors. On September 18, 2012, he, along with the other representatives from the European robotics manufacturers and research institutes, joined European Commission Vice President Neelie Kroes in signing the Memorandum of Understanding for euRobotics aisbl.

## WORKSHOPS AT THE GERMAN COMPUTER SCIENCE CONFERENCE

Prof. Thomas Rose has organized two workshops at the German Computer Science Conference (Informatik 2012). The workshop on "Knowledge Management and Standard Operating Procedures in Health Care" addressed modeling methodologies as well as representation concepts for medical and clinical procedures. Several speakers from academia, health care and clinical information systems presented IT support at different levels of administrative and medical support. Accompanying has been the workshop on "IT Support for Emergency Management".



*Nanjing delegation with Professor Cremers and Vice President Professor Linfang Qian (center), Nanjing University of Science and Technology (NUST).*

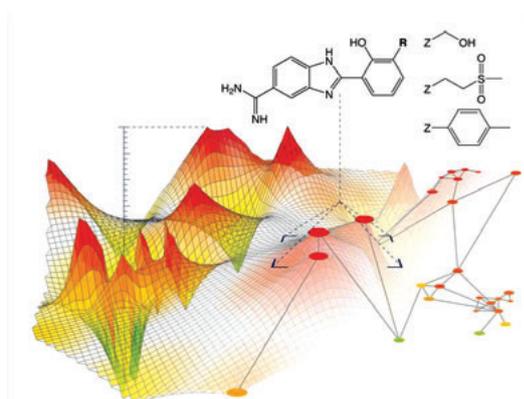


*BMC summer party: Professor Cremers in conversation with Mr. D'hein, former spokesman City of Bonn.*



*Kaisa Nyberg.*

# Research@B-IT



Shown is a schematic representation of transforming 3D (left) and 2D (right) activity landscape representations. In structure-activity relationship networks (right), nodes are compounds and edges similarity relationships. In both 3D and 2D activity landscapes, a continuous color code indicates compound potency from red (highly potent) over yellow (intermediate) to green (lowly potent). On the 3D landscape, white regions are interpolated surface areas.

## COMPOUND ACTIVITY LANDSCAPES PIONEERED BY LIFE SCIENCE INFORMATICS GROUP

Modeling auf activity landscape representations of large compound data sets currently is a popular topic in pharmaceutical research. An activity landscape is generally defined as a graphical representation that integrates compound similarity and potency relationships. Activity landscape representations enable graphical access to complex structure-activity relationship patterns in large data sets and aid medicinal chemists in large-scale data analysis and the selection of key compounds for drug discovery efforts.

Over the past few years, the Bajorath research groups at B-IT has pioneered computational methods for 2D and 3D visualization of activity landscapes of increasing complexity including single-target activity landscapes, dual-target selectivity landscapes, and high-dimensional landscape views that capture high-dimensional bioactivity spaces. These methodologies have resulted in numerous

publications and have experienced high interest in the pharmaceutical industry.

For example, Pfizer USA has recently launched a collaborative effort with the Bajorath group to develop structure-activity relationship visualization methods for specific pharmaceutical applications. Several other pharmaceutical companies from Europe, Japan, and the USA are currently in negotiations with the B-IT group to launch similar collaborations.

## 2012 HIGHLIGHTS OF MI PROGRAM

Here are some of the highlights at Prof. Jan Borchers' B-IT Chair for Media Informatics and Human-Computer Interaction since the last B-IT annual report:

- Prof. Borchers was an invited speaker at numerous events, including the TEDx conference and the "Handelsblatt-IT-Tagung" on enterprise IT
- Our classes on iPhone Application Development and Java became the top two downloads on iTunes U Germany
- REXplorer, our 2007 locative city game for Regensburg, was placed into the Computer Game Museum Berlin
- Malte Weiss, Chat Wacharamanatham, Simon Voelker and Prof. Jan Borchers received an award at ACM UIST 2011 for their paper FingerFlux
- Project MACS acquired 180 k of research funding to create the control bridge of the future for large maritime vessels
- National Science TV magazine Galileo on the PRO7 channel reported on our experiments in printing food in 3D
- We successfully launched the Humberg Guide, an iPod-based mobile guide for museum visitors in the Humberg House in Dingden
- Our project AURA: Ad-Hoc Interaction with Non-Planar Objects received a 300k research grant from DFG, the German National Science Foundation.

## NEW WAYS TO COMBAT NEURODEGENERATIVE DISEASES

To provide fresh impetus to Germany's biopharmaceutical research sector, the German Federal Ministry for Education and Research (BMBF) launched a pharmaceutical research initiative entitled "BioPharma: For the Medicine of Tomorrow" in 2008. Neuroallianz emerged as one of the winning consortia of the tendering process. The Neuroallianz Consortium has adopted an innovative, strategic partnership model to facilitate collaborative research between both academic institutions and pharmaceutical companies.

Fraunhofer SCAI together with UCB as the industry partner runs a project related to a central IT platform which supports the work of the entire Neuroallianz Consortium. This project is focused on applied bioinformatics and also advanced data mining. Several students from the Life Science Informatics curriculum have been doing their Master thesis in scientific areas related to the Neuroallianz work of SCAI. LSI students have been developing new approaches to model aspects of neurodegenerative diseases or working on the semantic basis for in silico research on neurodegenerative diseases. In several cases, this work resulted in scientific publications which contribute substantially to the scientific profile of both, the Department of Bioinformatics at Fraunhofer SCAI as well as the Life Science Informatics curriculum at B-IT and they confirm the concept of the Neuroallianz Consortium.

## ERC GRANT AWARDED TO PROFESSOR BASTIAN LEIBE

Professor Dr. Bastian Leibe, Professor of Computer Science at RWTH Aachen University and faculty member within the B-IT Research School, has been awarded an ERC Starting Grant for his ground-breaking work in computer vision, computer graphics, and



*Not just Fraunhofer President Hans-Jörg Bullinger was highly impressed by the demo of the FireSim interactive firefighting analysis and training system at CeBIT 2012, but representatives from more than 30 firefighting departments took the effort to attend the world's largest computing fair just to discuss with the developers from the B-IT Media Process Group of Prof. Thomas Rose. In this context, B-IT Media Informatics student Ashwin Mani developed an agent-based simulation for emergency scenarios in his Master thesis "Influence Analysis of UbiComp Systems on Large-Scale Emergency Scenarios Using Agent-Based Simulations".*

machine learning. The European Research Council (ERC) awards these grants of 1.5 M€ to outstanding junior researchers in fundamental research in a highly competitive process across all scientific disciplines.

## IMPROVING SUPPLY MANAGEMENT PROCESSES

Prof. Thomas Rose cooperated with a major semi-conductor supplier in a thesis on improving the management of supply management processes. As of today, these include many "specifics" about the product without an overall design of the supply process. Standards for SCM have been implemented, but only for coarse-grained levels of information. Once zooming into more detailed production schedules, a zoo of planning systems unfolds. Conceptual modeling as integration vehicle emerges. Hence, the thesis addressed a conceptual model for integrating production planning. The student is currently in an industrial PhD support program under supervision of Thomas Rose.

## Master Program in Media Informatics



*Prof. Dr. Jan Borchers,  
Media Computing*



*Prof. Dr. Thomas Rose,  
Media Processes*

Computer scientists with an applied focus have been in great demand in the past, and this is expected to continue for the foreseeable future. Graduates of the Master Program in Media Informatics will be well-prepared for the challenges faced when working in computer systems engineering and for creative work with audio-visual media. The Aachen – Bonn – Cologne region is home to many prospective employers, including global players such as Philips, Microsoft, Telekom, Vodafone, Bertelsmann Group, as well as many television stations including RTL, WDR etc.

While a Bachelor degree in Computer Science typically qualifies to participate in large software projects, the Master degree provides the qualifications for project leadership. Graduates of the program in Media Informatics can be expected to be technically innovative, to work as system architects, and to manage large projects. Students who excel during their master program will also have the necessary qualification to pursue a doctoral degree in Germany or abroad. The Excellence Research Cluster “Ultra-Highspeed Mobile Information and Communication (UMIC)” offer an exceptional research environment for the students.

The Master Program in Media Informatics educates the students to successfully meet the novel technical and economic challenges at the intersection of computer science, software engineering, next-generation communication systems, and the media. It is offered as a joint program of RWTH Aachen University and University of Bonn. The program is characterized by a significant portion of lab courses embedded in research of the participating Fraunhofer Institutes for Applied Information Technology FIT and for Intelligent Analysis and Information Systems IAIS.

The degree is conferred by RWTH Aachen University. Cooperation partners from industry and media research contribute to a rich teaching program. The course contents are structured according to the ECTS (European Credit Transfer System) and consist of three main blocks: Computer Science and its mathematical foundations, Multimedia Technology, Media Science and business aspects. Major topics include: internet infrastructures, data communication, digital interactive media, management of information, computer graphics, animation, visualization, speech / image / video processing, game design, security and cryptography, designing interactive systems, cooperative work environments, e-business, knowledge management, virtual and augmented reality, and software engineering.

30 Media Informatics students have completed their degree in the academic year 2011-2012. The graduates quickly found interesting positions either as doctoral students in Germany and abroad, or in attractive companies. Reacting to the increased demand caused by changes in military service and highschool duration in Germany, the incoming class of fall 2012 comprise the unusually high number of 42 students, from a total of 12 countries. Media Informatics students were again very successful in obtaining competitive scholarships such that ten students received a scholarship this year. Three incoming students were pre-selected for participation in the prestigious Erasmus Mundus program European Master of Informatics we are conducting jointly with the universities of Edinburgh (UK) and Trento (Italy).

## NEWS FROM MEDIA INFORMATICS ALUMNI

### MING LI

*PhD Candidate, B-IT Research School, RWTH Aachen University, Germany*



Thanks to the well-organized B-IT program, I had the chance to learn state-of-the-art techniques from highly qualified scientists. During my study in Media Informatics, I obtained theoretical knowledge and practical experience from lectures, seminar, lab works, hiwi and thesis. The interdisciplinary lectures broaden my view and brought me into scientific research. Especially the area of computer graphics attracted my attention. That was the reason I started my doctoral study in Computer Graphics Aachen under guidance of Prof. Kobbelt, with a scholarship from the B-IT Research School.

### JIANYU MA

*Senior Sales Manager, Ansaldo STS, Beijing, P. R. China*



I started the study of media informatics in RWTH Aachen in 2006. I graduated as Master of Science at end of 2008 and went back to China. I joined Bombardier China as project engineer of Shenzhen mass transit line 3 in Feb. 2009. Bombardier is the largest railway transportation company in the world. The project was to provide a signaling system to ensure the train operates under the safety control. I needed to make sure all the technical requirement from China customer could be transferred to overseas development team completely, all the equipment from overseas could delivery on time to meet project schedule. After two years, I was nominated to be the project manager. Finally the Shenzhen line 3 signaling system opened

on time to meet customer Schedule. This created a world record for Bombardier and got a president award. In March 2012, I joined Ansaldo, another world-known railway transportation company. My role is senior sales manager which include setting up new business, project proposal & bid, contract negotiation, company strategy and so on. We were awarded the Hangzhou line 2 signaling contract with a value of 30 M€ in June 2012.

### BESMIRA NUSHI

*PhD Candidate, ETH Zürich*



I have been part of the Media Informatics Master Program as an Erasmus Mundus scholarship student and it has been a great experience from both academic and social point of views. MI strongly applies the theoretical knowledge into practical projects and research. I would like to note that is one of those programs that is able to make students feel the same confidence to work either in industry or in the research world. First, I worked as a teaching assistant at the Faculty of Natural Sciences at the University of Tirana in Albania; it is really interesting to share the gained knowledge with students and colleagues especially on the fields of Multimedia Systems and Data Mining. From September 2012 I became part of a PhD Program at the Systems Group in ETH Zurich. The master degree in MI and RWTH Aachen were important factors that helped me to get accepted into the program, not only because of the reputation but also because of the diversity and the flexibility of the courses. In MI, a student is free to choose and plan his study plan according to his interests and get involved in many interesting labs, seminars and projects often in collaboration with leading research institutes and companies.

### List of employers of MI Alumni:

*Business: Ableton AG, Adecoco, Adidas, Agfa Healthcare, Ancud IT Beratung, Ansaldo STS, AOL, Avedas AG, Bank of Mexico, BCA Auctions, Bertelsmann AG, Bombardier Inc., Brainloop AG, BTC Business Technology Consulting AG, Capgemini, CAS GmbH, CBC Cologne Broadcasting Center GmbH, COMNEON GmbH, Deutsche Telekom, Dynevo GmbH (Bayer), Ericsson, European Computer Telecoms, Finantix Srl, Forth corporation, Fox Chase, Google, Huawei, IdeaObject Softwares, IMC Financial Markets, Inforcept Networks, INRIA, IP Labs, iPharro Media, IW-One / QSC, Kisters, Lakshmi Technology and Engineering Industries, LHS Telekommunikation, Lycos, Mastercard, Microsoft, NAVTEQ, Next Level Integration, Novartis, Oando Plc, Philips, Plinga, PricewaterhouseCoopers AG, Qiagen, QSC, Recomind, Samsung Electronics, SAP, sd&m, Secat, Siemens, Simfy, Sogou, Solutions 4 Media, Sytel Repl, T-Systems, Teleca, Tessella, Vantage Labs, Vodafone, Werum Software & Systems, Workplace Systems, Xerox Research Centre Europe, Yahoo!*

*Universities & Research: Czech Technical, Chinese Academy of Science, ETH Zürich, Fraunhofer FIT, Fraunhofer IAIS, Max Planck Institute for Informatics, Research Center Jülich, Robert Bosch Foundation, RWTH Aachen, Swiss Federal Institute of Technology, Uniklinikum Bonn, University of Agder, Arab American Jenin, Asia and the Pacific, Atma Jaya Yogyakarta, Augsburg, Bahria, Bonn, Cambridge, Duisburg-Essen, Edinburgh, Engineering & Technology Peshawar Pakistan, Hamburg, Heidelberg, Stuttgart, Tilburg, Tirana, the West Indies, Trento, TU Eindhoven, TU Darmstadt, TU Munich.*

# Master Program in Life Science Informatics



*Prof. Dr. Jürgen Bajorath,  
Life Science Informatics*



*Prof. Dr. Martin Hofmann-  
Apitius, Life Science Infor-  
matics*

The Master Program in Life Science Informatics (LSI) is offered by the University of Bonn and RWTH Aachen University in cooperation with the Fraunhofer Institutes of Scientific Computing (SCAI) and Applied IT (FIT). The degree is conferred by the University of Bonn. This interdisciplinary program educates the participants to successfully master the novel technical and economic challenges at the crossroads of biotechnology, medicine, pharmaceuticals and computer science. The curriculum consists of three main blocks: Computer Science and Mathematics for life scientists; Basic principles of Life Science Informatics; Biology of the cell and systems biology.

Major topics include biomedical database systems, data mining and machine learning, statistical genetics, drug design, medical imaging and visualization, computational neuroscience, computational modeling of regulatory and metabolic networks, cheminformatics, bioinformatics, molecular modeling, molecular biology, pharmaceutical chemistry, biotechnology and systems biology. The program emphasizes a profound understanding of biological structures (such as proteins, nucleic acids, genes, metabolic, neural networks and organisms) as well as the appropriate application of methods of computer science to this field. It also includes training designed to sensitize students to the ethical implications of emerging biotechnologies. This combination will enable the successful students to understand biological or medical problems and to find appropriate and valid solutions that bioinformatics can offer.

The program is characterized by a significant share of research lab courses embedded in both basic and applied research of the participating Fraunhofer Institutes FIT and SCAI as well in labs of CEMBIO (Center for Molecular Biology) and LIMES (Life and Medical Sciences Research Biocenter Bonn). The final six months of the program are dedicated to

the Master thesis which can be done in cooperation with industry.

Graduates of the program are well prepared for the typical professional tasks in applied data analysis, systems biology and data modeling, in industrial functional genomics, drug design and pharmacology. The Aachen – Bonn – Cologne – Düsseldorf region is home to many prospective employers, including excellent academic institutes and research driven companies. The regular and well attended meetings of the LSI Series “The ABC of Life Science Informatics” in the years 2008-2011 have contributed to strengthen ties with regional scientists of the region. Several interesting Master thesis have been carried out in collaboration with them. The interaction and collaboration with companies could be extended to companies such as Merck KGaA. LSI students were also instrumental in this process. This has increased the visibility of the program considerably, not only in the region but on a larger geographical scale.

This year, 24 students successfully graduated, a new record for the program. Top students again received excellent offers from institutions such as Max Planck Research Schools, Cambridge University UK or IIT Bangalore in India. The superb response to the program in the previous years made it possible to refine the call for new students and to optimize the selection process for incoming students. This two-step application process – carried out for the second time this year – includes an online application for all applicants, and Skype interviews with a selected number of applicants carried out by staff members of the program. About 60 interviews with applicants from all over the globe were held from a total of 105 applications. Thirty two students, another record number of students since the program’s start, began their studies in Life Science Informatics in winter semester 2012/2013.

## LSI LECTURE SERIES HAVE BECOME A REAL SUCCESS

Professor Holger Fröhlich organized two lecture series: One in Algorithmic Bioinformatics (WS 2011/12) and one in Systems Biology (SS 2012). The lecturers come from all over Europe, this time from Belgium, Finland, France, Germany, Italy, and the Netherlands. Students and staff members (from B-IT and meanwhile from other university institutes) had the opportunity to explore current research in the area of Algorithmic Bioinformatics and Systems Biology with research approaches from important European research institutes.

## LSI SUCCESS STORIES



**ASHUTOSH MALHOTRA** joined the LSI curriculum at B-IT in October 2010; his background was in bioinformatics. His studies were supported by a grant of the state of North Rhine-Westphalia (ScholarShipPLUS program) and he was invited to join the bioinformatics research team at Fraunhofer SCAI. Very soon, he made substantial contributions to the work done at Fraunhofer SCAI in the area of modeling of neurodegenerative diseases. Guided by Erfan Younesi, a PhD student at the Department of Bioinformatics, who himself obtained his Master degree in Life Science Informatics from the University of Bonn, Mr. Malhotra laid the foundations for advanced disease modeling and information extraction in the area of Alzheimer's disease. Two publications resulted from his work in the course of his Master thesis; due to his outstanding performance as a Master student he was subsequently offered a position as a PhD student at Fraunhofer SCAI.



**DISHA GUPTA-OSTERMANN** joined the LSI program in October 2009 and obtained her Master degree in Life Science Informatics in January 2012. She continues her education with a PhD thesis in the field of structure-activity relationship visualization with a scholarship from Boehringer Ingelheim. Ms. Gupta-Ostermann has already co-authored three publications in leading international journals.



**DR. HARSHA GURULINGAPPA** joined the LSI program in 2006 and graduated in 2008. Then he was accepted into B-IT Research School as a scholar and graduated in 2012. During the time of his PhD thesis he published 13 research papers and was successful in several challenges, among them the prestigious TREC-CHEM Challenge in the area of Chemical Informatics Retrieval in 2010. Additionally he placed third in the "I2B2" Challenge (text mining in electronic patient records) held in 2010 at the University of Albany, USA. After his graduation from B-IT Research School he joined Molecular Connections (PVT), a pioneering in silico discovery services company in India, as principal scientist.



**DR. YUAN WANG** obtained a Bachelor's degree in Computer Science from Zhejiang University in China and joined the LSI program in October 2004. She successfully continued her education from 2006-2009 with a PhD thesis. Since January 2010, Dr. Wang is senior scientist at Disease and Translational Informatics, F. Hoffman La Roche, Basel, Switzerland.

## List of employers of LSI Alumni:

Accenture, B-IT Research School, Cambridge University (UK), Charité Berlin, Ericsson, European Bioinformatics Institute, F. Hoffmann-La Roche Ltd, Fraunhofer Institute SCAI, Galileo Press, German Center for Cancer Research (DKFZ) Heidelberg, Hamilton Medical, Heidelberg Institute for Theoretical Studies, Hype Innovation Inc., IIT Bangalore, Leaf Bioscience s.r.l., LHS Telecommunications, Max Dellbrück Center Berlin, Max Planck Institute for Biophysical Chemistry, Max Planck Institute for Plant Breeding Research, Max Planck Institute for the Biology of Ageing, Max Planck Institute Tübingen, Max Planck Institute for Neurological Research, Medtronic, Molecular Connections Private Limited, National Institute for Biological Sciences, National Technical University of Singapore, Philips, Research Center Jülich, RWTH Aachen, University of Bonn, University of Cologne, University of Heidelberg, University of Kiel, University of Leipzig, University of Luxembourg, University of Mainz, University of Oxford (UK), University of Tübingen, University of Utrecht, University of Würzburg

# Master Program in Autonomous Systems



Prof. Dr. Gerhard Kraetzschmar,  
Autonomous Systems



Prof. Dr. Paul-Gerhard Plöger,  
Autonomous Systems



Prof. Dr. Erwin Prassler,  
Autonomous Systems

The Master Program in Autonomous Systems is offered by the B-IT Applied Science Institute (b-itAS) in the Department of Computer Science at the Bonn-Rhein-Sieg University of Applied Sciences. b-itAS cooperates closely with the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS in implementing the program, which started in winter 2002. The program is managed by three professors (Gerhard Kraetzschmar, Paul G. Plöger, Erwin Prassler), six teaching and research associates (Naveed Akhtar, Iman Awaad, Anastassia Küstenmacher, Frederik Hegger, Nico Hochgeschwender, and Matthias Füller) and researchers, who have been recruited in due course of the two European research projects XPERO and BRICS, namely Björn Kahl, Nico Hochgeschwender, Jan Paulus, and Azamat Shakhimardanov.

In this program, students get a solid theoretical background in autonomous mobile robots, control and systems theory, robot manipulation, learning and adaptivity, hardware-software co-design of embedded systems, probabilistic reasoning, robot architectures, and planning and scheduling. The students may specialize in the fields like computer vision, navigation, sensors and modeling, artificial neural networks or advanced manipulation. The courses are combined with research projects conducted at IAIS and other partner institutions. The b-it AS program has been accredited by ASIIN since 2005. In April 2012, ASIIN reaccredited the MAS program without any requirements until September 2018. In addition to the accreditation certificate from the German Accreditation Board, the program got the special ASIIN accreditation label and the Euro Inf Label from the European Quality Assurance Network for Information Education (EQANIE).

In the academic year 2011-2012, 25 students joined the MAS program from an applicant pool of 170 candidates. Twelve students completed their degrees. Around half of these students continued with doctoral studies or other research positions. The MAS program has always attracted the interest of students all over the globe. The 14 different nationalities of the 25 students who joined the program in the 2011-2012 academic year is proof of this fact.

The three professors of the program are actively involved in many scientific activities, including memberships in technical committees of IEEE or in the RoboCup Federation trustee board, numerous program committees of workshops and scientific conferences like IROS, ICRA, ICMA, and AAMAS.

## SASI GADE STARTS HIS COMPANY

Sasi Kiran Gade who graduated in October 2010 started his own company "Gade Autonomous Systems Private Limited" which propagates the German Way of Doing Research in Indian Academia. So far this company has trained 200 students and robot enthusiasts associated with some premier universities and schools in India. The company also focuses on design and development of human robot interaction modules for the NAO robot of Aldebaran Robotics (France) and Scitos robot of MetraLabs GmbH (Germany). They are working on using robots to preserve the heritage and traditional values of humans. Recently, their work with the NAO robots has garnered more international attention. They taught the NAO robot an ancient form of Yoga called "Surya Namaskara". The Surya Namaskara performed by the NAO robot has not only motivated many people to start yoga, it has also attracted the interest of many youngsters to the field of robotics.



NAO robot.

## GERMAN-RUSSIAN ROBOTICS INITIATIVE

In February 2012, Bonn-Rhein-Sieg University of Applied Sciences (BRSU), together with the Baumann State Technical University (MSTU Baumann) in Moscow, and the Moscow Polytechnic Museum, organized the first ever "Robolympics" robotic games. About 400 visitors followed the finals at the Moscow Polytechnic Museum and the results were reported on three TV stations and various print media.

Robolympics was organized by the Department of Computer Science at BRSU within the framework of the "German-Russian Robotics Initiative", a project sponsored by the German Federal Ministry of Research (BMBF). It took place as part of the "German-Russian Year of Education, Research and Innovation".

The participants of Robolympics included both bachelor students and freshmen enrolled in masters programs in the fields of computer science, robotics and mechanical engineering. The participants programmed small robotic systems (NXT robot kits) with tasks that are typical for service robots, such as navigation within a small arena and cleaning the floor while simultaneously avoiding obstacles.

Along with the student activities, the event also provided the opportunity to watch two brand new full-fledged industrial robots in action: "Jenny", the service robot of the b-it-bots team at BRSU and KUKA's educational platform "YouBot".

In May 2012, BRSU also held the first "German Russian Conference on Robot-



*"Robolympics" robotic games at the Moscow Polytechnic Museum.*

ics", at the world leading robotics industry fair: Automatica in Munich. The event was chaired by Prof. Dr. Paul G. Plöger of BRSU and Prof. Dr. Arkady S. Yuschenko of MSTU Baumann. It included five keynote speakers from top Russian research institutions and five German researchers who currently shape the domain of Service Robotics.

## PHD'S BY MAS ALUMNI

In its first 10 years (2002-2012), the Master Program in Autonomous Systems has produced many graduates who are now successfully serving in academia and industry. Among the students graduated so far, Ronny Hartanto, Alex Juarez, Martin Linden and Emi Mathews have completed their PhDs. Dr. Ronny Hartanto was awarded the FBTI Informartikpreis 2012 for his dissertation titled "Fusing Reasoning with HTN Planning as a Deliberative Layer in Mobile Robotics". Many other graduates are currently pursuing their PhDs at German and other renowned European and American universities and institutes.



*KUKA YouBot.*



*Dr. Hartanto with Johnny Jackanapes, one of the world's best service robots.*

# International Program of Excellence in Computer Science



Prof. Dr. Joachim von zur Gathen, Computer Security



Prof. Dr. Stefan Kowalewski, Embedded Systems



Prof. Dr. Christian Bauckhage



The Enigma crypto machine.



Bond's Thursday crew.

The International Program of Excellence in Computer Science (IPEC) at B-IT offers compact courses primarily during the semester break and at the highest educational level. This results in faster studies and advanced quality in selected subject areas. These courses apply to a limited number of highly qualified students of the University of Bonn, the RWTH Aachen University and, in the future, other German or foreign universities.

Undergraduate IPEC courses are planned in a way that the time required for the bachelor degree will be reduced up to one year. Additionally there are cross-cutting courses that accelerate the master studies at the B-IT as well as regular summer and winter schools that are designated for selected topics of computer science. These courses are held in cooperation with international guest scientists. Applications of foreign students are welcome.

The expected impact of the Program of Excellence is not limited to a significant acceleration of undergraduate and graduate studies in conjunction with an international visibility. It also brings together outstanding students with internationally noted scientists and with fellow students from abroad and activates new forms of encouraging competition among students. The IPEC courses usually comprise a mix of lecture classes, seminars, and lab courses, such that students can make best use of the compressed time schedule. Currently, this part of the program is being restructured as to provide an "honors class" supplement to the top 10% bachelor students in Aachen and Bonn, loosely linked to the NRW public-private scholarship programs the Ministry of Innovation has initiated for this group of students.

## SCHÜLER-KRYPTO 2012

On two days in February 2012, 162 high school students, as well as 11 teachers met for the 11th Schüler-Krypto to learn at B-IT on secret messages, encryption and decryption. Everybody was asked to take up the role of James Bond and program RSA on the laptop built-in to Bond's BMW Z8. We used MuPAD on it, a computer algebra system which among many other things is capable of calculating with arbitrarily large numbers. As a sidetrack, in a game-like setting the students could experimentally find out how the main step in the encryption and decryption of RSA, namely the modular exponentiation, can be executed in a jiffy. A few other glimpses of computer science were presented in the lunch break. The Cyber Defense Lab from Fraunhofer FKIE presented various extras on intrusion detection and other ways to detect, find and analyze malware and botnets. The laser and light show, also this year presented by Matthias Frank, from the laser and light lab fascinated pupils and teachers.

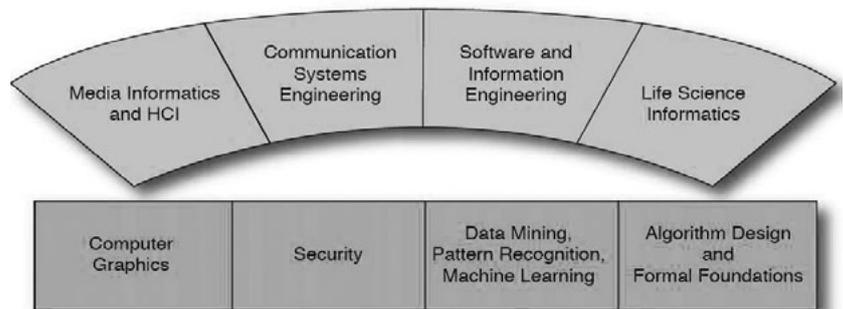
## CRYPT@B-IT 2012

This summer school on cryptography at July 16-20, 2012, offered undergraduate and graduate students, postdocs and researchers the opportunity to crypt a bit. It invited to the exploration of some fundamental areas of cryptography. In addition, there were tutorials and hands-on exercises on topics related to the lectures, including an exhibit of an actual Enigma machine. The permanent presence of world-class researchers and teachers was much appreciated by the audience, and in fact some research collaborations were started during the summer school. Lecturers: Joachim von zur Gathen, B-IT; Valtteri Niemi, Nokia, Turku; Dennis Hofheinz, Karlsruhe Institute of Technology (KIT); Max Gebhardt, BSI Bonn; and members of the cosec group.

# The B-IT Research School

The B-IT Research School complements the successful international B-IT master programs with a structured doctoral training. A key aspect of our approach is that the B-IT Research School does not just support the scholarship students but also the 150-200 project researchers from the projects of RWTH Aachen, the University of Bonn, the Fraunhofer institutes in Birlinghoven, and the University of Applied Sciences Bonn-Rhein-Sieg. We thus close the gap between our Master Programs and our large research projects such as the UMIC Excellence Cluster, the Collaborative Research Centers and Focused Doctoral Programs, the EU- and BMBF-funded cooperation projects and direct industrial projects.

Started in late 2008 with half a dozen initial doctoral scholarships, the program has mean-



while awarded a total of 33 scholarships of which about 60% went to non-German candidates and the unusually high share of 30% went to women. Up to September 2012, already eight doctoral theses were successfully defended by scholarship holders, and several more completed theses are presently under review.



Tamara Bobic.

## PHD FELLOWSHIP FOR TAMARA BOBIC

Tamara Bobic joined the LSI curriculum in October 2010, her background is in computer science (diploma). She had already support for her studies in Germany by a fellowship from DAAD, but was offered to join the Department of Bioinformatics at Fraunhofer SCAI as a student researcher in addition. In parallel to her studies at B-IT, she got involved in research activities in the area of relationship mining with a particular focus on unstructured information sources. Guided by Dr. Roman Klinger, an expert for machine learning and data mining, she contributed to the scientific progress of the text mining team at Fraunhofer SCAI and when she finally handed in her Master thesis, she was already author of two publications. Ms. Bobic is now continuing her work at Fraunhofer SCAI as a PhD student; due to her excellent performance in her studies she was granted a PhD fellowship from the B-IT Research School.



*In March 2012, with its General Assembly, the B-IT Research School opened its Aachen site within the computer science building of RWTH Aachen University, including large and small seminar rooms for the doctoral courses and a few offices for administration and visiting faculty. In the basement, it hosts 23,000 books from the early days of the former GMD library at Birlinghoven Castle, among them some valuable works from early computer science and applied mathematics.*

## B-IT Universities Institute

ABC – three letters that stand for a veritable “magic triangle”: the region between Aachen, Bonn and Cologne, which is not only economically strong, but also a leader in science, education and research. The large number of research establishments based here make the area one of Europe’s biggest and most important science landscapes. Almost 10 per cent of all German students – around 130,000 people – are studying at the Rheinisch-Westfälische Technische Hochschule in Aachen, the Rheinische Friedrich-Wilhelms-Universität Bonn and the Universität zu Köln, which together constitute one of the most important higher education locations in Europe. The three ABC institutions are closely linked and collaborate in many fields of teaching and research.

### UNIVERSITY OF BONN

The University of Bonn is a research-oriented university with currently 30,000 students. Its research tradition of 200 years is closely linked to the names of Hermann von Helmholtz, Heinrich Hertz and Friedrich August Kekulé who carried out seminal work at the University of Bonn. This strong academic tradition has been continued until present with the more recent Nobel laureates Wolfgang Paul and Reinhard Selten. Bonn cooperates with numerous other universities and research institutions around the globe. The specializations it has developed enjoy worldwide recognition. About 4,000 students from foreign countries are enrolled in Bonn. Their presence underlines the international character of the university and enriches both academic and social life in Bonn. Living up to its long tradition as a classical university with a full range of academic disciplines, the University of Bonn offers nearly a hundred different first degree programs. Students can choose from a wide and modern spectrum of subjects that allows a multiplicity of combinations.

### RWTH AACHEN UNIVERSITY

RWTH Aachen University was founded as a Polytechnic in 1870 with considerable support from local industry. In 1948 it was established as Rheinisch-Westfälische Technische Hochschule Aachen (RWTH), the Institute of Technology of the State of North Rhine-Westphalia. Today, RWTH is one of the most renowned technical universities in Europe with around 35,000 students. RWTH offers more than 120 courses of study (undergraduate and postgraduate).

The RWTH master programs educate engineers who are keen to engage in R & D, innovation, and entrepreneurship. In 2007, RWTH Aachen was elected as one of nine “elite universities” within the German excellence program.



*The spacious Hofgartenwiese is a major summer attraction on the University of Bonn campus.*

## BIRLINGHOVEN CASTLE CAMPUS

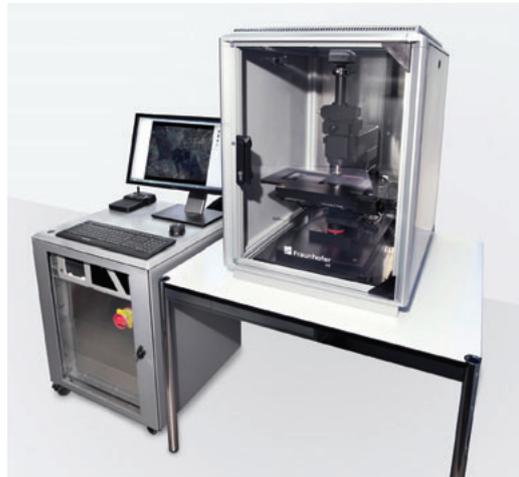
The Birlinghoven Castle campus (IZB) is one of the largest and most influential computer science research sites in Germany. About 500 researchers work in the IZB institutes. That represents a quarter of the Fraunhofer ICT Group, Europe's largest IT research organization. The institutes collaborate closely with the European ERCIM network of national IT research centers as well as with leading research establishments in the USA, Eastern Europe and Asia. Three IZB institutes contribute to the B-IT master programs Media Informatics and Life Science Informatics:



Entrance of Birlinghoven Castle.

## FRAUNHOFER FIT

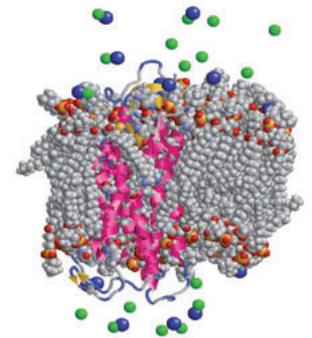
FIT, the Fraunhofer Institute of Applied Information Technology, investigates human-centered computing in a business or engineering process context. The usability and usefulness of information and cooperation systems is optimized in their interplay between human work practice, organization and process. In Life Science Informatics the institute focuses on protein analysis, visual support for navigation in micro surgery, and assistive information technology. In Media Informatics innovative information visualization systems, mixed and augmented reality environments for industrial planning, pervasive gaming applications, and value chains for public-sector information services are main research topics.



*TopoScan microscope of Fraunhofer FIT: TopoScan is a modular hardware-software platform for the automated high content analysis of biological samples. Its unique software-driven architecture combines two properties within one system: Streamlined workflows with minimal intervention for the reproducible acquisition and analysis of high content assays.*

## FRAUNHOFER SCAI

The Fraunhofer Institute for Algorithms and Scientific Computing SCAI engages in computer simulations in product and process development and is a strong partner in industry. The Department of Bioinformatics is doing applied research and development in the field of: Information Extraction / Semantic Text Analysis, Applied Chemoinformatics and Data-grid / Grid Infrastructure. Complementary to the data- and knowledge-driven approaches taken in the Department of Bioinformatics, the Department of Simulation Engineering focuses on chemical engineering by means of multi-scale simulations. Through gaining a deep understanding of the microscopic behavior and mechanism of chemical systems, material and drug development is improved.



*Fraunhofer SCAI: Membrane-embedded receptors, like the prototypic rhodopsin shown above, are pharmaceutically most interesting. The aim is to gain control over cellular response by designing new drugs.*

## B-IT Applied Science Institute

### BONN-RHEIN-SIEG UNIVERSITY OF APPLIED SCIENCES (BRSU)

Founded in 1995, the Bonn-Rhein-Sieg University of Applied Sciences significantly extends the range of applied research and teaching in the greater Bonn area. It specializes in business administration, natural sciences, engineering and computer science, strongly encouraging cooperation with industrial partners and a focus on use-driven and interdisciplinary research and teaching.

The three campuses at Sankt Augustin, Rheinbach and Hennef are well equipped with modern laboratories, studios, workshops and facilities for cooperative research. By 2012, the six departments accommodate more than 6,000 students.

The Department of Computer Science offers a Bachelor and a Master program in Computer Science and in cooperation with the Departments of Business Administration a Bachelor program in Business Information Systems. The Master program Autonomous Systems is offered by the B-IT Applied Science Institute, a cooperation between the Department of Computer Science and the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS.



*Campus of the Bonn-Rhein-Sieg University of Applied Sciences.*

### FRAUNHOFER IAIS

At Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS, research experts explore and develop innovative systems designed to analyze data and to make information available. On the one hand, the IAIS teams realize application solutions in the fields of data mining, business intelligence or high-resolution management for optimizing products, services and processes. On the other hand, the institute's scientists develop systems that use innovative forms of media presentation to help make large amounts of data accessible (knowledge extraction, interactive exploration, knowledge management, media analysis and visualization).

The institute's research and development activities are defined by the business areas Marketing, Market Research & Media Analysis, Business Planning & Controlling, Digital Media Asset Management, Process Intelligence, Preventive Security, Spaces for High-Tech Experience, Media Production and Adaptive Robotics. Within these business areas, the IAIS experts develop innovative and service oriented IT solutions for customers from commerce and industry, e.g. trade, media, telecommunications or energy industries as well as for partners from the public sectors.

The Institute's scientific research focuses on Machine Learning, Multimedia Pattern Recognition, Visual Analytics, Process Intelligence and Adaptive Robotics. Fraunhofer IAIS and its staff of approximately 250 combine to create a comprehensive industry sector knowledge database encompassing all of the engineering sciences, in particular IT, but also Mathematics, Natural Sciences, Business Studies, Geo Sciences and Social Sciences.

# General Information

## GENERAL ADMISSION REQUIREMENTS

- A first university-level degree (B.Sc., B.Eng.), as specified for the individual programs, with grades well above average is required. The Graduate Record Examination (GRE) is strongly recommended.
- All courses are held in English, thus fluency in English is vital. It is evaluated on the basis of TOEFL 550 paper-based, 213 computer-based, or IELTS 6.0.
- Working knowledge of German is necessary to take up some of the culture that the Aachen – Bonn – Cologne region has developed over the last 2,000 years. Therefore, a basic German language course is offered before start of the program and during the first year.
- Admission is coupled to placement in the Fraunhofer lab courses and therefore strictly limited. Application deadline has been March 1 for Fall admission but may change from year to year; check [www.b-it-center.de](http://www.b-it-center.de) for current admission details.

## FEES AND FINANCES

A student union fee of ca. 230 € per semester covers student activities, subsidized meals, and free public transportation in the whole state of North Rhine-Westphalia.

A student's monthly expenses, including study material, will be about 700 €. B-IT does not offer formal scholarships but several student assistantships are available on a competitive basis. For information on funding from German sources please contact the DAAD – German Academic Exchange Service [www.daad.de](http://www.daad.de).

## STUDYING IN BONN

Most of the teaching in B-IT is concentrated in Bonn and its eastern neighbor, Sankt Augustin. Newcomers to Bonn soon grow very fond of the city – a fact confirmed by thousands of students and academics, German and foreign, who have come here to learn, teach or research. Since the German Bundestag moved its seat and parts of the Federal Government to Berlin in 1999, Bonn attracted a number of international organizations, especially United Nations bodies, and some major corporations. Among others, Deutsche Telekom and Deutsche Post have their headquarters there. Now Bonn is evolving into an internationally recognized science region – with the university as one of the dynamic forces driving this change. In addition, Bonn offers a wide variety of attractions and amenities. The city's most famous son, Ludwig van Beethoven, is the star attraction of a lively and varied arts and culture scene. The city boasts an opera house, several theatres, concert halls and other venues, as well as a range of fascinating museums.





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University of Applied Sciences

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**Autonomous Systems**  
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