



# ANNUAL REPORT

## 2008-2009

## Introduction



Vice Minister  
Dr. Michael Stückradt



Prof. Dr. Gerhard Barth

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

Since its inception in 2003, the Bonn-Aachen International Center for Information Technology (B-IT) has pioneered excellence in international graduate education for applied information technology. The key to this success has been a unique cooperation between two leading universities, a young university of applied sciences, and the Fraunhofer society for applied research.

The B-IT Master programs excel in many regards. Due to careful selection and intensive education, student success rates are among the highest in North Rhine-Westphalia, ranging up to over 90%. In 2009, B-IT students have successfully participated in worldwide research competitions, winning e.g. two RoboCup robotics championships. B-IT graduates are not just in great demand by industry, but have also been offered prestigious doctoral fellowships by institutions such as Cambridge University, Stanford University, and the University of Oxford. Conversely, applicants to B-IT have been attracted from some of the best undergraduate institutions in the world, and many highschool students and top-quality undergraduates took advantage of attractive special courses within B-IT's regional IPEC program.

After winning a research school competition announced by the NRW Ministry of Innovation, Research, and Technology (MIWFT-NRW) in 2008, B-IT has expanded its graduate programs by innovative doctoral training. In cooperative funding between the participating institutions and NRW State, the first 18 doctoral scholarships went to students from 11 countries.

I invite young talents from all over the world to take advantage of B-IT's still young but already internationally renowned graduate programs, and would like to thank the directors, faculty, and students of B-IT for their successful work.

**Dr. Michael Stückradt**  
Vice Minister of Innovation, Science  
and Technology NRW  
Chairman, B-IT Foundation Council

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 five internationally renowned representatives from academia and industry:

- Prof. Dr. Gerhard Fischer, University of Colorado, Boulder
- Dirk Friebel, Nokia Research Center, Bochum
- 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



B-IT main building.

*The cover image uses a scientific visualization method to illustrate the geographic distribution of new B-IT student origins.*

## Report by the Scientific Directors

The academic year 2008-2009 has been another successful year for B-IT. The industrial placement record for our graduates remains outstanding despite the economic crisis. But equally important, our master graduates attract the attention of internationally outstanding doctoral programs in places such as Cambridge University, Stanford University, the University of Oxford, ETH Zurich, and many others. Under these circumstances, we consider ourselves particularly fortunate that the newly approved B-IT Research School enabled us to keep some of the best graduates for doctoral studies in Germany, even against the mentioned competition. Six of the eighteen first doctoral scholarships in the B-IT Research School could in fact be awarded to B-IT Master Graduates.

Due to successes in the German Excellence Initiative as well as new initiatives by the North Rhine-Westphalian, German federal, and European funding agencies, the third-party funding for research has grown further in the past year. Moreover, through cooperation with the Erasmus-Mundus program of the EU, the DAAD, and other funding schemes, the number of master student scholarships could be increased, and many further students found work study opportunities in the many new research projects as well as in industrial and research internships. A highlight is certainly the winning of several international RoboCup tournament by a B-IT team from the Autonomous Systems program that had started into the competition just a few years ago. The excellent research conditions were certainly an important factor to fend off yet another very competitive offer to one of our B-IT Professors, Jan Borchers, by the University of Zurich.

Using the advantage of its attractive location and building, B-IT is no longer just addressing the narrow scientific community. The highly visible lecture series with international stars in Life Science Informatics of the last two years is now being complemented by a Media Informatics lecture series involving researchers, practitioners,

and politicians in a broad debate on privacy issues; this is complemented by compact courses in which several hundred highschool students from NRW are motivated in their interest for mathematics and informatics through exciting experiments with IT security. Our additional emphasis on IT security – recommended by the B-IT advisory board – is also supported by the move of Prof. Martini' security group into the B-IT building. Hosting the leading international conference MobileHCI 2009 in Bonn with 350 participants from all five continents further increased the visibility in the international research community. Successful business workshops on innovation in software-intensive systems drew 40 small and medium size entrepreneurs to B-IT and several Life Science Informatics symposia brought together researchers and practitioners from the region and helped B-IT to foster not just research, but practice innovation. Established events such as the leading German master student conference "GI Informatiktage" are continuing to grow in attraction.

We would like to extend our cordial thanks to the B-IT Foundation Council led by Chairman Vice Minister Michael Stückradt and Secretary Hans Stender, to the B-IT Advisory Board led by Founding President Gerhard Barth, to the B-IT Faculty and especially the study coordinators Martin Hofmann-Apitius and Otto Spaniol, to our assistant directors Alexandra Reitelmann, Jürgen Rapp, Gertraud Peinel, Christoph Quix, Stefan Lüttringhaus-Kappel, and Thomas Bode, but most of all to the B-IT students for their enthusiasm and excellent cooperation.

This report intends to inform stakeholders, existing and future students and doctoral candidates, as well as the interested public about the B-IT activities in the academic year 2008-2009. Enjoy reading it!

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



**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*

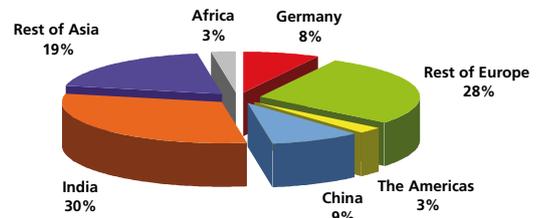
## B-IT in Profile

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 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.

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.

Home Countries of New B-IT Students.



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.

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. The success of the B-IT programs is also demonstrated by a very good placement record for the first groups of master graduates, 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 federal project funds and 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 Board of Directors. B-IT directors and B-IT professors are very active in fundraising as a basis to further

broaden the education and research activities in B-IT. Research funding provides means for re-investment to keep our equipment up to date but also offers funded opportunities for B-IT student research as well as doctoral studies opportunities for many B-IT graduates. The B-IT foundation is currently exploring additional fundraising opportunities in continuing education e.g. in the security sector; initial measures include the Privacy Lecture Series 2009 and the

move of the IT security research group of Prof. Martini into the B-IT Building. This will complement successful fundraising activities for student funding, such as the 2.5 M€Erasmus-Mundus program EuMI, the complementary India4EU program approved in 2009, the B-IT Research School and numerous individual scholarships from industry and public sources.

## 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

### Assistant Directors/Study Advisors

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*Dr. Stefan Lüttringhaus-Kappel,*

University of Bonn

*Dr. Gertraud Peinel,*

B-IT Research School

*Dr. Jürgen Rapp,*

RWTH Aachen University

*Dr. Alexandra Reitelmann,*

University of Bonn

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Founding President

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University of Applied Sciences

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## Events and Visits

### **SYMPOSIUM SOFTWARE ENGINEERING ON JUNE 3, 2009**

On one hand the cycles of innovation are getting shorter and software allows to quickly and easily adapt a product to new needs. On the other hand software serves a tool of integration. Software-based solutions allow by their combination and interaction for new functions. Software has therefore become a key element in a highly competitive market. Fraunhofer FIT and its co-operation partners from industry and academia presented up-to-date results from this area that have been obtained through an initiative funded by BMBF (German Federal Ministry of Education and Research). The present symposium, held at B-IT, addresses software-developers, users and decision makers from industry and academia. Main topics included: end user development, usability, engineering of embedded complex control systems, and transition to a more flexible document and process landscape.



### **ABC OF LIFE SCIENCE INFORMATICS**

In regional symposia in 2008 and 2009, called "The ABC of Life Science Informatics", scientists met for one day to present their work and to exchange ideas. On November 6, 2009 the second Mini Symposium took place in B-IT. The participants included researchers from academia (including Max-Planck Institutes and Research Centre Jülich) and industry. University hospitals have joined this symposium seeking help for their needs in improved treatment. B-IT provides the platform and the framework where different institutions can meet and find appropriate partners for the solution of their scientific or research problems. For the students of the LSI curriculum this mini symposium provided an excellent opportunity to find out about current research activities in the region and several Master thesis projects have been initiated during the meeting.



*Welcome Party 2009: Professor Cremers welcomed B-IT students to the B-IT Students' Welcome Party on October 30, 2009.*

## LSI LECTURE SERIES 2009

The successful Life Science Informatics Lecture Series was continued in 2009. B-IT Professors Martin Hofmann-Apitius and Jürgen Bajorath gathered again a plethora of high profile researchers. The series was opened with a talk by Professor Dr. Hanno Wild, Head of Medicinal Chemistry at Bayer HealthCare AG speaking about trends in "Life Science Informatics and Drug Discovery". Further researchers from the industrial sector included Peter Ertl (Novartis Institutes for BioMedical Research, Switzerland), David de Graaf (Boehringer Ingelheim Inc., Richfield, USA) and Michael Engel, (Grünenthal Aachen). Professors Mathias Rarey (Hamburg) and Hugo Kubinyi, (Heidelberg) contributed as representatives of University research. PhD students from the B-IT Research School had the opportunity of meeting the lecturers before their lectures to discuss their PhD theses in the context of industrial and academic research.



*Professor Dr. Hanno Wild, Head of Medicinal Chemistry at Bayer HealthCare AG.*



*Dr. David de Graaf, Vice President of Biotherapeutics and Integrative Biology at Boehringer Ingelheim.*



*Professor Dr. Matthias Rarey, University of Hamburg, discussing with students after his talk.*



## MOBILEHCI 09 HELD IN BONN

### Cellphone, PDA & Co: One thumb is not enough

The 11th International Conference on Human-Computer Interaction with Mobile Devices and Services (MobileHCI 2009) was organized by B-IT partners at the University of Bonn in September 2009. Program Chairs included Professors Volker Wulf (University of Siegen), Dr. Markus Eisenhauer (Fraunhofer FIT), and Prof. Matthias Jarke. Only 20% of the 176 received submissions could be accepted for presentation, making MobileHCI one of the most competitive conferences in the field. Hot debates among the almost 350 delegates from 28 countries raged about the usability of future multi-function mobile phones with dual interfaces and gesture recognition. But also wearable mobile devices embedded in clothing, bicycles, and the like found the attention of scientists. Keynote talks were presented by Jun Rekimoto, Professor at Tokyo University and Director of the Interaction Labs in the Sony Computer Science Laboratories, Kentaro Toyama, Co-Founder of Microsoft Research India, und Peter Möckel, Manager of Deutsche Telekom Laboratories (T-Labs) in Berlin.

## INFORMATIKTAGE 2009



*GI president Professor Jähnichen and Professor Creemers opened InformatikTage 2009, the elite student meeting of the German Informatics Society GI, organized by B-IT for the fourth time in a row, in March 2009. A record number of 130 students, supervising faculty, and industry representatives joined the meeting.*

# Research at B-IT

A specific feature of B-IT is its close integration of teaching and research at all levels. In many cases, research results by student teams lead to publications or demonstrations that capture public attention. On this page, we can give but a few examples.

## **MEDIA COMPUTING CONTINUES AS TOP GERMAN CHI GROUP**

Prof. Jan Borchers' B-IT Media Computing Group attracted funding from third parties such as the DFG Excellence Initiative and the City of Aachen of more than 300k Euros in 2008, 400k in 2009, and has been accepted for a 500k per year research program to continue its work on the Aixplorer next-generation mobile tourist guide for the Route Charlemagne in Aachen through the NRW.IKT initiative for 2010 through 2012. The group now includes a total of ten doctoral students and postdocs, up from the original 3.5 B-IT funded researchers.

With four CHI Papers & Notes for 2009, the Media Computing Group continued to expand its 2008 position as Germany's leading HCI research group in terms of archival publications at ACM CHI, the premier international conference on Human-Computer Interaction. Since its inception in '03, his group has published more such publications than any other German other institution. The group also published an additional six other submissions at CHI 2009, and showed two systems as Interactivity exhibits at the conference. Student Marcus Reul was awarded 3rd place in the Undergraduate Student Research Competition at CHI 2009, from a total of 93 submissions. It's the second year in series for the Media Computing Chair to bring home an award in this competition.

At UIST 2009, another tier-1 conference on user interface technology, PhD student Malte Weiss from Jan Borchers' Media Computing Group

won the 2nd place in the Student Innovation Contest in the category "Best Implementation" for his game "BallMeR" in which users try to kick a ball into the other player's goal using a force-sensitive keyboard prototype from Microsoft Research.

## **REGIONAL RESEARCH COLLABORATION IN LIFE SCIENCE INFORMATICS**

Several widely recognized Universities, large research institutes and companies with substantial life science informatics activities are located in the Aachen-Bonn-Cologne (ABC) region. The LSI curriculum at B-IT has strong collaborative links to most of these institutes, including a working relationship with – amongst others – the Jülich Supercomputing Centre (High Performance Computing Group; Dr. Achim Streit) and the Max-Planck-Institute for Plant Breeding in Cologne (Prof. Dr. Heiko Schoof). Prof. Schoof focuses on crop genome analysis, and has been collaborating for several years with B-IT Professor Hofmann-Apitius. Two LSI students already did their Master thesis with Prof. Schoof at the Max Planck Institute.

Regional experts in computer science or medical informatics will share their knowledge with our students from winter semester 2009/10 on: Dr. Achim Streit from Jülich Supercomputing Centre will start teaching at B-IT in spring 2010; he will introduce students into high performance (HPC) and grid computing. Dr. Michael Rossbach, working at the medical research centre "life & brain" in Bonn, will start this winter semester with a lecture series on "medical informatics". Both experts will broaden the offering for Master students and through both academic teachers we are linked to important research institutes with an international outreach in the region.



Students playing Mister X in Bonn.

## MISTER X – DEVELOPING AN INNOVATIVE LOCATION-BASED MULTIPLAYER GAME THE AGILE WAY

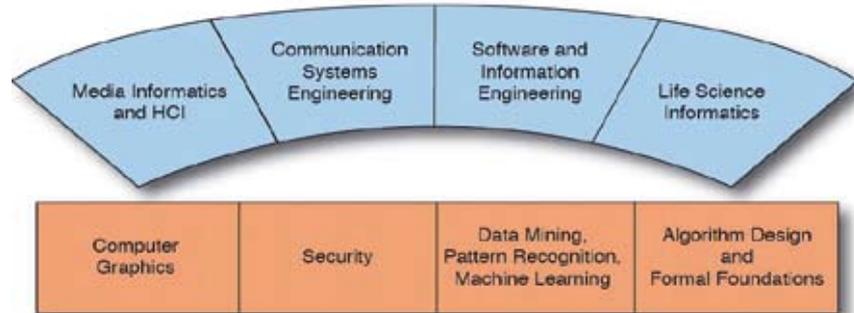
Since several years, the Agile Lab Courses, provided by Professor Cremers and his groups, have been a favorite choice of many students within the B-IT curriculum. Participants are faced with a 4-5 weeks industry-inspired team-oriented software development. "Mister X" is an innovative hide-and-seek game on smart mobile phones weaving the virtual game mechanics into the real outdoor activity. Mister X is part of the research project Adaptive Mobile Gaming of the University of Bonn in cooperation with the Deutsche Telekom. All players (one Mister X and up to four detectives) share a common map. Mr. X's position is updated every few minutes, whereas the detectives are continuously shown. The goal for the detectives is to catch Mr. X within a certain time. „Nasty gadgets“ can be collected and applied: a player can make himself invisible for a short period, a screamer can be ignited that emits a sharp scream on all players' devices, or Mr. X's map can be turned upside down to hamper him. The detectives can initiate a conference call to support joint strategic planning and cooperation. But Mr. X might have installed a wiretap and listen!

The main problem of transferring the board game to the mobile outdoor setting has been solved by a combination of technical and non-technical features. The conference call option helps players share gaming experiences. Having two players share one device instead of letting them all play „alone“ supports cooperation and enhances the game experience. The game mechanics should enforce real meetings of players to proceed (e.g. puzzles that can only be solved placing multiple screens next to each other). Analyzing how the audience could meaningfully interact with an ongoing game is one of the next goals.

Already the current state fascinates players and spectators: Press releases accompanied the final presentations of the corresponding labs and the media coverage for the current prototype involves news articles, radio interviews and TV reports. On the scientific level, the Mister X mobile prototype raised much attention, e.g. at the MobiCom 2009 in Beijing, China, or at the Conference on Advances in Computer Entertainment Technology (ACE 2009) in Athens (Greece), where Mister X mobile was one of the three award-winning Creative Showcases.



# B-IT Research School



Faculty and students of B-IT Research School.

## RADICALLY IMPROVED DOCTORAL TRAINING THROUGH B-IT

The North Rhine-Westphalian Ministry of Innovation, Science, Research and Technology (MIWFT-NRW) has approved financial support totaling initially over 1.5 M€ for the Bonn-Aachen International Research School on Applied Informatics (B-IT Research School) for the period 2008-2013. The B-IT Research School is operated by RWTH Aachen University with the University of Bonn and the Fraunhofer Institute Center Birlinghoven Castle. Professors Matthias Jarke (RWTH Aachen University and Fraunhofer FIT) and Armin B. Cremers (University of Bonn) serve as initial scientific directors.

The NRW financial support is matched by funds from the University Rectorates, the B-IT Foundation, and the participating institutes. The B-IT Research School will support scholarships for up to 20 doctoral candidates, plus a program of compact courses and research seminars within Applied IT. Two junior fellowship positions will be filled to support this work.

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.

The B-IT Research School clusters the doctoral candidates across participating institutions in eight key themes where the region is highly competitive internationally. Each area is coordinated by one or two internationally known researchers and organizes its own program of regular research seminars, where the doctoral candidates present their research, and of compact courses in which international visitors join the local faculty to train the candidates in latest scientific status and methods of their fields, but also in soft skills around project management, writing and presentation techniques, and general scientific methodology. The course program is organized such that project researchers are not hindered in their normal duties. Conversely, internship programs offer the more theoretically oriented students the opportunity to obtain experience in larger research projects.

The first six doctoral scholarships were granted in October 2008. Further scholarships were awarded after a tough selection from over 250 applications in April 2009, thus reaching a total of 18 doctoral scholars from 11 countries; six of them are graduates from the B-IT master programs. From the start, several of the scholarships have been co-financed by industry or other organizations. It is planned to continue and strengthen this public-private cooperation.

Scholars, supervisors and organizers held their first general assembly in August 2009. A highlight of the event was the keynote talk of Prof. Peter Martini on his groundbreaking analysis of



*Prof. Borchers demonstrates Aachen's Mayor Jürgen Linden the "Friedenstisch" multitouch table.*

the infamous Conficker worm that had threatened millions of users worldwide and whose structure was first dissected here.

The B-IT Research School conducted initial compact doctoral training courses with well-known international researchers throughout the academic year, in the areas of communication, HCI and Media, Computer Graphics, Information and Software Systems, and Life Science Informatics. Doctoral candidates did not only have the opportunity to listen to course teaching but there was also time for individual discussion and counseling with the international professors. Visiting faculty included, among others, Tamal Dey (Ohio State University), Jim Hollan (University of California at San Diego), Kalle Lyytinen (Case Western University), John Mylopoulos (University of Toronto), Ramon Puigjaner (University of the Balears), and Bill Verplank (Xerox and Stanford). B-IT doctoral candidates were also given the opportunity to take part in the large international conferences we organized on communication systems (P2P 2008 in Aachen, Networking 2009 in Aachen), web-based learning (ICWL 09 in Aachen), and mobile human-computer interaction (MobileHCI 09 in Bonn). Several of these conferences held special doctoral colloquia co-organized by the B-IT Research school where our scholarship students had the opportunity to meet their peers from many other countries. The same purpose was also served by cooperation with Doctoral Schools such as the European Summer School on Technology-enhanced Learning (Terchova, Slovakia).

Olga Domanova joined the LSI curriculum with a Bachelor degree in biotechnology from the Technical University of Saint Petersburg, Russia. She has obtained a fellowship from the German Academic Exchange Service and participated in the "work study program" at the Department of Bioinformatics at Fraunhofer SCAI. In the third semester, she was offered a PhD position at a highly reputed University in the UK. As she had also applied for a PhD fellowship of the B-IT Research School and her very convincing presentation prompted the selection committee to assign a B-IT Research School fellowship to her, she was in the favorable situation to be able to choose between two options. She ultimately chose the offer made by B-IT Research School to stay in Bonn and to do her PhD thesis in the area of chemical information mining with B-IT Professor Martin Hofmann-Apitius.



*Olga Domanova.*

Florian Heller has a double link to B-IT: he is a B-IT Research School PhD candidate in Prof. Jan Borchers' Media Computing Group, a B-IT endowed chair at RWTH. Thanks to Florian's CORONA system, Aachen City Hall visitors can now join a medieval coronation feast: CORONA tracks visitors around the coronation hall, creating a continuous, personalized 3D audio augmented reality on their mobile audio player – a world premiere. Walking around the hall, you can overhear the king's speech, medieval guests and their political chit-chat, or the kitchen staff discussing the next course. In the same hall, visitors can interactively explore the key players of the 1748 Peace Treaty and the historical connections, using a multitouch table, the so-called "Friedenstisch". CORONA is part of Aachen's large-scale Route Charlemagne project within the ikt.nrw research and innovation program.



*Florian Heller.*

## 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 DFG Research Training Group “Software for Mobile Communication Systems” and the new Excellence Research Cluster “Ultra-High-speed 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 research, including the DFG-funded Collaborative Research Center “Media and Cultural Communication”, 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; and Fundamentals of Media Science and business. 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.

In 2008, Prof. Jan Borchers received an offer for a professorship at the University of Zurich, Switzerland, but he decided to stay with RWTH Aachen University in the B-IT Endowed Chair on Media Informatics. In his research, he continues to contribute to the Excellence Cluster UMIC and has acquired new projects such as the Route Charlemagne project (see Research@B-IT section). He also coordinates our activities in the Apple iTunes university program from which students can download video-taped courses and electronic course materials.

Thirty one Media Informatics students have completed their degree in the academic year 2008-2009. The graduates quickly found interesting positions either as doctoral students in Germany and abroad, or in attractive companies. The incoming classes of fall 2008 and 2009 totaled 71 students, from 26 countries; as in previous years, about one third is female. B-IT students were again successful in obtaining competitive scholarships. Ten incoming students, pre-selected from more than 500 applicants, were awarded the prestigious Erasmus Mundus scholarship program we are conducting jointly with the universities of Edinburgh (UK) and Trento (Italy). Media Informatics student Siyu Tang won one of the three RWTH master student scholarships awarded within the faculty of Mathematics, Informatics, and Natural Sciences; she was also awarded a prestigious internship at the Nippon Institute of Technology (NIT) in Tokyo, Japan.

## RESEARCH ON MEDIA PROCESSES

Two PhD Students from the research group of Prof. Thomas Rose finalized their thesis. Gertraud Peinel received her PhD on the investigation of business models for electronic government services. Specific attention was devoted to the modeling of governmental objectives and the advantages and disadvantages for the participation in collaborative service chains. Martin Sedlmayr received his PhD for the development of a modeling framework for the support of Standard Operating Procedures in intensive care units of hospitals. This framework allows medical experts to capture their know-how about treatment processes with an emphasis on medical objectives. An execution environment for the framework is embedded in daily operating procedures.

The CoCar project on car-to-car communication and traffic management has been one of the most successful and publicly visible BMBF-funded projects in 2009. As subcontractor to Ericsson, the Media Processes group supported the analysis of movement data of mobile phones in street vehicles, in order to generate information on traffic prediction, e.g. for navigational purposes.

## RECENT B-IT MEDIA INFORMATICS ALUMNI

### Emilija Arsenova

I graduated from the Media Informatics program in 2008. Immediately after, I started working for one of the four largest international accountancy and professional services companies in the world - PricewaterhouseCoopers (PwC), in the area of IT Consulting. My scope of duties include process design and analysis, risk analysis of SAP and other systems, development and implementation of SAP user and role concepts, development and implementation of compliance



concepts and tools, etc. I have also become a member of the SAP Center of Excellence, with focus on security and identity management, one of a kind service offered by PwC Germany. The Master in Media Informatics program provided me with the necessary knowledge and experience: my personal favorite aspect of the studies was the opportunity to do practical work at the Fraunhofer institutes. The master's thesis, which I developed in cooperation with Fraunhofer FIT, proved to be an essential career guideline; it was the RWTH Aachen nominee for the best master thesis award by Fakultätentag Informatik. One of the best features of the programs is the fact that the classes are lectured by highly motivated top researchers. I would highly recommend this program to anyone.

### Diana Luz Cheng Abusabal

After completing my Masters degree in Media Informatics in 2009, I have recently started my job at Vodafone Group in Düsseldorf as a Graduate Trainee in their Technology Rotation Program.



In this program, I will participate in a number of projects in different areas of technology, involving topics from network engineering to internet services and web development. By working with a leading global organization I will have the opportunity to travel for work and will receive extensive support for career development, such as relevant training courses. Through my studies in Media Informatics I acquired a good level of expertise in theoretical and applied computer science topics. I had to work in technically challenging projects, with a large number of participants and typically within an international team – these are skills which I need for my job on a daily basis. Moreover, living in Bonn for over 2 years has given me a number of personal satisfactions – making friends from all over the world, learning a new language and enjoying the cultural life of an excellent place to live in.

Media Informatics Graduates accepted a wide range of positions in research and business:

Ableton AG  
Atma Jaya Yogyakarta University  
Avedas AG  
B-IT  
Bahria University  
Bank of Mexico  
Bertelsmann AG  
Bombardier Inc.  
Brainloop AG  
CAS GmbH  
CBC Cologne Broadcasting  
Center GmbH  
COMNEON GmbH  
Deutsche Telekom AG  
Ericsson AG  
European Computer Telecoms AG  
Finantix Srl  
Fox Chase  
Fraunhofer FIT  
Fraunhofer IAIS  
IdeaObject Softwares (Pvt) Ltd.  
IP Labs  
iPharro Media GmbH  
IW-One AG / QSC AG  
Kisters AG  
Lakshmi Technology and  
Engineering Industries Ltd.  
LHS Telekommunikation  
Lycos  
Mastercard  
Microsoft  
NAVTEQ  
Novartis  
Oando Plc  
PricewaterhouseCoopers AG  
Qiagen GmbH  
Research Center Jülich  
RWTH Aachen University  
SAP AG  
sd&m AG  
Siemens AG  
Siemens Healthcare AG  
Solutions 4 Media  
T-Systems  
Technical University Eindhoven  
Teleca  
Tessella plc  
The University of the West Indies  
University of Asia and the Pacific  
University of Augsburg  
University of Bonn  
University of Duisburg-Essen  
University of Edinburgh  
University of Hamburg  
University of Heidelberg  
University of Stuttgart  
University of Trento  
Vodafone AG  
Workplace Systems

## Master Program in Life Science Informatics



Prof. Dr. Jürgen Bajorath,  
Life Science Informatics



Prof. Dr. Martin Hofmann-  
Apitius, Life Science Informatics

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. Each student is assigned a professor as personal mentor.

Computer scientists with an applied focus in biosciences as well as biologists with a strong background in computer science have been in great demand in the last few years, and this is expected to continue in the foreseeable future. Graduates of the program are well prepared for the typical professional tasks in applied data analysis and data modeling, in industrial functional genomics, drug design and pharmacology. The Aachen – Bonn – Cologne – Düsseldorf region (ABCD region) is home to many prospective employers, including global players as well as highly specialized medium-sized companies.

Eleven master theses were completed in 2009. Among the LSI alumni so far, 59% are currently involved in PhD projects, whereas 30% work in companies and 11% at universities or research institutes. The number of applicants to the Life Science Program grew from 67 in 2006 to 105 in 2007 and to 118 in 2008. Twenty students were selected for start in October 2009 from 128 applicants in 2009. Seventy percent of them are female.

Four of the LSI incoming students in autumn 2009 were awarded a LSI Work Stipend in one of the research groups participating in the Life Science Informatics program. The students will get involved into research right from the very beginning of their studies. The leaders of the respective research groups will make sure that this additional involvement does not interfere with their studies. This year two groups participate in this program with the following students: Shweta Bagewadi and Tamara Bobic (Professor Hofmann-Apitius) and Mercedes Castillo Martinez and Eleonora Khabirova (Professor Thomas Berlage).

## NEWS FROM LSI STUDENTS

### Ye Hu

Ye Hu joined B-IT in 2006, graduating from Southeast University in Nanjing, a 211 elite university in China.

She joined the group of Professor Bajorath to carry out her master thesis in co-operation with Professor Gütschow, Pharmaceutical Institute, University of Bonn. In 2009 Ms. Hu joined Professor Bajorath's group as a PhD student in the area of chemoinformatics. Ms Hu has meanwhile published four papers within her PhD thesis:



- Peltason L, Hu Y & Bajorath J. From structure-activity to structure-selectivity relationships: quantitative assessment, selectivity cliffs, and key compounds. *ChemMedChem* 4, 1864-1873, 2009.
- Hu Y, Lounkine E & Bajorath J. Filtering and counting of extended connectivity fingerprint features maximizes compound recall and the structural diversity of hits. *Chem Biol Drug Des* 74, 92-98, 2009.
- Hu Y, Lounkine E & Bajorath J. Improving the performance of extended connectivity fingerprints through activity-oriented feature filtering and application of a bit density-dependent similarity function. *ChemMedChem* 4, 540-548, 2009.
- Lounkine E, Hu Y, Batista J & Bajorath J. Relevance of feature combinations for similarity searching using general or activity class-directed molecular fingerprints. *J Chem Inf Model* 49, 561-570, 2009.

### Paurush Praveen

Paurush Praveen obtained a Bachelor Degree of Engineering in Biotechnology from the Acharya Institute of Technology, Bangalore, India. In his Master thesis, he explored for the first time a systems biology approach



to model parasite-host interactions within the activities at Fraunhofer SCAI aiming at treating so-called "neglected tropical diseases". Within the WISDOM project, Paurush's work contributes to the identification of novel drug targets in *Plasmodium falciparum* (the Malaria causing agent), *Trypanosoma brucei* (the parasite causing sleeping sickness) and *Theileria parva* (an intracellular parasite that immortalizes lymphocytes in cattle).

### Albina Asadulina

Albina Asadulina holds a Bachelor of Engineering in Computer Science from Kyrgyz Russian Slavic University. She joined the LSI curriculum in WS 2008/09 with a fellowship of the German Academic Exchange Service (DAAD). Even before she arrived in Bonn, she was offered a research position at the Department of Bioinformatics at Fraunhofer SCAI as part of the "work study program" that has been established between the Fraunhofer institutes and B-IT. Between the second and third semester, she did an internship with the group of Prof. Peter Murray-Rust at Unilever Research Institute of Cambridge University, UK.

## International Program of Excellence in Computer Science



Prof. Dr. Joachim von zur Gathen, Computer Security

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.



Prof. Dr. Stefan Kowalewski, Embedded Systems

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.



Prof. Dr. Christian Bauckhage

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.

Prof. Dr. Christian Bauckhage, Fraunhofer IAIS, accepted a position as Associate Professor of Media Informatics at the University of Bonn in

October 2008. After getting his doctorate in Bielefeld, Germany, he held research positions at York University (UK) and Deutsche Telekom Laboratories, Berlin, prior to joining B-IT. His research area is image / video retrieval and statistical learning.

In the academic year 2008-2009, 25 compact undergraduate courses for small teams of very good students were held, many of them with a lab or seminar component and thus a lot of active participation. A total of 303 participants successfully passed these courses, significantly continuing the upward trend of the last years. With the transition from the Diploma to the Bachelor curriculum in Aachen (2006) and Bonn (2007), these numbers have grown and the program has been successfully restructured to specifically target the best bachelor students.

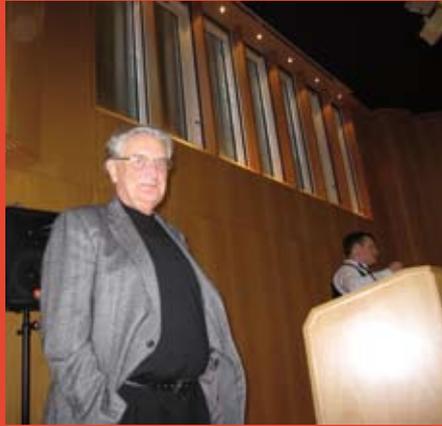
Since 2009, the IPEC program collaborates closely with the B-IT Research School in summer schools and lecture series for young researchers. Moreover, additional efforts are being undertaken towards further broadening the existing offerings in the IT Security and Privacy sector towards a specialized study program.

## PUBLIC LECTURE SERIES ON PRIVACY

In 2009, B-IT is offering a public lecture series addressing technical, legal, and political aspects of the debate on Privacy. Guest speakers include former IFIP President and privacy pioneer Klaus Brunstein, liberal former federal minister Gerhard Baum, artist and internet activist padaluun, previous and current privacy responsables of the German government Spiros Simitis and Peter Schaar, and theology professor Knut Wenzel. Participants and students have the opportunity to discuss with the speakers in an informal atmosphere before their Thursday evening talks. The lecture series also serves as one of the starting points for establishing a continuing education program in the important field of IT security and privacy at B-IT.

## CRYPT@B-IT 2009

This summer school on cryptography in August 2009 offered undergraduate and graduate students, postdocs and researchers the opportunity to crypt a bit. It provided acquaintance and interaction in an intellectually stimulating and informal atmosphere in pleasant surroundings. It was dedicated to the exploration of some fundamental areas of cryptography: design and analysis of block ciphers and cryptographic hash functions; cryptography: Numbers at work and play; and the Enigma crypto machine. The permanent presence of world-class researchers and teachers was much appreciated by the audience, and some research collaborations were started during the summer school. Lecturers included Joachim von zur Gathen, B-IT; Max Gebhardt, BSI Bonn; Marc Joye, Thomson R&D, France; and Bart Preneel, Katholieke Universiteit Leuven.



*Gerhard Baum's public lecture found a captive audience of over 100 in B-IT's main lecture hall.*

## SECRET MESSAGES "ZHU GDV OHVHQ NDQQ, LWV VFKODX" OR HOW TO MAKE A WIRELESS LAN CABLE TAP-PROOF

B-IT Department of Computer Security (cosec) presented a lecture within "Kinderuni" (Children's University), a Lecture Series of the University of Bonn addressing school children. The students were introduced to cryptography, taking "typical" examples from their experience. Here is one example: The current school lesson is boring (may happen...). Aline wants to send a note to Sebastian. But Luca is interested in it too. How can Aline send Sebastian a note without Luca being able to read it? Encryption is a way to achieve this. But how can it be done? Computers are in wide use today, often connected to the Internet or to each other through Wireless LAN. But anyone who is able to detect and receive the respective waves can monitor this. Is it probably the suspicious van at the opposite side of the street? Encryption can prevent this.

# Master Program in Autonomous Systems



Prof. Dr. Gerhard Kraetzschmar,  
Educational Robotics



Prof. Dr. Paul-Gerhard Plöger,  
Autonomous Systems



Prof. Dr. Erwin Prassler,  
Robot Planning

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), four teaching and research assistants (Iman Awaard, Ronny Hartanto, Timo Henne, Anastassia Küstenmacher) and researchers, who have been recruited in due course of the two European research projects XPERO and BRICS, namely Shahzad Cheema, Nico Hochgeschwender, Björn Kahl, Uwe Köckemann, Jan Paulus, Michael Reckhaus, and Asamat Shakhimardanov.

Students get a solid theoretical background in Autonomous Systems. Examples of lectures are Autonomous Mobile Robots, Control and Systems Theory, Robot Manipulation, Learning and Adaptivity, Hardware-Software Co-design of Embedded Systems, and Probabilistic Reasoning. The students may specialize in fields like System Design, Navigation, Sensors and Modeling, Computer Vision or Manipulation. The courses are combined with research projects conducted at IAIS or other approved institutions. The b-itAS program has been accredited by ASIIN in 2006.

In the academic year 2008-2009, 24 students were admitted from 186 applications. 12 students completed their degree; more than half of them continued with doctoral studies or other research positions. Deyaun Qiu was awarded the DAAD (German Academic Exchange Service) International Student Prize for his Master Thesis "GPU-based ICP Scan Registration Algorithm", and Dirk Holz won a best paper award for his paper "Efficient 2D-Navigation of Mobile Service Robots".

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 or ICMA; among others Erwin Prassler held the General Chair of the IEEE International Conference on Robotics and Automation (ICRA) 2009, and Gerhard Kraetzschmar was the Workshop Chair.

In March 2009 the kick-off of the BRICS project (Best Practice in Robotics) took place. Erwin Prassler is the coordinator of this 1 million Euro project granted for four years by European Union. Project partners are b-itAS, KUKA Roboter, Gesellschaft für Produktionssysteme, Fraunhofer IPA, Germany, Bluebotics, Switzerland, University of Twente, The Netherlands, and University of Bergamo, Italy.

In April 2009 the XPERO project (Learning by Experimentation; partners b-itAS, Fraunhofer IAIS, Germany, Vienna University of Technology, Austria, University of Verona, Italy, University of Ljubljana, Slovenia, American University of Paris, France; project leader Erwin Prassler) won the first prize for the best technical exhibit at FET'09 (Future and Emerging Technologies) in Prague, Czech Republic.

Gerhard Kraetzschmar was invited to give talks on the occasion of the Emeritation Colloquium for Prof. Dr. Herbert Stoyan, Erlangen-Nuremberg University, and at RoboParty 2009, University of Minho, Guimares, Portugal. Paul G. Plöger was invited to give lectures at RoboCup@Home, Graz, Austria, and Erwin Prassler gave an invited lecture at PERMIS 2009 (Privilege and Role Management Infrastructure Standards), Gaithersburg, United States.



## TEAM B-IT-BOTS RETURNS HOME AFTER THE GAME IS BEFORE THE GAME!

In 2009, a dream finally came true! The team "b-it-bots" from BRSU succeeded in winning the World RoboCup Championships taking place in Graz. During this tournament, the "b-it-bots" once again faced stiff competition and came in ahead of the team "eR@sers", Tamagawa University, Japan, second place and the team "NimbRo", University of Bonn, Germany, third. This comes one year after being runner-up during the 2008 championships. The b-it-bots were also awarded first place in the German Open in Hannover (20-24 April 2009).

The RoboCup@Home League is a competition for service robotics that takes place in an environment of several furnished rooms. During the course of the competition, these rooms are changed several times. The robot must independently and safely find and navigate within these rooms autonomously. It can recognize objects, learn their names and remember the places where the objects are located. The robots of the advanced teams can also manipulate the objects and move them. Objects to be learned and recognized can be the faces of the residents and their guests. The residents interact with the robots via natural spoken language, even if it is in an environment with loud background noise. The RoboCup@Home League is becoming a standard benchmark for service robotics and attracts the interest of a growing number of research groups.

This year's world championships saw 19 teams compete for the title of @Home champion. This is an almost two-fold increase in the number of competitors since last year's championships. The b-it-bots faced tough competition from teams from all over the world.

Johnny Jackanapes, the team's robot, was accompanied and supported by his entourage of six Master's of Autonomous Systems students, Dirk Holz, Thomas Breuer, Geovanny Giorgiana, Zha Jin, Christian Müller and Frederik Hegger; two research associates Ronny Hartanto and Jan Paulus; along with two professors Paul Plöger and Gerhard Kraetzschmar.

In the world championships final, Johnny was first introduced to new surroundings and was then able to grasp a drink from the dining table and deliver it to a guest. During the process of learning the new environment, the internal state of Johnny's map was updated and presented to the jury as proof of concept that the map was built on-line. Johnny also showed his speech recognition and face detection capabilities. He revealed his newest feature, namely facial expression identification.

Now that the b-it-bots have been crowned as the world leaders in the @Home league twice this past year, this provides the program with an added impetus to maintain this momentum and standard of excellence in future events.



## 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. More than 5,000 students from 130 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 30,000 students, of which more than the half are enrolled in engineering. More than 4,000 international students are enrolled, including around 900 Asian students. RWTH offers more than 65 first degree programs in Science, Engineering, Economics, Medicine and Arts and more than 20 graduate programs in Science and Engineering. The specific strength of RWTH’s engineering education is the combination of education and advanced research. RWTH’s engineering departments closely cooperate with national and international industries. Most of the engineering professors at RWTH held positions in industry before they became RWTH faculty members. 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. Under this program, RWTH receives a total of ca. 180 Mio. € for its strategic development, three excellence clusters, and a Graduate School. B-IT faculty are involved in two excellence clusters and the graduate school as well as the central strategy proposal.



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



Entrance of Birlinghoven Castle.

The Birlinghoven Castle campus has for almost 35 years been one of the largest and most influential computer science research sites in Germany. Since 2001, it is a member of the Fraunhofer Society of Applied Research. Today 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. The campus also hosts one of the best-equipped Computer Science research libraries in Germany. Three IZB institutes contribute to the B-IT master programs Media Informatics and Life Science Informatics:

### FRAUNHOFER FIT

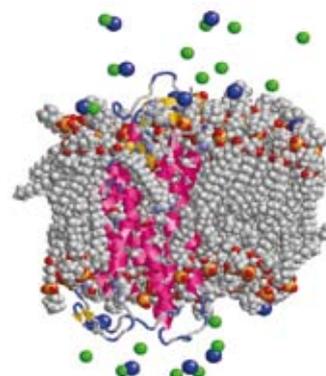
Fraunhofer FIT investigates human-centered computing in a business or engineering process context. The usability and usefulness of information and cooperation systems is optimized in their interplay between human work practice, organization and process. In Life Science Informatics the institute focuses 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.



Underwater treasure quest: As a demonstrator Fraunhofer FIT created the world's first mobile underwater AR game. Its main component is a waterproof display in front of a diver's mask. The display lets the diver see his or her real underwater environment plus additional virtual objects.

### 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 Datagrid / 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 behaviour 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

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 2005, the six departments will accommodate more than 4.500 students and about 120 faculty members.

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

Fraunhofer IAIS develops solutions that, by their intelligence, enable humans to take better decisions and that, by their autonomy, relieve humans in general and in particular extend the range of human actions. Knowledge computing and autonomous robots are the two core areas of the institute which have a history reaching back to 1998.

One focal point of IAIS is to develop business intelligence solutions for integrated analysis of databases, multimedia-, text-, web- and geo-data (visualization, extraction of information, data mining) to support better decision-making. Logistics companies and one of the major European retail groups use IAIS systems for interactive support of location analysis and marketing campaigns. IAIS software simplifies generating and sharing ideas in small teams and large groups, e.g., for citizen participation in urban planning. Complex systems are modeled in IAIS with multi-agent systems that have been developed in telematics applications. In the field of autonomous robots, IAIS develops sensor-based, robust wheel-driven and walking mobile robots. The institute is a leader in the research on sensor fusion of 3D laser-scanner data for the exploration of unknown environments. In addition to supporting explorative tasks, robots can be valuable educational tools: They combine solutions from mechatronics, computer science, and electronics that are major elements of engineering curricula. Here, IAIS provides its own robotic systems and related courses. Real-time simulation and control of non-linear systems, intelligent control systems as well as hard- and software integration round out the competence profile of the institute.

# 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

Tuition fee is 500 Euro per semester. In addition, a student union fee of ca. 200 Euro 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 650 Euro. 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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### **Media Informatics**

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