

# Annual Report 2013

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



*Helmut Dockter*

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

This year, the international master programs of the Bonn-Aachen International Center for Information Technology (B-IT) celebrate their tenth anniversary. And they have a lot to celebrate.

In October 2003, the first full batch of about 50 students in Media Informatics, Life Science Informatics, and Autonomous Systems joined the program. Already then, the pattern of B-IT probably being the most international of international programs in Germany became visible – for example, the incoming class of 2013 again comes from almost 30 different countries in all continents except Australia.

About one third of the early students have by now completed their doctoral degree, and gone on to advanced research careers in science and industry. Roughly the same percentage also persists for subsequent incoming student groups. Among the others, about 70 percent have contributed towards reducing the enormous shortage of applied IT personnel in German industry and business. Most of the remaining graduates have returned to their home countries in educational and industrial roles, ranging from professorships to company founders. You will find a few of these success stories mentioned in this report.

The B-IT programs have pioneered an impressive number of national strategies that have emerged during the following years, such as the internationalization of master programs as a consequence of the Bologna treaty, the strategic cooperation of state-led universities with federally owned large-scale

research institutions and with Universities of Applied Science, and a focus on applied and industrially oriented IT research:

- Media Informatics with societally important foci such as Multimedia Internet, IT Security, Big Data Integration, or Social Media
- Life Science informatics with major scientific impact in healthcare, biomedical and biochemical research
- Autonomous Systems addressing important advances in Robotics and other embedded systems in science as well as industry.

For the last five years, the B-IT master education has been complemented by the B-IT Research School co-funded by NRW State which offers B-IT graduates as well as other international top students a fast-track opportunity for a doctorate in applied IT. Already, 17 doctoral theses have been defended within the Research School, almost half of them coming from B-IT master programs.

The success of the newly hired B-IT professors in terms of research output as well as third-party funding has been such that all participating universities are now co-funding their groups from own means beyond the foundation support, to avert attractive offers from other famous universities made to these colleagues, some of whom are also celebrating the tenth anniversary of their research groups this year.

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



*Prof. Dr. Gerhard Barth*

# Report by the Scientific Directors

The tenth anniversary of our B-IT master programs provides an opportunity to take stock. We have successfully passed two accreditations, the initial ones being the first ever in all three participating universities, the re-accreditation including the Germany-wide first EuroInf labels. The pioneering integration of university teaching with Fraunhofer research has become subject of national strategy discussion. The deep integration between computer science and application components has attracted many bachelor graduates from top international universities. Thus, B-IT is reducing the shortage of top IT personnel in Germany, and providing highly trained people for the home countries. Each of the three B-IT master programs has developed a specific profile:

- In B-IT Media Informatics, a recent poll among the over 250 alumni showed that 64% work in industry whereas 36% aimed for a Ph.D. 63% hold positions in Germany (half of them in NRW state), 17% in the rest of Europe, and 19% all over the world, often in their home countries.
- B-IT Life Science Informatics with a strong emphasis on chemo-informatics as well as biomedical informatics lab places requires extreme selectivity. Well over half of the roughly 120 graduates went on for a Ph.D., many in the most prestigious programs in the world.
- In B-IT Autonomous Systems, students are intensely involved in applied research both at Fraunhofer and Bonn-Rhein-Sieg University, with little traditional coursework. Over 40% of the so far over 100 graduates continue with doctoral studies, several completed their Ph.D.

Details about employers in science and business can be found in this report. Since 2008, the B-IT Research School offers top master graduates the opportunity to stay in the B-IT context for the Ph.D. Many B-IT graduates are taking advantage of this opportunity. We are grateful to the B-IT Foundation and the NRW State government for their continued financial

support that has made all this possible, and look forward to the next challenges where we aim at broadening our offers towards current critical themes such as IT security and data science.

**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*

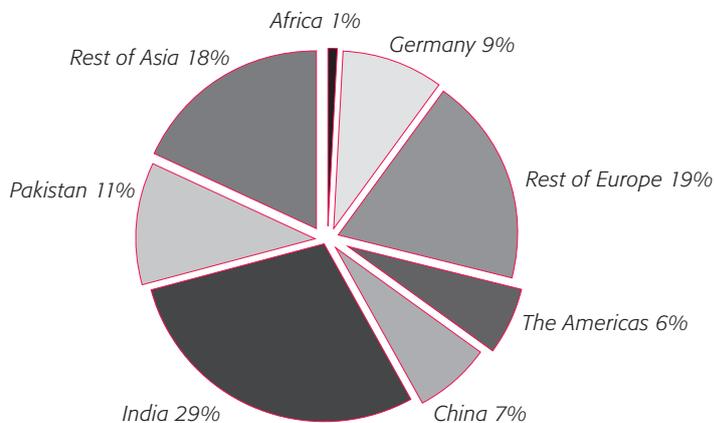


**Prof. Dr. Kurt-Ulrich Witt**  
*Bonn-Rhein-Sieg University  
of Applied Sciences*

## 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-Rhine-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 new 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.



A Welcome Party for the incoming students was held on October 24, 2013, together with the award ceremony for the prize winners of the Short Video Student Festival at B-IT. On the left: Life Science Informatics Professor Berlage and B-IT director Professor Jarke.

## 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

### Coordinators B-IT Study Programs

*Prof. Dr. Jan Borchers*

(RWTH Aachen University), Media Informatics

*Dr. Jürgen Bajorath*

(University of Bonn)

*Prof. Dr. Gerhard K. Kraetzschmar*

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

### Assistant Directors/Study Advisors

*Iman Awaad, M.Sc.,*

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

Prof. Dr. Gerhard Barth,

Founding President

### B-IT Foundation Council

*Helmut Dockter (Chairman)*

Vice Minister of Innovation, Science and Research NRW

Chairman, B-IT Foundation Council

*Hans Stender (Secretary)*

Chancellor, Bonn-Rhein-Sieg University of Applied Sciences

*MinDir Dr. Hermann Müller-Solger*

Federal Ministry of Research and Education

*Prof. Dr. Ulrich Buller*

Board of Directors, Fraunhofer-Gesellschaft

*Jürgen Nimptsch*

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*Frithjof Kühn*

County Chairman, Rhein-Sieg-Kreis

*Prof. Dr.-Ing. Ernst Schmachtenberg*

Rector, RWTH Aachen University

*Prof. Dr. Jürgen Fohrmann*

Rector, University of Bonn

*Prof. Dr. Hartmut Ihne*

Rector, Bonn-Rhein-Sieg

University of Applied Sciences

*Wolfgang Griebel*

President, Bonn / Rhine-Sieg

Chamber of Commerce

## Events and Visits

### **MEDIA COMPUTING GROUP ESTABLISHES NEW HCI CENTER**



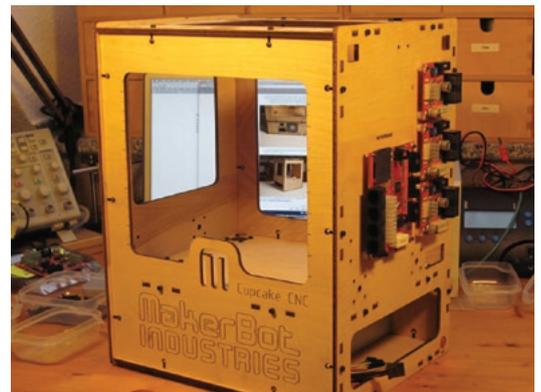
*From left to right: Jan Borchers (B-IT), Eva Jakobs, Martina Zieffle, Peter Russell (all RWTH Aachen), Michael Tobias (P3 Group).*

The Media Computing Group, B-IT-endowed Chair at RWTH Aachen University, has established a new Human-Computer Interaction Center (HCI Center) at RWTH. With faculty from linguistics, communication science, architecture, and P3 Communications GmbH, the center will conduct academic and industry-funded research and development in usability to study, design, develop and evaluate new user interfaces.

### **MEDIA COMPUTING GROUP HOSTS THE FIRST FABLAB CONFERENCE EUROPE**

FabLabCon is a conference that is a part of the Makerfaire Kerkrade that takes place right outside Aachen city. One day after the Makerfaire (September 7-8, 2013), we invited researchers, educators and practitioners to present and discuss their ongoing work on FabLabs and Personal Fabrication. The conference is sponsored by the Federal Ministry of Education and Research, within the framework of the Make Light initiative of the funding program Photonics Research Germany.

Our FabLab has started on December 7th, 2009. It is part of a worldwide network of more than 50 fabrication laboratories and open to the general public every Tuesday at no cost except for materials. A FabLab is a small workshop with tools that allow digital fabrication. In Aachen, we have multiple 3D printers, a laser cutter, and a CNC milling machine. With the 3D printers, we can print 3D objects made of ABS plastic, the laser cutter can cut and mark almost any material, and the CNC milling machine can produce high quality printed circuit boards (PCBs) in a few minutes. The Fab Lab Aachen is also used by our students in classes, for our research projects and by other institutions at RWTH Aachen University.



*FabLab.*

### **B-IT DIRECTOR JARKE APPOINTED TO ACATECH AND CAF**

In a ceremony held in Berlin in October 2013, Prof. Matthias Jarke was appointed to the acatech German National Academy of Sciences and Engineering by its presidents Hüttl and Kagermann. In spring 2013, the European Commission also appointed him as the only representative from German science on the CONNECT Advisory Forum (CAF), the main advisory group for ICT research in the funding program Horizon 2020.

## SOFTWARE DEVELOPMENT AND INTEGRATION IN ROBOTICS

Research associate Nico Hochgeschwender, Prof. Davide Brugali (University of Bergamo, Italy) and Prof. Roland Philippsen (Halmstad University, Sweden) hosted the 8th SDIR workshop (Software Development and Integration in Robotics) at the ICRA 2013 in Karlsruhe. ICRA is one of the most important robotics conferences worldwide. The goal of the workshop was to discuss new trends and opportunities in software development for autonomous systems. 64 participants from all over the world attended the event, making it one of the best-attended workshops at the conference.

## WORKSHOP ON THE OPERATIONAL PREPARATION FOR MAJOR POWER BLACKOUTS

Professor Thomas Rose organized in November 2012 a workshop on the operational preparation for major power blackouts (Operative Vorbereitung auf Stromausfälle) in the context of project InfoStrom. InfoStrom focused on the design of computer-supported collaboration means for the preparation of power blackouts. InfoStrom has been successfully concluded with a trans-sectoral demonstration of InfoStrom solutions in February 2013 as one element of Germany's initiative towards Crisis and Emergency Management at federal level. Communication and process support are at the heart of InfoStrom's objectives. The scope of solutions ranges from social media for empowering rescue and relief forces in terms of communication support, via interactive maps in command centers, up-to smart checklists for the operational support of rescue organizations.



*Workshop on the operational preparation for major power blackouts, November 20, 2012, Birlinghoven Castle, Sankt Augustin.*

About 100 participants from the state of North Rhine-Westphalia and abroad attended the presentations and the interactive session for preparing counter measures. The workshop has been broadcasted in several news casts across various media including TV.

## INSTANT USER INTERFACES PRESENTED AT ITS 2013

Dedicated input devices are frequently used for system control. The Media Computing Group presented its Instant User Interfaces at the ACM Interactive Tabletops and Surfaces 2013 Conference (ITS), October 8-11, 2013. Instant User Interfaces are an interaction paradigm that loosens this dependency and allows operating a system even when its dedicated controller is unavailable. We implemented a reliable, marker-free object tracking system that enables users to assign semantic meaning to different poses or to touches in different areas. With this system, users can repurpose everyday objects and program them in an ad-hoc manner, using a GUI or by demonstration, as input devices. This project is part of project AURA.

# Research@B-IT

## **MEDIA COMPUTING GROUP REMAINS TOP GERMAN GROUP AT CHI, RECEIVES SEVERAL AWARDS**

The Media Computing Group, Prof. Jan Borchers' B-IT-endowed Chair at RWTH Aachen University, has remained Germany's leading HCI research group in terms of archival publications (Papers and Notes) at ACM CHI, the premier international conference on Human-Computer Interaction. Jan-Peter Krämer, Thorsten Karrer, Joachim Kurz, Moritz Wittenhagen, and Prof. Jan Borchers receive an Honorable Mention for their CHI 2013 paper "How Tools in IDEs Shape Developers' Navigation Behavior".

## **MEDIA COMPUTING GROUP PROJECT AIXPLORER CONTINUES WITH 1.5 M€ OF FUNDING**

Aixplorer is a mobile tourist guide system combining urbanistic-historical and touristic applications into a new and unique experience. The state of NRW funds the 3-year project with a 1.5 M€ grant through its IKT/Ziel2 program.

## **EMOROBOT RESEARCH PROJECT LAUNCHED**

The BMBF project between Fulda University, Bonn-Rhein-Sieg University, the University of St. Gallen, and Technical University of Dortmund, launched in June 2013. It will investigate the use of emotion-stimulating assistive robots in the field of dementia care for patients in long-term treatment. The Bonn-Rhein-Sieg University team is led by Prof. Dr. Erwin Prassler and Dr. Björn Kahl. The work with the robots and other assistive systems in the Katharinenstift in Wiesbaden is conducted by research associate Matthias Füller (robot control and motion planning) and the student Teena Hassan (human robot interaction and automatic emotion recognition). The study, set up for a period of three years, is

sponsored by the German Federal Ministry of Education and Research. The research project is led by Prof. Dr. Helma Bleses of Fulda University of Applied Sciences.

## **BENCHMARKING ROBOTICS: ROCKIN**

The RoCKIn EU co-ordinated action, which will run for the next three years, kicked off in 2013 with the RoCKIn Camp event in Eindhoven this past June. The project builds upon the challenge-driven approach, long used in RoboCup, to test and streamline robotics research through standardized testbeds and benchmarks. This will be achieved through robot competitions, symposiums, educational RoCKIn camps and technology transfer workshops.

The consortium comprises Bonn-Rhein-Sieg University (BRSU), Técnico Lisboa (Portugal), Sapienza University (Italy), Politecnico di Milano (Italy), KuKA Labs (Germany) and InnoCentive EMEA (UK). Prof. Dr. Gerhard Kraetzschmar, who is supported by Sven Schneider, Frederick Hegger, Rhama Dwiputra, Nico Hochgeschwender, and Iman Awaad leads the BRSU team.



## **AURA: AD-HOC INTERACTION WITH NON-PLANAR OBJECTS**

This project explores how to make everyday objects and surfaces, including non-planar ones, in our environments into interactive controllers. The project is funded by a 300 k€ grant from the German National Science Foundation (DFG), and runs from June 2012 to May 2015.

## IT SUPPORT FOR EMERGENCY MANAGEMENT

Professor Thomas Rose has co-organized a workshop at the German Computer Science conference (GI-Jahrestagung) on "IT Support for Emergency Management". The latter has already been the fourth annual event for this topic. Hence, ICT for emergency management has been established as an operational topic in the scientific community. Presentation of procedures and counter measures is an essential requirement in this community. The treatment of mass casualties is one dominating challenge for evaluating research results, since (Ü)MANV is the only uniformly planned procedure. In addition, interface considerations for mobile devices as well as communication services are a natural interest.

## LSI RESEARCH HIGHLIGHTS

Professor Bajorath's group has published more than 30 scientific articles during the reporting period. A scientific collaboration with Pfizer has been substantially expanded in which the group develops algorithms for computational drug discovery at Pfizer as well as methods for visualization of complex drug discovery data. Moreover, the group also participates in the third funding period of SFB704.

## PROFESSOR FRÖHLICH PARTICIPATES IN THE IDENTIREST PROJECT

The goal of the IDENTIREST project, funded by the initiative "Validation of Innovative Potentials of Research" of the German Federal Ministry of Research and Technology, is to find new therapies and prognostic as well as diagnostic biomarkers for glioblastoma, one of the most common and aggressive malignant brain tumors in humans. The approach of the IDENTIREST project was judged best project within the initiative "Validation of Innovative Potentials of Research". The project is run in

collaboration with the University Clinic of Bonn and the Life and Brain Center of the University of Bonn (with Prof. Scheffler und PD Glas as project coordinators from the department of Professor Oliver Brüstle, University of Bonn).

## EMBEDDED SYSTEMS CHAIR OF PROF. KOWALEWSKI CELEBRATES TENTH ANNIVERSARY

Ten years ago, in November 2003, RWTH Aachen's Chair of Computer Science 11 led by Professor Stefan Kowalewski started its research and teaching in the field of Embedded Systems. For the first five years, it was co-funded by the B-IT Foundation where it contributed to the IPEC program.

From small beginnings, the chair has grown to a staff of over 20 researchers and engineers, with a research focus on model-based control methods that ensure the safety of complex embedded systems such as self-driving cars or medical technologies. In recent years, Prof. Kowalewski has served as an Area Coordinator within DFG Excellence Cluster UMIC, as Chairman of the Computer Science Department, and most recently, as Dean of the Faculty of Mathematics, Informatics, and Natural Sciences at RWTH Aachen University. A symposium with speakers from research and industry is held on November 8, 2013 to celebrate the anniversary.



Prof. Stefan Kowalewski.

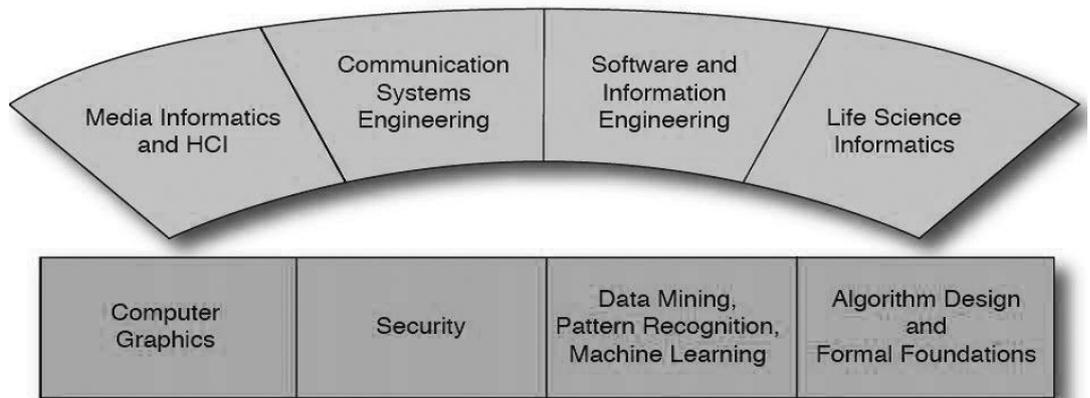


Prof. Dr. Holger Fröhlich.



winter colloquium of the Chair of Computer Science 11 in Kleinwalsertal, March 2013.

# 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 meanwhile 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 October 2013, already 17 doctoral theses were successfully defended by scholarship holders, and several more completed theses are presently under review.

## FRIEDRICH WILHELM AWARD FOR CHRISTIAN CORSTEN

The Friedrich Wilhelm Foundation selected Christian Corsten (now PhD student) to be one of the recipients of their Friedrich Wilhelm Award for his master's thesis "Co-Objects: Instant User Interfaces through Everyday Objects". The thesis explores how everyday objects can be "abused" to control devices and technical systems – a pen becomes a clicker for your PowerPoint presentation, the glass on your sofa table a volume knob for your TV. His related paper was just accepted for presentation at the Interactive Tabletops and Surfaces (ITS 2013) conference. Each year, the foundation selects from RWTH's top MSc, PhD and habilitation theses for this award and comes with a 500 € prize.

## TWO PHD THESES WITH DISTINCTION

We are very proud to have two PhD students finish their thesis with summa cum laude. Malte Weiss defended his PhD thesis on "Bringing Haptic General-Purpose Controls to Interactive Tabletops with Distinction". Thorsten Karrer defended his PhD thesis on "Semantic Navigation in Digital Media with Distinction".



*Life Science Informatics Retreat 2013 with Dr. Brown, Kyoto University.*

## **LIFE SCIENCE INFORMATICS RETREAT 2013 AT B-IT**

On September 17-18, 2013, Professor Bajorath organized the Life Science Informatics Retreat. He invited Dr. John E. Brown of Kyoto University, Japan. Dr. Brown gave a detailed and very insightful overview of the research area of chemogenomics. This included an introduction to the scientific field of chemogenomics as well as scientific and professional requirements for aspiring scientists in this area. The retreat that consisted of three lectures gave students many opportunities to interact with the lecturer after his presentations in a formal setting and during lunch in a less formal setting. After the lectures Dr. Brown also met with PhD students to discuss their thesis projects.

## **B-IT GRADUATE XIANG LI RECEIVES PHD WITH DISTINCTION**

Xiang Li who joined the B-IT Media Informatics Program with a B.Sc. from Tsinghua University, defended his doctoral thesis at

the Chair of Prof. Matthias Jarke in November 2012. His research which was also published in several top conferences, addressed a novel formal solution to problems of schema integration in databases. After receiving the rare degree "with distinction" for this outstanding thesis, he accepted a position at Google Research in Munich.

## **DR. WASSERMANN RECEIVED CIC AWARD**

Dr. Anne Mai Wassermann, recently graduated doctoral student of Professor Bajorath, received the 2013 prize for the best doctoral thesis in the field of computational chemistry and chemoinformatics, awarded by the Gesellschaft Deutscher Chemiker GDCh (Society of German Chemists), Section Computational Chemistry. She received the award at the occasion of the 9th German Conference on Chemoinformatics (GCC 2013) on November 11, 2013.

## 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)” offers 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 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.

28 Media Informatics students have completed their degree in the academic year 2012-2013. The graduates quickly found interesting positions either as doctoral students in Germany and abroad, or in attractive companies.

The incoming class of 2013 comprises 31 students, from a total of 15 countries. Media Informatics students were unusually successful in obtaining competitive prestigious scholarships and 14 students received a scholarship this year.

### **MEDIA COMPUTING GROUP CLASSES OCCUPY TOP PLACES ON ITUNES U GERMANY**

The Java and iOS Programming classes of Prof. Jan Borchers’ Media Computing Group, B-IT-endowed Chair at RWTH, ranked among the top 20 downloads on iTunes U, Apple’s free video portal for university classes in Germany during 2012/13.

## NEWS FROM MEDIA INFORMATICS ALUMNI

### Klesti Hoxha

*PhD, University of Tirana, Albania*



I finished my undergraduate studies in Albania before joining the MI program in 2009. I was still undecided about my future career, whether it would be focused in academia or not. Since the beginning of my master studies, I was really impressed by the high quality lectures offered within the program and the fact that they included state-of-the-art research results held by the instructors themselves. After having the opportunity to write a research-oriented master thesis at the RWTH Aachen, I was finally convinced that I want to pursue an academic career. Now I am back in Albania, working at the University of Tirana as a lecturer/researcher and I have also just started my PhD.

### Yaowen WuTarek Sheha

*Graduate Research Assistant, Heinrich-Hertz-Institut HHI Berlin, Germany*



As a former student of the MI program in B-IT, I would like to express my gratitude to such a strong program that enabled me to gain and improve my knowledge in different fields of Computer Science.

Because of my interest in image and video coding, and after the permission of the program coordinators, I was able to sign up for a course given by a professor at RWTH Aachen. This course along with other courses and my ambitious to this field was the reason for me to get accepted to finish

my master thesis at the Image Processing Department in the Fraunhofer Heinrich Hertz Institute, Berlin. The department is supervised by one of the most prestigious professors in this field, Prof. Dr. Thomas Wiegand.

### Onusa Yamcharoen

*Founding CEO, Solnista, Thailand*

After graduated in MSc. MI, I started working at IVU Traffic Technologies AG as system engineer in Aachen for two years. Then, I went back to Thailand and worked as an IT Freelancer. After a year I set up an IT solutions company "Solnista", since I want the business to grow more. That is my status. The study at B-IT helped me grow my thoughts and grow my world. It made me experience in many advanced technologies and intelligent research works along with giving professional/researching skill developments. Thank you very much to give me this opportunity.

### Marius Shekow

*Software Developer, Fraunhofer FIT, Bonn, Germany*



At Fraunhofer FIT I develop C++ software in the area of mobile augmented reality. On the technical side this involves real-time processing of various sensor data coming from location, orientation and image sensors, as well as 3D geometry rendering. In these fields knowledge from B-IT lectures and labs is very helpful. As our software is also used outside in the field by clients, user interface design plays an important role. The lecture Designing Interactive Systems and the User-Oriented Design lab provides a great foundation here.

### List of employers of MI Alumni:

*Business: Ableton AG, Adec-co, 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, Recommend, 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 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.

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 2008-2012 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, 28 students successfully graduated: a new record for the program. Top students again received excellent offers from institutions such as Max Planck Research Schools, Charité Berlin or Microsoft Research-University of Trento Centre for Computational and Systems Biology (COSBI), Italy. 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 third time this year – includes an online application for all applicants and Skype interviews with a selected number of applicants. About 50 detailed interviews with applicants from all over the globe were held this year. Nineteen carefully selected students will begin their studies in Life Science Informatics in winter semester 2013/2014.

## LSI SUCCESS STORIES

### Antonio de la Vega de Leon



Antonio de la Vega de Leon joined the Life Science Informatics program in 2010 with a Bachelor's degree in Biology from the Complutense University of Madrid. As a senior student (second year) he became student tutor and taught junior students of the program. He eventually carried out his master thesis in the group of Professor Jürgen Bajorath. One publication resulted from his master thesis. Antonio continues his education in the group of Professor Jürgen Bajorath in a PhD thesis project.

### Shweta Bagewadi



Shweta Bagewadi obtained a Bachelor's degree in Biotechnology from Sir M Visvesvaraya Institute of Technology, Bangalore, India. After graduation, she worked at Cognizant Technologies PVT. Ltd., India, as programmer analyst before she began her studies in the Master Program of Life Science Informatics in 2009. In 2012 she joined the group of Professor Hofmann-Apitius as a doctoral student.

### Deena Gergis



Deena Gergis obtained a Bachelor's degree in Bioinformatics from Ain Shams University, Cairo, Egypt. She joined the master program of Life Science Informatics in October 2012 with a "Scholarship Plus" stipend. It is awarded by the State of North Rhine-Westphalia to outstanding students from newly industrializing countries. October this year Ms. Gergis was appointed student tutor to the group of B-IT Professor Holger Fröhlich. She will teach incoming students (juniors) in the field of algorithmic bioinformatics.

### Paurush Praveen



Paurush Praveen Sinha joined the Master Program of Life Science Informatics in 2007 with a Bachelor's degree in Biotechnology from Acharya Institute of Technology, Bangalore, India. He graduated in Life Science Informatics with a master thesis in 2009 from the group of Professor Hofmann-Apitius. Mr. Praveen Sinha continued his education with PhD thesis project in the group of Professor Fröhlich within B-IT Research School. Paurush's had several excellent papers during his time as a PhD student. His accepted paper in the German Conference on Bioinformatics in Göttingen in September 2013 for instance, was selected as a "highlight-paper". It was also published in the important "Bioinformatics" journal. In fall 2013, he joined Microsoft Research-University of Trento Centre for Computational and Systems Biology (COSBI), Italy. Besides his academic activities, he was also a member of B-IT cricket team.

List of employers of LSI Alumni:

4GATC Biotech, Accenture, B-IT Research School, Cambridge University, Charité Berlin, Ericsson, European Bioinformatics Institute, Fraunhofer IAIS, Fraunhofer SCAI, Galileo Press, GATC Biotech, German Center for Cancer Research (DKFZ), Hamilton Medical Hoffmann-La Roche, Hype Innovation, IIT Bangalore, Leaf Bioscience, LHS Telecommunications, MarAnCon, Max Dellbrück Center Berlin, Max Planck Institute for Biophysical Chemistry, Max Planck Institute for Neurological Research, Max Planck Institute for Plant Breeding Research, Max Planck Institute for the Biology of Ageing, Max Planck Institute Tübingen, Medtronic, Microsoft Research-University of Trento Centre for Computational and Systems Biology (COSBI), Molecular Connections Private Limited, National Technical University of Singapore, Philips Research North America, Research Center Jülich, RWTH Aachen, and the universities of Bonn, Cologne, Dresden, Düsseldorf, Ghent, Kiel, Leipzig, Luxemburg, Mainz, Münster, Oxford, Tübingen, Utrecht, Western Australia, Würzburg, Zürich.

## 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's program in Autonomous Systems is an international program, taught entirely in English, offering multi-faceted training in the fields of robotics and artificial intelligence. Various robot platforms are used for educational and research purposes, including the Care-O-Bot 3, and the youBot. The focus is on enabling and integrating the necessary intelligence behind the autonomous behavior of artificial agents rather than on the hardware-related aspects of robotics. Students get a solid theoretical background in autonomous mobile robots, advanced control methods, robot manipulation, learning and adaptivity, hardware-software co-design of embedded systems, probabilistic reasoning, and planning and scheduling. The courses are combined with research work conducted at the Fraunhofer Institute for Intelligent Analysis and Information Systems (IAIS) and other partner institutions.

Students take a number of core courses in the first semester as well as compulsory seminars, and practical courses throughout their studies. The Winter Semester 2012 saw the first students study under the new curriculum, which received ASIIN accreditation in April 2012. 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). Students now choose one of two tracks to specialize in at the end of their first semester: the Intelligent Robots track and the Robot Systems Design track.

In the academic year 2012-2013, 28 students joined the MAS program from an applicant pool of 303 candidates. 15 students completed their degrees. The MAS program has always attracted the interest of students all over the globe. The 13 different nationalities of the 28 students who joined the program in the 2012-2013 academic year is proof of this fact.

The program 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 (BRSU). b-itAS cooperates closely with the Fraunhofer IAIS in implementing the program, which started in the winter of 2002. Two dual degree programs exist with both the University of New Brunswick in Canada and the German-Jordanian University in Amman, Jordan.

The program is managed by three professors (Gerhard Kraetzschmar, Paul G. Plöger, and Erwin Prassler), four teaching and research associates (Iman Awaad, Frederik Hegger, Nico Hochgeschwender, and Anastassia Küstenmacher) and researchers, who have been recruited through the XPERO, BRICS, RoCKIn, EmoRobot and Echord Edufill projects, namely Björn Kahl, Rhama Dwiputra, Matthias Füller, Jan Paulus, and Azamat Shakhimardanov.

The faculty and staff are actively involved in many scientific activities, including memberships in technical committees of IEEE or in the RoboCup Federation trustee board, the euRobotics aisbl board, numerous program committees of workshops and scientific conferences such as IROS, ICRA, ICAR, ICMA, and AAMAS.

## FROM R&D PROJECT TO PRODUCT



MAS student Atish Patange's R&D project on object detection and image in-painting in x-ray images was conducted at GREX Technologies in Limburg, where he proposed new solutions in the field of automated food quality inspection. Using the available state-of-the-art image processing, machine learning and statistics methods, Atish's solution was able to detect damaged beverage and food cans and bottles in a production line via X-ray images at an extremely fast rate (up to 46 items per second). He not only succeeded in speeding up the process considerably, but did so in a computationally inexpensive way. GREX Managing Director, Elias Delipetkos, was highly impressed with the work: Atish's solutions were so sound that they have already been integrated in the company's products. For his thesis, Atish is investigating distortion correction in food packets through the exploitation of X-ray image intensity values. The R&D and thesis projects are supervised by Prof. Dr. Kraetzschmar and Dr. Elias Delipetkos.

## MAS ALUMNI CONTINUE TO RECEIVE THEIR PHDS



This year saw two more MAS alumni, Christian Rempis and Beatriz Leon, receive their PhDs. Mr. Rempis completed his PhD titled "Evolving Complex Neuro-Controllers with Interactively Constrained Neuro-

Evolution" at the University of Osnabrück. Ms. Leon defended her doctoral thesis titled "From Robot to Human Grasping Simulation" at the University Jaume I in Castellon de la Plana in Spain, becoming the first female MAS alumna to obtain a doctoral degree.

In a development unique to BRSU, a graduate institute has been established which aims to support the further qualification of BRSU graduates and staff. Three researchers within the Autonomous Systems program are being supported through the institute; Iman Awaad, Nico Hochgeschwender and Anastassia Küstenmacher are receiving scholarships to pursue their doctoral work. Both Iman and Anastassia are alumni of the Autonomous Systems program.

## DAAD PRIZE AWARDED TO MAS STUDENT MANDAR PATHARE



Mandar Satyanath Pathare, from India, was awarded the DAAD prize for outstanding accomplishments by a foreign student studying at a German University this past October. He impressed with his friendly and helpful demeanor, his ability to solve challenging interpersonal conflicts, his interdisciplinary knowledge, precise work, self-reliance and distinctive diligence.

# 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

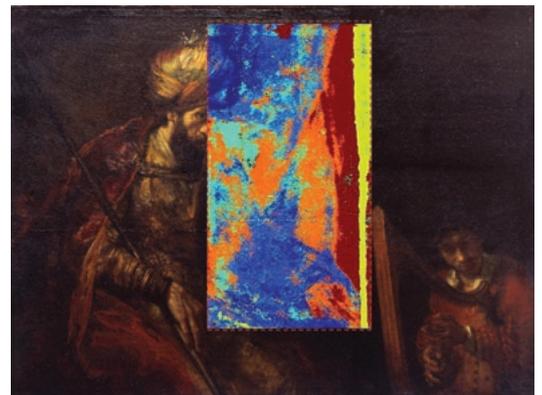
The International Program of Excellence in Computer Science (IPEC) at B-IT offers compact courses primarily during the semester break and at the highest educational level. This results in faster studies and advanced quality in selected subject areas. These courses apply to a limited number of highly 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.

## XRF IMAGING

"Saul and David" is attributed to the workshop of Rembrandt van Rijn with a disputed attribution to the master himself. At an unknown moment in the past the painting was cut into two separate paintings and later rejoined. It was investigated with a mobile XRF scanner prior to conservation treatment in the conservation studio of the Mauritshuis Museum. The planning for this treatment was not straightforward, as the extent of original paint still present in the painting was unknown. Preliminary examinations revealed, that much of the curtain visible in the background of the painting was added after the parts were rejoined to visually blend them together. Further, it was known from studies of paint cross sections that the original small rich paint is still present under the surface of the curtain, but its exact extent was unknown. This is just one of the important applications of novel technologies developed in a new BMBF-funded project conducted by Prof. Bauckhage with his students, in cooperation with DESY Research Center Hamburg and the University of Bonn.



Results of clustering given representation by SiVM. The pixels were first represented as convex combination of extreme basis vectors  $W$  determined by SiVM. Given the resulting coefficient matrix  $H$  we clustered all pixels. For the visualization different colors for different clusters were used.

## SCHÜLER-KRYPTO 2013

On two days in February 2013, 187 high school students, as well as 9 teachers met for the twelfth Schüler-Krypto to learn@bit on secret messages, encryption and decryption. They came from Alfter, Andernach, Bedburg, Bergisch Gladbach, Eitorf, Frechen, Königswinter, Neustadt (Wied), Sankt Augustin, and Siegburg.

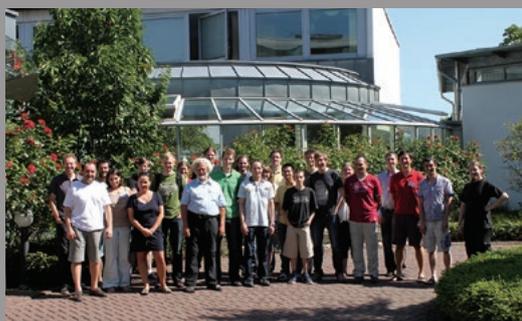
After a one hour introduction to the topic by Michael Nüsken the students got to the nitty-gritty. Everybody was asked to take up the role of James Bond and program RSA on the laptop built-in to Bond's BMW Z8. We used MuPAD on it, a computer algebra system which among many other things is capable of calculating with arbitrarily large numbers. After lunch everybody decrypted answers from Moneypeny, set up a public-key infrastructure and exchanged encrypted messages with each other. 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. And finally everybody could take home her personal visual cryptogram.

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 2013

This summer school on cryptography offered undergraduate and graduate students, postdocs and researchers the opportunity to crypt a bit. For the first time it was organized together with the Ruhr-Universität Bochum. It provided acquaintance and interaction in an intellectually stimulating and informal atmosphere in pleasant surroundings. It took place 29 July – 2 August 2013 in the b-it building and invited to the exploration of some fundamental areas of cryptography: sponge functions and Keccak; lattice-based cryptography; the Enigma crypto machine.

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. The participants had the possibility to get to know each other in a more informal way during an excursion to the Regierungsbunker in the valley of the Ahr and also during the social events in the evening. After the summer school some participants expressed their appreciation and thanked the organization team for this year's summer school. Lecturers: Joachim von zur Gathen, b-it Bonn; Alexander May, Ruhr-Universität Bochum; Joan Daemen, STMicroelectronics; Chris Peikert, Georgia Institute of Technology; Max Gebhardt, BSI Bonn, and the members of the cosec group.



*Bond's Thursday crew.*



*Having fun with RSA.*



*Enigma.*

## 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 percent 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 about 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 40,000 students. RWTH offers 130 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.*

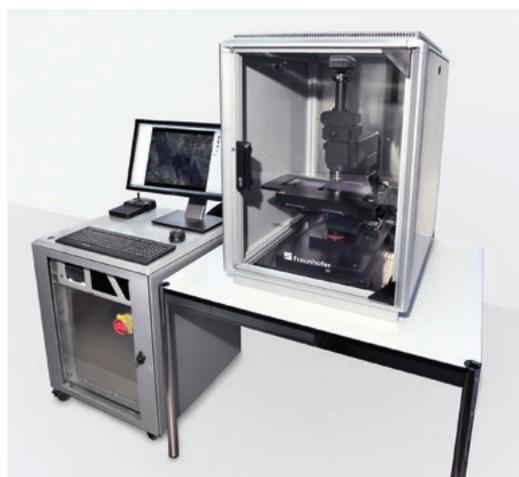


Entrance of Birlinghoven Castle.

The Birlinghoven Castle campus 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:

### 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.



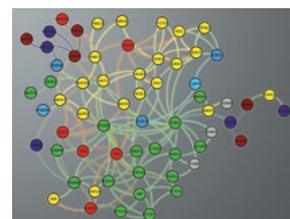
TopoScan microscope of Fraunhofer FIT: TopoScan is a modular hardware-software platform for the automated high content analysis of biological samples. Its unique software-driven architecture combines two properties within one system: Streamlined workflows with minimal intervention for the reproducible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

### FRAUNHOFER SCAI

The Fraunhofer Institute for Algorithms and Scientific Computing SCAI conducts research in the area of computational science and is a valued corporate partner for industry and academia. SCAI designs and optimizes industrial applications, implements custom solutions for production and logistics, and employs high-performance computers. The Department of Bioinformatics at Fraunhofer SCAI carries out applied research and development in three areas:

1. Techniques for information extraction in the life sciences, including recognition of named entities and relationships in text as well as large-scale, automated information extraction.
2. Integrative biology, with a particular focus on modeling neurodegenerative diseases.
3. eScience, Grid and Cloud Computing as well as technologies for the operation of HPC (Clusters) with a focus on SLA, security, and license management.

The Department of Bioinformatics is partner in major funded projects at national and EU level. Software tools for information extraction developed at SCAI BIO are used in the vast majority of pharmaceutical companies worldwide.



Fraunhofer SCAI: A hormonal network underlying dementia and Alzheimer's disease.

## B-IT Applied Science Institute

### **BONN-RHINE-SIEG UNIVERSITY OF APPLIED SCIENCES (BRSU)**

Founded in 1995, the Bonn-Rhine-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 2013, the different departments accommodate more than 6,600 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-Rhine-Sieg University of Applied Sciences.*

### **FRAUNHOFER IAIS**

The Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS develops tailor-made IT solutions to support companies and organizations optimize products, services and processes, as well as to implement intelligent information management. There is a particular focus on the analysis, access and targeted use of Big Data, new media technologies and solutions for innovative business and security processes.

In order to support customers in their information management and decision-making processes, the scientists use innovative technologies such as knowledge extraction, visual analytics and data mining to provide them with holistic analyses of large amounts of data. Semantic and adaptive media applications open up new possibilities for linking data and knowledge and for making them accessible via the Internet. By utilizing business intelligence solutions the Fraunhofer IAIS team is able to optimize its customers' business, IT and security processes and so improve their business success. The institute's research and development activities are defined by the business areas Big Data Analytics, Business Modeling & Analytics, Content Technologies & Services, Enterprise Information Integration, Image Processing, Intelligent Media & Learning, Marketing, Market Research & Media Analysis and Preventive Security. Fraunhofer IAIS and its 230 strong team combine in-depth industry knowledge with expertise in a full range of technical disciplines, most notably computer science but also mathematics, natural sciences, business management, 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. 240 € 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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Germany

## **FOUNDING DIRECTORS**

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University of Bonn

Prof. Dr. Matthias Jarke  
RWTH Aachen University  
Fraunhofer FIT

Prof. Dr. Kurt-Ulrich Witt, Bonn-Rhine-Sieg  
University of Applied Sciences

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### **Media Informatics**

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### **Life Science Informatics**

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