Annual Report
2014

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

Helmut Dockter

FOREWORD BY THE CHAIRMAN OF THE B-IT FOUNDATION

The Geman Government has pronounced the Science Year 2014 as the Year of the Digi-tal Society. Well beyond the traditional ICT (Information and Communication Technolo-gies), digitization is penetrating all aspects of business, public administration, science, and society throughout the world – as also emphasized by the focus set by NRW State Government on addressing Societal Chal-lenges as a key guideline in their research and innovation support.

The inherent interdisciplinarity and interna-tionality in the digital society must also be reflected in university education. With their international master programs, and accompa-nying programs from Bachelor to Doctorate, the Bonn-Aachen International Center for Information Technology (B-IT) has pursued exactly this vision since its founding in 2003:

* Media Informatics with societally important foci such as Multimedia Internet, IT Security, Big Data Integration, or Social Media
* Life Science informatics with major scien-tific impact in healthcare, biomedical and biochemical research
* Autonomous Systems addressing impor-tant advances in Service Robotics in science as well as industry.

About 550 master graduates from B-IT, and already over 20 Ph.D. graduates from the accompanying B-IT Research School (started only in late 2008) for doctoral studies, con-tribute significantly to reducing the shortage in specialists for such applied IT in practice and research, including several of the fed-eral Excellence programs in the participating universities. The endowed B-IT professor-ships are now annually acquiring several million Euros of research funding, while the participating universities have recognized the value of B-IT by serious co-investments in these professorships, complementing the B-IT Foundation funding. Highly competitive awards for B-IT Faculty such as the Skolnik Prize of the American Society for Chemistry, and the first-ever ACM Fellow appointment in NRW by the Association for Computing Machinery show the recognition B-IT has achieved internationally.

With the end of the academic year 2013-2014, one of the Founding Directors of B-IT, Prof. Armin Cremers, is retiring after 40 years of professorship. With a history as a pioneer in novel research directions such as cogni-tive robotics, and being one of the most successful educators of famous Informatics researchers in Germany, Prof. Cremers has been instrumental in the successful build-up of B-IT over the past twelve years. The government of NRW wishes to express his gratitude for these and many other achieve-ments, in recent years also as Vice Rector of the University of Bonn.

I would also like this opportunity to thank all B-IT directors, faculty, and students for the excellent cooperation in my five years as Chairman of the B-IT Foundation, and wish my successor Dr. Thomas Grünewald as well as the B-IT all the best for the coming years.

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

Report by the Scientific Directors

The deep integration between computer science and application components offered by the international master programs of the B-IT continues to attract bachelor graduates from top international universities. Thus, B-IT is reducing the shortage of top IT personnel in Germany, but also provides highly trained people for the home countries:

- Media Informatics is a key contributor to the proliferation of computing technologies via smartphones and other devices. It is also the main source of Big Data. The study program teaches attractive user experience, computer graphics and vision, business processes and analytics. About two-thirds of the about 300 graduates have gone to industry, the rest continued into Ph.D. programs.
- B-IT Life Science Informatics offers a strong emphasis on chemo-informatics as well as biomedical informatics lab places. Well over half of the roughly 150 graduates went on for a Ph.D.
- In B-IT Autonomous Systems, the focus is on networked and embedded systems research with little traditional coursework. Over 40% of the so far over 120 graduates continue with doctoral studies.

Since its founding, the B-IT is residing in a former embassy building close to the river Rhine in Bonn. In 2014, construction started on a new B-IT Building, closer to related fields of Bonn University and expected to be completed about the end of 2016.

We are grateful to the B-IT Foundation and the NRW State government for their continued financial support. In particular, we want to thank Vice Minister Helmut Dockter for his leadership in the B-IT Foundation Council, and warmly welcome Dr. Thomas Grünewald as his successor.

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

B-IT FOUNDING DIRECTOR ARMIN B. CREMERS RETIRES AFTER 40 PROFESSOR YEARS

Founding Director Professor Cremers celebrated 40 Years of University Lectureship on 22 May 2014, based on his Habilitation in Computer Science in 1974 from Karlsruhe University, Germany. Already in 1973, aged 27, he was appointed Assistant Professor at UCLA, and in 1976 he became full professor at the University of Dortmund where he stayed until his move to Bonn University in 1990.

Throughout his career, Prof. Cremers showed an unusual ability to spot future important themes very early, and to set up teams of extremely promising young researchers. As just one such example, we mention his founding of a cognitive robotics research initiative in the early 1990s, from which came worldwide top research stars like Sebastian Thrun (inventor of MOOCS and before that, leader of Google's self-driving car initiative at Stanford) or Wolfram Burgard (Leibniz-Prize winner 2013). Altogether, at least 18 university professors came out of his team.

With this background, he was a perfect choice as founding co-director when B-IT was designed from 2001 onwards, and has served in this role until now. "On the side", his extraordinary leadership capabilities were sufficient to take on the roles Dean of one of Germany's largest faculties, and as Vice Rector of Bonn University, a post he had also already held in Dortmund.

Management, faculty, and students of B-IT offer Prof. Cremers their sincere thanks, together with best wishes for the future where we shall continue to seek his advice.

The University of Bonn has proposed Prof. Stefan Wrobel, director of Fraunhofer IAIS, as his successor in the role as Bonn's B-IT Scientific Director.

Prof. Dr. Armin B. Cremers
University of Bonn

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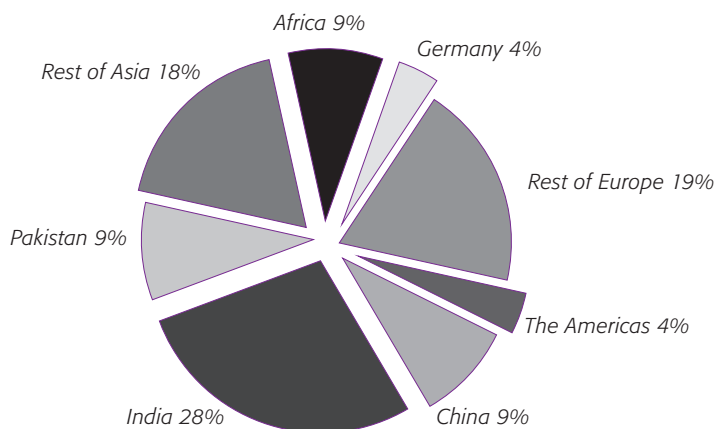*RWTH Aachen University and Fraunhofer FIT*

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.

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 million € Foundation initiated through the Bonn-Berlin program of the German federal government, as well as by matching NRW state funds.

Home countries of new B-IT students.

Founding Director Prof. Cremers celebrates 40 Years of University Lectureship on 22 May 2014. He received his Habilitation in Computer Science in 1974 from Karlsruhe University, Germany. Congratulations! Prof. Cremers with lecturers of his group: (from left to right) Dr. Günter Kniesel, (Research on Object Oriented Technologies and Systems – ROOTS), Prof. Armin B. Cremers, and Daniel Speicher (Software Architecture and Middleware – SAM).

OFFICERS

Founding Scientific Directors
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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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Dr. Jürgen Bajorath
(University of Bonn)
Prof. Dr. Gerhard K. Kraetzschmar
(Bonn-Rhein-Sieg University of Applied
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Dr. Stefan Lüttringhaus-Kappel,
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Fraunhofer Institute for Applied Information
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Chamber of Commerce

Events and Visits

SOCIAL MEDIA: B-IT OPENS YOUTUBE CHANNEL

B-IT Social Media activities expand with the opening of the B-IT Youtube channel. B-IT Prof. Christian Bauckhage provided the first content for the channel: His lecture "Computer Game AI" held in the Summer Semester 2014. In his lecture, Prof. Bauckhage introduces the students to the use of Artificial Intelligence in computer games. The design and development of computer games has become an important scientific discipline. But the field also has a huge economic impact. Prof. Bauckhage built upon his scientific interest in computer games he already had developed during his PhD thesis: He wanted to improve computer games by making characters of the game more interesting, particularly the game adversaries of the player. Prof. Bauckhage showed his students – among others – how machine learning techniques could help to achieve this goal.

The lecture was videotaped, finally edited, and published on B-IT's new Youtube channel and B-IT's Facebook site. To date, this online-lecture received 9369 views (Youtube and Facebook), an outstanding result for an online lecture in the field. This tremendous success has prompted considerations to produce and publish further B-IT lectures on B-IT Youtube channel.

BONN VISION WORKSHOP 2013

On 1st October 2013, the 2nd Bonn Vision Workshop was held at B-IT. The meeting was organized by the Department of Computer Science III, namely by Dr. Simone Frintrop, Prof. Dr. Jürgen Gall and Prof. Armin B. Cremers. The gathering was supported by B-IT Research School. Bonn Vision Workshop intended to bring together all research groups in and around Bonn who are interested in computer vision. After the successful first workshop in 2009, this year's workshop was

Poster session at Bonn Vision Workshop 2013.

again well attended: about 100 participants, researchers, PhD students and students gathered at B-IT to exchange ideas about computer vision. Prof. Armin B. Cremers welcomed the participants. After the welcome, nine research groups presented their work. Besides the professorial presentations several PhD students of B-IT Research School were given the opportunity to present their work in poster sessions and received valuable and extensive feedback for their respective thesis projects.

NEW STEAMPUNK ROBOTIC EXHIBIT AT NEW BMBF HEADQUARTERS

In October 2014, the Media Computing Group installed a new public exhibit at the new headquarters of the German Ministry of Science and Education (BMBF). The exhibit "ROBOLED" is a robotic arm that types on an iPad. The data entered on the iPad is then sent to a high-tech organic LED wall. The point of the exhibit is to show that the DIY and Maker community has to resort to antiquated forms of technical communication (such as typing), in order to talk to modern commercial devices because they do not offer open technical interfaces. The robot pulls the current weather forecast from online sources and, via the iPad, displays them on the wall.

TALK OF DR. SACH MUKHERJEE

From left to right: Professor Dr. Holger Fröhlich, Professor Dr. Armin B. Cremers, and Dr. Sach Mukherjee.

Sach Mukherjee, group leader of Clinical Genomics at the Medical Research Council (MRC) Biostatsics and School of Clinical Medicine, University of Cambridge, UK, was guest lecturer at B-IT again. Dr. Mukherjee, then invited by Prof. Holger Fröhlich, had already visited B-IT in January 2013 when he gave a talk on "Network learning for disease biology", a very well attended guest lecture. This year, he was invited by Prof. Armin B. Cremers to deliver a presentation about "Disease subspaces: High-dimensional Approaches to Explore Disease Heterogeneity". His talk, delivered on 30 July 2014 in B-IT lecture hall, was – again – very well attended.

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.

NEW CONDUCTING EXHIBIT IN VIENNA

Back in 2000, Prof. Jan Borchers developed a museum exhibit to conduct the Vienna Philharmonic for the HOUSE OF MUSIC VIENNA. It has been used by over 2 million museum visitors since. In September 2014, his Media Computing Group completely redesigned the conducting technology behind this successful system, moving to a computer-vision based algorithm that uses an infrared camera. The advantage: the conductor's baton is now a simple and much more robust stick with a reflective ball, instead of a custom-built active electronic device. The new system also features entirely new gesture recognition algorithms that offer an unprecedented level of control over the on-screen orchestra.

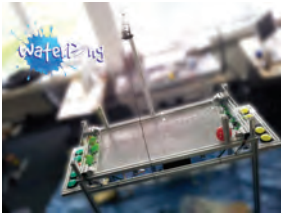*Conduct exhibit for the Vienna Philharmonic.*

Honors and Awards

Acatech admission ceremony for Prof. Jarke, with Prof. Henning Kagermann, President of acatech (left) and Prof. Reinhard F. Hüttl (right).

WaterPong.

PROF. JARKE NAMED ACM FELLOW

The Association for Computing Machinery (ACM) named B-IT Founding Director Prof. Matthias Jarke ACM Fellow, recognizing his contributions to conceptual modeling, requirements engineering and metadata management as well as his leading role in advancing computer science in Germany. Prof. Jarke is the first NRW scientist, and only the tenth in Germany, to become ACM Fellow, in the history of this program.

2015 SKOLNIK AWARD FOR PROF. BAJORATH

The American Society for Chemistry Division of Chemical Information announced the winner of the Skolnik Award for contributions in Theoretical Chemistry, Prof. Jürgen Bajorath, head of the B-IT Life Science Informatics Program. He will receive the prize in fall 2015 in Boston at the Annual Meeting of American Chemical Society. Since over ten years, Prof. Bajorath is the first to receive this prestigious international award during his active work phase.

ERC ADVANCED GRANT AND LEIBNIZ PRIZE FOR PROF. KOBBELT

Prof. Leif Kobbelt from RWTH Aachen University, regular teacher of computer graphics courses at B-IT Media Informatics, had the highly unusual honor of receiving the highest-ranked European and national research awards within a single academic year. Only a few months apart from each other, he received the extremely competitive Advanced Grant of the European Research Council ERC, and the Leibniz Prize by the German Science Foundation DFG, for his groundbreaking work in geometric modeling.

OUTSTANDING PAPER AWARD AT THE 13TH IFIP EGOV CONFERENCE

Dr. Gertraud Peinel and Prof. Thomas Rose have been awarded an Outstanding Paper Award at the 13th IFIP EGOV Conference in Koblenz for the most interdisciplinary and / or innovative research contribution in 2013. The paper entitled "Business Processes and Standard Operating Procedures – Two Coins with Similar Sides" compiled their experience gained in a number of research projects with rescue and relief organizations on planning for large-scale emergencies. In addition, their publication at last year's conference on Environmental Informatics has been selected as outstanding paper for publication in the journal "Environmental Impact Assessment Review". The paper on "The Dark Side of Photovoltaic – 3D Simulation of Glare Assessing Risk and Comfort" reports on a tool for the assessment of reflections caused by solar panels, developed with support of two MI students.

MEDIA COMPUTING GROUP WINS PEOPLE'S AWARD IN THE UIST STUDENT INNOVATION CONTEST

WaterPong was our entry for the UIST 2013 Student Innovation Contest and built by Hesham Omran, Ignacio Avellino, and Jan Zimmermann. In honor of PONG, it's a two-player mashup of ping pong and air hockey – just with water pumps! You play at an interactive, rear-projected, computer-vision-enhanced, water-flooded table. Shoot water from four pumps by hitting humongous arcade buttons! Score goals by propelling the ball into your opponent's end zone! Pick up power-ups for special boosts! Over 240 conference attendees participated in the voting, and awarded WaterPong the First Prize from 26 competing entries.

Research@B-IT

B-IT BOTS FINISH SECOND IN THE WORLD CUP

The robocup team B-IT bots came in second at the Robocup Worldcup in Brazil. A hard earned and well-deserved success considering that the team consists almost entirely of new members with no former competition experience – except for this years' German Open, where they finished third. The Masters students Oscar Lima, Shehzad Ahmed, Bipin Kumar, Santosh Thoduka, Devvrat Arya, Alexander Moriarty, Ashok Sundaram und Jose Sanchez have been coached by team leaders and MAS alumni Sven Schneider and Frederik Hegger and Prof. Gerhard Kraetzschmar as team coach. From July 21st to 24th the battle of the bots was held in different leagues for Soccer, Rescue, @Home, @Work and Logistics. The participants of the @Work League competed in seven rounds to determine the winners of their event.

RoboCup@Work is a relatively new competition that targets the use of robots in work-related scenarios. It aims to foster research and development that enables use of innovative mobile robots equipped with advanced manipulators for current and future industrial applications. Robots cooperate with human workers for complex tasks ranging from manufacturing, automation, and parts handling up to general logistics.

The B-IT bots have been taking part in international competitions since 2008. In their first years, they competed in the @Home-League for domestic service robots, where they became world champions with robot "Johnny" in 2009.

HIGHLY CITED CHEMO-INFORMATICS RESEARCH

The group of Prof. Bajorath has substantially expanded the collaboration with Pfizer USA on drug discovery methods. The new, more intensified collaboration has started in the beginning of 2014. Also, the group has published more than 30 original papers. Prof. Bajorath himself was listed among the most highly cited authors in the field of Chemistry worldwide according Thomson/Reuters citation database, 2014 release.

CONTRACT WITH THE UNIVERSITY OF HA'IL

Fraunhofer FIT has established a Technology Transfer Contract with the University of Ha'il in the Kingdom of Saudi Arabia. This contract followed a series of research visits of Universities from the Kingdom of Saudi Arabia with their students to FIT to elaborate on joint opportunities. The contract was signed by the Vice Minister for Higher Education and Prof. Thomas Rose during the International Exhibition & Conference on Higher Education in April 2014. It aims to assess current curricula in the realms of computer and software engineering at the University of Ha'il, that has currently more than 38,000 students in undergraduate programs. In addition, research labs and joint research activities will be designed as follow-up activities.

B-IT Research School

NRW State funding of the B-IT Research School has ended as originally scheduled in fall 2013 with remarkable results: Scholars from 15 countries were supported during the 5-year term in eight research classes with a total amount of 1.7 million € for the scholarships. By that time, 20 students had finalized their doctoral degree; 8 students started their graduate research only in 2012 or later, but we nonetheless expect the finalization of all remaining doctoral theses soon. Only four scholars dropped out due to serious work or family reasons.

The B-IT Research School complemented the successful international B-IT Master Programs with a structured doctoral training. We closed 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 of RWTH Aachen, the University of Bonn, the Fraunhofer institutes in Birlinghoven, and the University of Applied Sciences Bonn-Rhein-Sieg. Summarizing this success story, we supported 26% women and accordingly 74% men with a proportion of foreign students of 52%. The scholars have generated until 2014 more than 200 first-class publications with several best paper or best poster awards.

A first place has been reached in the TREC-CHEM-competition 2011 of the US National Institute of Standards, and the Team Nimbro@Home of the University of Bonn has participated in the national and international competitions in RoboCup 2011 and 2012 and won four times. The B-IT Bots won also the Robocup@home competition at German Open 2009, and RWTH Aachen's Alemaniac won the world championship in RoboCup logistics in 2014.

It also makes us proud to report that four children have been born during the school and that all mothers and fathers continued their studies after a short parental leave.

The doctoral studies were supplemented by a large number of guest presentations and compact lessons by top scientists and business managers from all over the world in the fields of cryptography, signal processing, reliable software systems and knowledge representation. In addition, the following special events have been organized:

- The ABC of Life Science Informatics (annual), Bonn
- crypt@bit (annual), Bonn
- Networking 2009, Aachen
- International Conference on Web-based Learning (ICWL) 2009, Aachen
- Mobile HCI 2009, Bonn
- Symposium Software Engineering 2009, Bonn
- 10th International Workshop on Computer Algebra in Scientific Computing 2009, Bonn
- Informatiktage 2012 & 2013, Gesellschaft für Informatik, Bonn
- Life Science Informatics Retreat 2013, Bonn
- Bonn Vision Workshop 2013

The B-IT Research School cooperated very close with the excellence cluster "Ultra-High-speed Mobile Information and Communication (UMIC)" at the RWTH Aachen University. Also, we cooperated with the "Hausdorff-Center Mathematik" at the University of Bonn as well as with three DFG-funded graduate schools in Aachen and Bonn. In the area of robotics scholars cooperated with the DFG research group FOR 1513 headed by Prof. Lakemeyer, RWTH Aachen, and in life sciences, with the clinical DFG research group 217 at the University of Düsseldorf (including Prof. Thomas Berlage, Fraunhofer FIT).

The first B-IT Research School assembly 2009.

The B-IT RS School also co-organized the NRW Young Scientist Award competition by the NRW graduate schools and awarded it In 2012 to Nenad Biresev, University of Bonn, for his publication with Jörg Stückler and Sven Behnke: "Semantic Mapping Using Object-Class Segmentation of RGB-D Images", 25th IEEE/RSJ International Conference on Robots and Systems (IROS), Vilamoura, Portugal, October 7-12, 2012; IROS is one of the top international robotics conferences.

BEST PAPER AWARD FOR B-IT RESEARCH SCHOOL SCHOLAR BRIGITTE BODEN

Brigitte Boden defended her PhD at the Chair for Data Management and Exploration (Prof. Seidl), RWTH Aachen, in June 2014. The topic of her doctoral thesis was "Combined Clustering in Graph and Attribute Data". During her period of research she contributed to 14 peer-reviewed publications in international journals and conferences, resulting in one best paper award for data mining at the European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML PKDD 2011). At the end of 2012 she spent a 2-months research period abroad with the research group of Prof. Ester at the Simon Fraser University in Vancouver, Canada. Results of this research period have been presented now at the ECML PKDD 2014, in Nancy, France.

MAHMOUD EL-GAYYAR

completed his doctoral thesis on "Distributed management of grid-based scientific workflows" in 2012 under Prof. Cremers's guidance. Scientific workflows have been getting more and more complex; new areas such as image processing of large-scale astronomical surveys call for a more flexible modularization of applications into smaller jobs connected by data and control dependencies. Mahmoud's work proposes novel solutions to the problems of user-friendly creation, reliable and scalable scheduling, efficient execution based on data caching, and smart sharing and reuse. His framework has been tested on real-life challenges in cooperation with astronomy. After graduation Mahmoud relocated to his home country Egypt where he has been appointed assistant professor of computer science at Suez Canal University.

DR. OLGA DOMANOVA

is an outstanding example of the interdisciplinary profile of many B-IT students. Equipped with a Bachelors Degree in Biotechnology from St. Petersburg State Technical University, she joined the Master Program in Life Science Informatics in 2007, graduating in 2009. She declined a Cambridge International Scholarship in Chemistry to join the B-IT Research School. From 2010 to 2014, her work under the supervision of Prof. Thomas Berlage (Fraunhofer FIT) was part of a DFG-funded Clinical Research Group (KFO 217 – Speaker: Prof. D Häussinger, University of Düsseldorf). Here she developed automated quantitative methods to analyze the mechanisms of liver diseases, a major contribution to translational research that was favorably evaluated by DFG. In 2013, she finished her Ph.D. in Computer Science at RWTH Aachen University, after having her first child in 2012. She now continues her research at Neurospin, the neuroimaging research centre of CEA, France.

Nenad Biresev.

Dr. Olga Domanova.

Master Program in Media Informatics

*Prof. Dr. Jan Borchers,
Media Computing*

*Prof. Dr. Thomas Rose,
Media Processes*

List of employers of MI Alumni:

Universities & Research: B-IT, B-IT Research School, Centro Nacional de Investigaciones Cardiovasculares, CERTH, Charité Berlin, Chinese Academy of Science, COSBI, Czech Technical, ETH Zurich, FGAN, Fraunhofer FIT, FKIE, FOKUS and IAIS, FSU Jena, Hasso-Plattner-Institut, HHI Berlin, Imperial College, INRIA, Institute of Molecular Medicine, K. U. Leuven, Max Planck, Research Center Jülich, Robert Bosch Foundation, RWTH Aachen, Swiss Federal Institute of Technology, Uniklinikum Bonn, Universitätspital Basel, University Clinic Carl Gustav Carus; Universities of Agder, Arab American Jenin, Asia and the Pacific, Atma Jaya Yogyakarta, Augsburg, Bahria, Bonn, Cambridge, Düsseldorf, Dresden, Duisburg-Essen, Edinburgh, Engineering & Technology Peshawar Pakistan, Ghent, Hamburg, Hasselt, Heidelberg, Ireland, Maynooth, Johannes Kepler, Kiel, Leipzig, Mainz, Münster, Paris, Rotterdam, Sud, Stuttgart, Tirana, Trento, Western Australia, West Indies, Tillburg, Trento, Zurich; TU Eindhoven, TU Darmstadt, TU Munich.

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 2013-2014. The graduates quickly found interesting positions either as doctoral students in Germany and abroad, or in attractive companies. The incoming class of 2014 comprises 43 students, from a total of 18 countries, selected from about 300 applicants.

NEWS FROM MEDIA INFORMATICS ALUMNI

USMAN AKRAM
Customer Support Engineer, Keynote SIGOS GmbH, Nuremberg, Germany

My current job includes supporting the international customer in automated end-to-end active testing of telecommunication networks. I primarily work in Customer Support Department with network operators in order to assist them in Network performance and Interoperability testing for mobile network and global roaming. B-IT has provided me a great opportunity to learn about the Computer Science and Communication Technology domains, while advancing my technical skills to collect, analyze, and adopt new problem solving techniques in the area of Computer Studies. Beyond the more tangible knowledge, B-IT's stress on teamwork with different engineering students has enhanced my ability to work with people of all backgrounds.

HALIL IBRAHIM CAKIR
Software Architect, Nexcom IT Services GmbH, Bonn, Germany

MS in Media Informatics was one of the greatest and unique experiences I have had. During my studies MI offered variety of courses in the field of UI Design, Communication and Networking, AI, Security and Programming. Therefore it was very helpful to choose between the career paths in order to pursue a happy career. For me web technologies and programming was always very interesting and after having the MI degree, I decided to work as a Software Architect. MI gave me the chance to study in an international atmosphere and to meet new friends from all

around the world. I highly encourage other students to pursue their master degree in Media Informatics Program of RWTH Aachen.

STEFAN IVANOV
iOS Developer, Wacom Europe GmbH, Sofia, Bulgaria

Upon finishing my masters' degree I was determined to pursue the job market rather than further academic development. I decided to return to Bulgaria and shortly after that received a few job offers. I accepted the one made by Wacom Europe GmbH and worked there for 14 months as a front-end iOS developer. In the meantime I participated at a few Startup Weekend events, winning one and being runner-up at another. Additionally, I prepared a course on Human-Computer Interaction and UX Design. The first edition is now over and I am really proud for being the lecturer of the first full course on this topic in my country. Since the beginning of the year I am running my own startup with funding from one of the two local accelerators – Eleven. Our project Stepsss is a pair of smart insoles that help you improve your running and stay away from injuries.

PHAN-ANH NGUYEN
Software Engineer, ISRA Surface Vision GmbH, Herten, Germany

Right after graduating in October 2013 I joined the ISRA Surface Vision GmbH in Herten as a software engineer. The company specializes in building optical surface inspection systems in which distributed systems and databases play an important role. Thanks to what I have studied in the MI Program, I can quickly catch up with the technologies in this industry. With all that I have experienced I feel confident and excited about my future career.

Business: Ableton, Adecco Engineering & IT, Adecco Phaholyothin Recruitment Ltd., Adidas, Agfa Healthcare, Airbus, Alcatel-Lucent, Ancud IT Beratung, Ansaldo STS, ANSR Source, AOL, ARC International ArcSoft, Avedas, Avid Technology, Bank of Mexico, BCA Auctions, Bertelsmann, BESA GmbH Blimp.Mx, Bombardier Inc., Brainloop, BTC Business Technology Consulting, Capgemini, CAS, CBC Cologne Broadcasting Center, Cellent AG, CGI, CIGNA, Cloudberrytec, CMLabs Simulations, COMNEON, Contentteam, Crytek, Daedalic Entertainment, Daimler, Delta Engine, Demax, Deutsche Telekom, Dolby Laboratories, Dynevo (Bayer), Ericsson, European Computer Telecoms, Evimed Online, Exact Software, Facebook, Famous Group, Finantix Srl, Forth corporation, Fox Chase, Game Analytics ApS, GATC Biotech, Global Crop Diversity Trust, Goodyear, Google, Grandcentrix, Hamilton Medical, HITS, Huawei, Humance, i22 internetagentur, IBM, IdeaObject Softwares, Ilypsys, IMC BV, IMC Financial Markets, Infineon, Inforcept Networks, Internet Company, IP Labs, iPharro Media, ITBrainiacs, IVU Traffic Technologies, IW-One, Johnson Controls, Keynote SIGOS, Kisters, Kuveyt Turk Participation Bank, Lakshmi Technology and Engineering Industries, LHS Telekommunikation, Lycos, MarAnCon, Merck, Mastercard, Microsoft, Mobilab Solutions, Monsanto, Movilizer, NAVTEQ, Nemetschek AG, Nexcom IT Services, Next Level Integration, Novartis, NVIDIA, Oando Plc, Ogilvy and Mather, Patersons, PCI Geomatics, Pepsi, Philips, Plinga, Pricewaterhouse-Coopers, Qiagen, Qosmotec Software Solutions, QSC, Recommind, Samsung Electronics, SAP, SD Inspiring Travel, sd&m, SE Consulting, Secat, Shell, SHS VIVEON, siCAT, Siemens, Siemens Healthcare, Simfy, Sogo, Solnista, Solutions 4 Media, Sony, Steinberg Media Technologies, Sytel Reply, T-Systems, Teleca, Telemotive, Tessella, Thomson Reuters, Turk Telekom, Twitter, Vantage Labs, Viacom, vmware, Vodafone, Wacom Europe, Werum Software & Systems, Whowish, Widespace AB, Wieden+Kennedy, Workplace Systems, Wieden+Kennedy, World Bank, Xerox Research Centre Europe, Yahoo!, Yieldlab AG, Zalando

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, pharmaceutics 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 biotechnolo¬gies. 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 2008-2013 have contributed to strengthen ties with scientists of the region. The 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, also on a larger geographical scale.

This year 21 student successfully graduated from the program. Top students received excellent placements again, such as Marie Curie Fellowships for (pre-)doctoral students. Marie Curie Fellowships are funded by the European Union and provide placements at European top Universities and Research Institutes. Further alumni were accepted into positions at Max-Planck-Research-Schools and Imperial College. About 30 Skype-interviews were carried out with a carefully selected number of new applicants. 17 new students will start their studies in Life Science Informatics in Winter Semester 2014/2015.

LSI SUCCESS STORIES

DR. HARSHA GURULINGAPPA

joined B-IT Research School with a scholarship in the group of B-IT Prof. Hofmann-Apitius, graduating from B-IT's Life Science Informatics master's program. His PhD thesis focused on text mining relevant to biomedical and clinical domains. In his time at B-IT RS he has won the TREC-CHEM Challenge 2010 in the area of chemical Information Retrieval. In addition, he placed third at "I2B2" challenge (text mining in electronic patient records) held in 2010 at the University of Albany, USA. More than 10 publications resulted from his PhD thesis. Harsha Gurulingappa graduated from B-IT RS in 2012 and joined Molecular Connections Pvt Ltd in Bangalore, India, the same year as principal scientist leading a team of researchers performing text mining in life sciences. Since December 2013 he works for Merck KGaA, Darmstadt, Germany, as technical manager of data mining and text mining applications as well as a project manager for pharma R&D IT-projects.

DOMINIK NOVOTNI

graduated as a medical doctor from Semmelweis University in Budapest in 2000. He joined the Master Program of LSI in 2003 and was admitted into the first group of students that joined the program. In 2005 he graduated from the LSI with a master thesis carried out in the group of Prof. Joachim Bumann (ETH Zürich). From 2005-2007 he worked at the Institute of Computer Science of the University of Bonn. In 2007 Dominik Novotni joined Hamilton Medical AG in Bonaduz, Switzerland. The company specializes in ventilation systems for patients ranging from neonates to adults. Mr. Novotni worked there at first as research engineer until 2010 and then joined the company management. He is currently in charge of Research and New Technology. He says about his studies in the LSI program: "Being one of the pioneer students at B-IT allowed me with help of professors to arrange a diversified and individually adapted curriculum. The fact that I am the first graduate at B-IT makes me extremely proud!"

MAGDALENA ALEKSANDRA ZWIERYNA

obtained a Bachelor's Degree in Biotechnology from Poznan University. During her studies at Poznan University she spent one year as an Erasmus student at Justus Liebig University in Gießen. She joined the Master Program of Life Science Informatics back in 2012 with a DAAD scholarship. Ms. Zwierzyna currently works in the group of Prof. Bajorath and carries out her master's thesis.

SWARIT JASIAL

joined the Master Program of Life Science Informatics in October 2012 with a degree Bachelor Degree in Bioinformatics from Jaypee College, India. Mr. Jasial has joined the group of Prof. Bajorath where he currently carries out his master's thesis.

NIKOLAS KLEANTHOUS

joined the Master Program of Life Science Informatics in 2012. He received a Bachelor's Degree in Computer Science from the University of Cyprus. In his Bachelor thesis, he carried out a study in the area of bioinformatics, involving Petri nets. He decided to continue his education in Life Science Informatics at B-IT. He is currently working on his master's thesis in the group of B-IT Prof. Fröhlich.

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, Galilleo Press, GATC Biotech, German Center for Cancer Research (DKFZ), Hamilton Medical Hoffmann-La Roche, Hype Innvation, 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 2013-2014, 22 students joined the MAS program from an applicant pool of 458 candidates. The MAS program has always attracted the interest of students all over the globe. The 12 different nationalities of the 22 students who joined the program in the 2013-2014 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.

THIRD PLACE FOR RUFUS AT THE ESA BIC START-UP AWARDS

Running is good for your fitness – however, many amateur athletes do not train in a way that is beneficial to their well-being and health. RUFUS is a robotic running coach that supports healthy professional training. It has been developed by runfun GmbH, a spin-off of the department of computer science at BRSU, in cooperation with the German Sports University Cologne. With its innovative training concept, the start-up company founded by Prof. Erwin Prassler convinced the jury and won third place in the ESA BIC Awards. The ceremony took place during the Automatica trade fair in Munich.

AICISS RESEARCH PROJECT LAUNCHED

The AICISS project was launched in January 2014 and aims to develop a novel steering system for the KUKA youBot robot by integrating several functionalities for mobile robot navigation such as motion control, route planning, avoidance of obstacles, localization and man-machine interaction. The KUKA youBot has been developed specifically as an affordable R&D platform yet with high quality standards which allow the transfer of research results to industrial systems. The specific area of implementation will be a restaurant service robot, so that the boundary conditions can be clearly defined and a realistic evaluation of the results is possible. The project is based on research findings of the European project BRICS ("Best Practice in Robotics") and develops them further for commercial use as a stand-alone technology.

AWARD FOR SVEN SCHNEIDER'S GRIPPING LANGUAGE

In his Master's thesis "Design of a Declarative Language for Task-oriented Grasping and Tool-use with Dextrous Robotic Hands", research associate Sven Schneider developed the domain-specific language GDDL (Grasp Domain Definition Language) for use in service robots. Thus, objects to be grasped and gripping sequences can be described independent of the robot platform used. His work offers an elaborate conceptual design and architecture for its realization. The model-based development approach enables the reusability of the descriptions. The innovative language was tested on various robot systems and delivered compelling and promising results. The Master's thesis was supervised by Prof. Gerhard Kraetzschmar, Prof. Paul G. Plöger and research associate Nico Hochgeschwender. Mr. Schneider completed his bachelor's degree in Computer Science at BRSU in the winter semester 09/10 and joined the Master's program in the same semester. He graduated in the summer semester 2013. Since then he is working as a research associate at the university where he will also be starting his PhD.

DAAD PRIZE AWARDED TO MAS STUDENT TEENA HASSAN

Teena Hassan, from India, was awarded the 2014 DAAD prize for outstanding accomplishments by a foreign student studying at a German University in October 2014. Her impeccable academic standing is one of many qualities that have made her a model to those around her – the very best mix of hard work, brilliance, generosity and compassion.

RUFUS, the personal running coach. © runfun GmbH

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.

10 YEARS OF AGILE LAB COURSES

IPEC offered in the last 10 years 17 Agile Lab Courses. Typically around twelve students have been introduced into Agile Software Development, formed a team and developed software of realistic complexity that is of real value for a research project or an external customer. Given the complexity of professional software development frameworks and the often limited clarity of requirements the step from passing an exam in a software construction course to feeling confident to contribute to a real product is huge. Gaining this confidence – that is what the courses are out to offer the students. The student teams developed or evolved Plug-Ins for Eclipse the leading open Integrated Development Platform for Java (9 courses), Context Sensitive Mobile Applications (6 courses), or specific software for other departments (2 courses).

Software of realistic complexity requires a broad knowledge. The course leverages on the number of students by asking everyone to become an expert in one area. The seminar, a wiki as a knowledge base and consequent pair programming allows the knowledge to expand into the team. The students are offered the responsibility to estimate the effort a certain functionality requires. Planning Poker during planning is very helpful in this respect. Daily stand-up meetings make sure that problems become obvious early and everyone shares the latest insights that are of value to the team. Each iteration ends after the presentation to the customer with a retrospective. In a respectful atmosphere everyone can discuss the challenges freely and actions addressing them can be found. The students are typically very satisfied with the course, praise the friendly and productive atmosphere and are surprised by the improvement of their skills.

SCHÜLER-KRYPTO 2014

Bond's Thursday crew.

On two days in March 2014, 173 high school students, as well as 11 teachers met for the 13th Schüler-Krypto to learn@bit on secret messages, encryption and decryption. They came from Aachen, Andernach, Bedburg, Bergisch-Gladbach, Bornheim, Bonn, and Neuwied.

After an 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 SAGE on it, a free open-source computer algebra system which among many other things is capable of calculating with arbitrarily large numbers. The students sent emails to Moneypenny and decrypted answers from her, 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 laser and light show again presented by Matthias Frank from the laser and light lab fascinated pupils and teachers. Moreover, he also provided answers to questions and material on study programs.

CRYPT@B-IT 2014

The UbiCrypt summer school crypt@b-it 2014 offered undergraduate and graduate students, postdocs and researchers the opportunity to crypt a bit. For the second time it was organized together with the Ruhr-Universität Bochum as a UbiCrypt Summer School. It provided acquaintance and interaction in an intellectually stimulating and informal atmosphere in pleasant surroundings. It took place 28 July – 1 August 2014 at the Ruhr-Universität Bochum and invited to the exploration of some fundamental areas of cryptography:

- Discrete Logs by Gary McGuire (Dublin).
- Functional encryption by Hoeteck Wee (Paris).

In addition, there were tutorials and hands-on exercises on topics related to the lectures. 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 Zollverein Coal Mine Industrial Complex and also during the social events in the evenings. After the summer school a number of participants expressed their appreciation and thanked the organization team for this year's summer school.

Group photo at Zollverein Coal Mine Industrial Complex in Essen.

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.
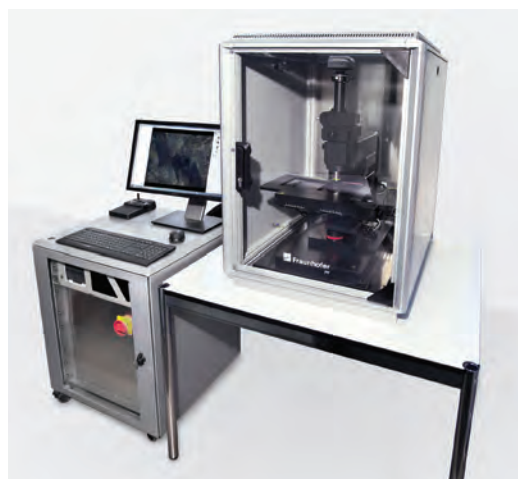
Entrance of Birlinghoven Castle.

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.

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.

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 in 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 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 for current admission details.
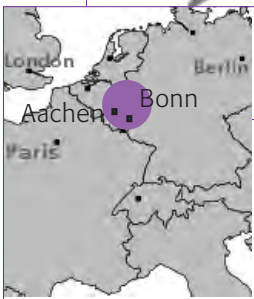
FEES AND FINANCES

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 800 €. 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.

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.