b-it

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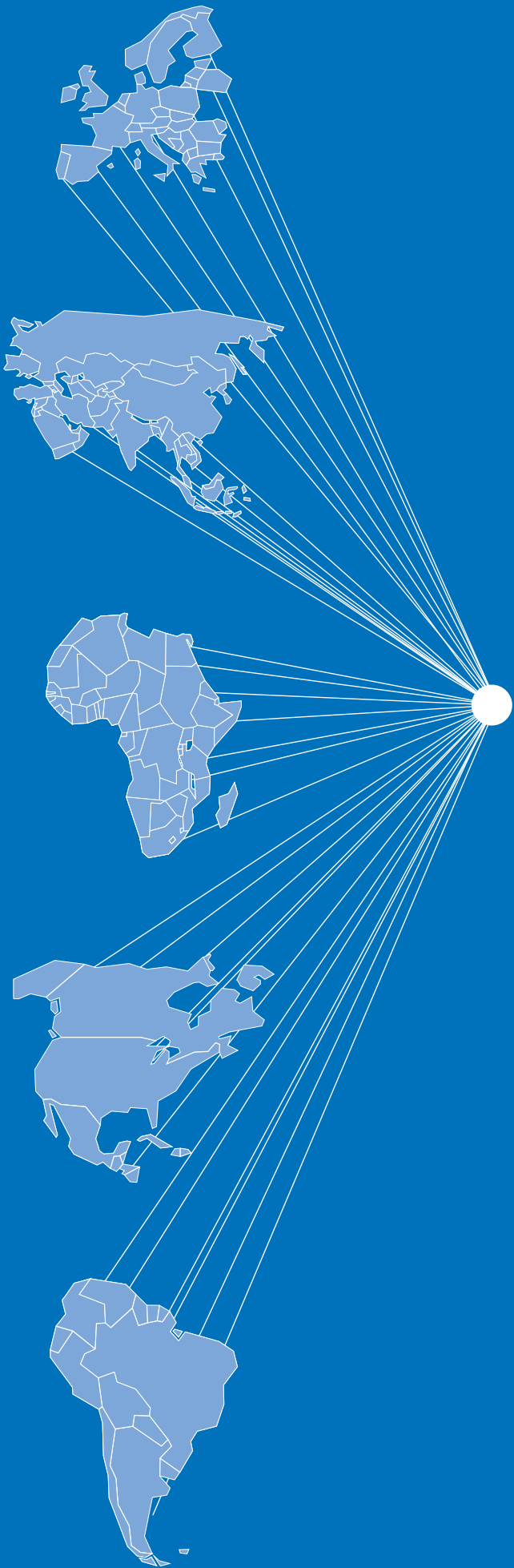International Center for
Information Technology**

Annual Report
2021

Foreword by the Chair of the b-it Foundation

Dr. Dirk Günnewig
State Secretary at the Ministry of Culture and Science of the German State of North Rhine-Westphalia
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few have imagined at the end of 2020 that the Corona virus would still dominate every-day life a year later. The past year was challenging for the higher education system and demanding for students and educators alike. The digital transformation of the society, and the move to the virtual space happened rapidly and became part of many peoples everyday live.

The topics of the Bonn-Aachen International Center on Information Technology (b-it) – Life Science Informatics, Media Informatics, and Autonomous Systems around a shared data science kernel – are relevant for this digital transformation.

It is great to see that the partner universities continue to demonstrate their research leadership with several awards, in venues such as the International Conference on Intelligent Robots and Systems, the International Conference on Advanced Information Systems Engineering, or the International Conference on Enterprise Information Systems. Winning the vice-world champions in the @Work league at the RoboCup World Championship June 2021 is a great success.

Also new projects and events by b-it support this ongoing digital transformation, for example the industrial applications of 5G campus networks and Blockchain Reality Lab by Fraunhofer FIT or the Smart City Robotics Challenge co-organized by Hochschule Bonn-Rhein-Sieg researchers.

Welcome to Professor Sebastian Houben, who joined the Autonomous Systems Program of b-it.

Despite all move to the virtual world and successes in the digital transformation – many parts of education require face to face time to achieve optimal results. For the ministry it is also encouraging that – with all the required safety measures in place – some face-to-face time between students and educators are possible at b-it.

Concluding, we would like to thank the b-it directors, study program coordinators, and the faculty and supporting staff, and the students for their additional efforts in difficult times, with best wishes for the future.

Dr. Dirk Günnewig
State Secretary at the Ministry of Culture and Science of the German State of North Rhine-Westphalia
Chair of the b-it Foundation Council

b-it Mission Statement

b-it is an international center for information technology. It is jointly carried by the leading universities and research institutes of the information technology region Bonn-Aachen. At b-it, a team of excellent scientific leaders attracts the best students from all over the world. At the same time, b-it is a strategic partner of the regional economy.

At b-it, research and teaching form an integrated unit at the highest level. International orientation and diversity are a particular asset and strength of our institution. In our teaching, we build on the complementary strength of our participating institutions.

Graduates of b-it are sought after as specialists and experts, regionally and internationally. They transport know-how and innovation into science and economy.

We are shaping the digital change in a dialog between economy and society. Our focus is Data Science in the application areas Media, Life Sciences and Autonomous Systems.

Report by the Scientific Directors

Even though the last year was challenging for students and educators, b-it was able to continue to offer highly selective graduate IT education to top international students in a unique cooperation between top research universities and the Fraunhofer Society. English-language Master's Programs link Data Science and AI to Robotics, Media and Communications, and the Life Sciences. b-it graduates continue to enjoy an excellent placement record in research and industry, as several examples in this report illustrate. We also are glad to report a careful and small move back from the virtual to the real: due to the COVID-19 pandemic, a virtual welcome for the incoming students was held on October 29, 2020. In November 2021, b-it could again celebrate its welcome as an in-person meeting, where students and staff members enjoyed being there in-person once again, even though some precautions had to be taken.

We are also glad to report that Professor Sebastian Houben joined the Autonomous Systems Program from October 2021. After positions as a Junior Professor of Applied Computer Science at Ruhr-Universität Bochum and senior researcher at the Fraunhofer IAIS, he was appointed as a full professor of computer science with a focus on autonomous systems and machine learning at the Hochschule Bonn-Rhein-Sieg.

We are especially grateful to our universities, who have supported b-it to compensate for the historically low interest rates.

Special thanks go to our previous Foundation Board Chair Annette Storsberg, who helped steer the b-it foundation through turbulent times and who retired recently.

Stefan Decker,
RWTH Aachen University and Fraunhofer FIT
Paul G. Plöger,
Hochschule Bonn-Rhein-Sieg
Stefan Wrobel,
University of Bonn and Fraunhofer IAIS

Prof. Dr. Stefan Decker
RWTH Aachen University and Fraunhofer FIT

Prof. Paul G. Plöger
Bonn-Rhein-Sieg University of Applied Sciences

Prof. Dr. Stefan Wrobel
University of Bonn and Fraunhofer IAIS

b-it in Profile

The southwest of North Rhine-Westphalia (NRW) 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, Hochschule Bonn-Rhein-Sieg (H-BRS) and the research institutes of the Fraunhofer Institute Center Birlinghoven Castle.

b-it offers highly selective international master`s programs in Applied IT, as well as summer / winter schools for qualified undergraduate computer science students. The b-it Research School offers doctoral training. Since 2018, most courses take place in the newly erected b-it building on the Poppelsdorf Campus for Mathematics and Computer Science of Bonn University. Admission to the b-it master's programs is linked to, and conditioned 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, while the b-it Applied Science Institute offers a Master of Science 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 Credit Transfer System (ECTS) standard, their focus on IT competence, and the deep integration of teaching and research.

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. A comprehensive external evaluation in 2015 confirmed the very positive developments and stimulated a few new accents. The success of the b-it programs is also demonstrated by a very good placement record, both in academia and industry.
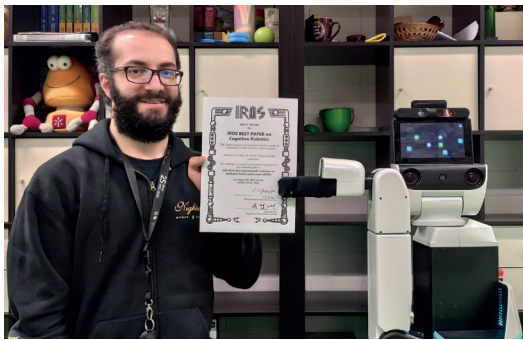
b-it is financially supported by a 56 M€ Foundation initiated through the Bonn-Berlin program of the German federal government, as well as by matching NRW state funds.
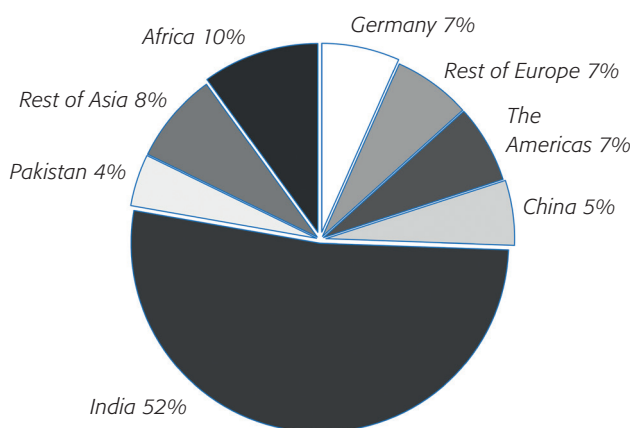
Home countries of new b-it students.

Honors and Awards

IROS Best Paper Award on Cognitive Robotics

Alex Mitrevski, a PhD student in the Autonomous Systems Group, and his PhD advisors, Prof. Paul Plöger (H-BRS) and Prof. Gerhard Lakemeyer (RWTH Aachen), won the Best Paper Award on Cognitive Robotics at the 2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). The largest conference in the field of robotics took place as a fully online conference at the end of October 2020 with more than 20,000 conference participants.

In the award-winning paper, titled "Representation and Experience-Based Learning of Explainable Models for Robot Action Execution", Mitrevski and his team present a model based on which a robot can learn how to perform everyday activities (such as picking up a cup) by guided experimentation, but so that it obtains conceptual and predictive knowledge about the activities that it performs. The ultimate objective of the representation is to equip a robot with the ability to predict and analyse its mistakes in a more systematic manner than is usually the case in robotics. This enables both users as well as developers to understand the robot's mistakes and allows the robot to learn from them.

Best Student Paper Award at ICEIS'21

Johannes Lipp, Siyabend Sakik, Moritz Kröger and Stefan Decker received the Best Student Paper Award at the 23rd International Conference on Enterprise Information Systems (ICEIS) for their paper "LISSU: Integrating Semantic Web Concepts into SOA Frameworks". The ICEIS'21 took place April 26-28, 2021, and was organized as a video conference.

## Autonomous Systems student Kolappan has been awarded the DAAD Prize

Ganesamanian Kolappan has been awarded the DAAD Prize for outstanding achievements of international students studying at German universities. The prize of the German Academic Exchange Service (DAAD) comes with 1,000 € and is awarded to students with both outstanding academic achievements and impressive social or cultural commitment.

Best Poster Award at CAiSE '21

Istvan Koren, Stefan Braun, Marc van Dyck (TIME), and Matthias Jarke won the Best Poster Award at the 33rd International Conference on Advanced Information Systems Engineering (CAiSE '21, Melbourne, Australia) for their paper "Dynamic strategy modeling for alliance-driven data platforms: The case of smart farming". The paper resulted from joint work of Informatik 5 resp. Fraunhofer FIT with the Innovation Management group TIME of Prof. Piller in the context of DFG excellence cluster "Internet of Production" and its linkage to the International Data Space initiative.

Djordje Vukcevic awarded with a PhD Scholarship from the Graduate Institute of H-BRS

Djordje, an MAS alumnus has been awarded with a 3-year PhD scholarship from the Graduate Institute of Hochschule Bonn-Rhein-Sieg (H-BRS) to pursue his studies on the topic of "Exploiting Natural Dynamics for Efficient and Robust Control of Modern Robots" where he will develop design patterns that exploit natural dynamics in unifying, explicit, general & real-time applicable ways. He is being internally supervised by Prof. Nico Hochgeschwender.
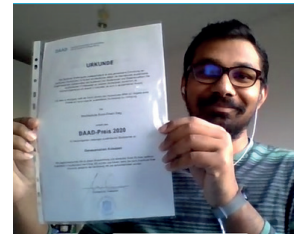
Ganesamanian Kolappan.

Gemma van der Voort, Life Science Informatics outgoing student, won together with Professor Thomas Schultz and Johannes Gruen a best Paper Award at the EG Workshop on Visual Computing for Biology and Medicine. She contributed with her successful Master Thesis to the award winning paper with the title "Reducing Model Uncertainty in Crossing Fiber Tractography".

The following Life Science Informatics students received awards for their excellent Master Theses by the Bonn Computer Science Society (Bonner Informatik Gesellschaft, BIG) for the award period 2018-2020: Sneshana Karpova (Supervisor Prof. Thomas Schultz), Özlem Musli (Supervisor Prof. Holger Fröhlich), Simon Müller (Supervisor Prof. Thomas Schultz).

Events and Visits

b-it Welcome Meeting 2020/2021

Due to the CoVid19 pandemic a virtual Welcome Party for the incoming students was held on October 29, 2020. In November 2021, b-it could celebrate its Welcome Party as in-person event again. Students and staff members enjoyed meeting again in-person, even though some precautions had to be taken.

MAS Alumni and Student Get-together on Wonder.me

On July 3, 2021, the MAS faculty, staff, students and alumni met online via the wonder.me platform. A total of 31 MAS community members attended and were welcomed by Prof. Paul Plöger and the H-BRS Alumni Management Office, Ms. Barbara Wieners-Horst. Given that MAS parties and the department's Alumni-Come-Together events had been canceled, the event was a great opportunity for students to network with alumni and a great chance for the faculty and staff to catch up with them.

9th International Planning for Robotics Workshop (PlanRob)

In the context of the International Conference on Automated Planning and Scheduling (ICAPS) which took place online in August 2021, Autonomous Systems Group member

Iman Awaad co-organized the 9th International Workshop on Planning and Robotics Workshop (PlanRob). AI Planning & Scheduling (P&S) methods are key to enable intelligent robots to perform autonomous, flexible and interactive behaviors. To foster close collaboration and synergy among researchers, the PlanRob workshop provides a stable, long-term forum (held annually at ICAPS since 2013). Here, researchers from both the P&S and robotics communities openly share relevant topics, research and development progress, future directions, and open challenges related to P&S when applied to robotics.

The highlight of the workshop program was a talk by Dr. Peter Stone, Professor at the University of Texas, Austin, on "Task Planning and Learning for General Purpose Service Robots."

SmartGreens 2021 Conference Chair

The 10th International Conference on Smart Cities and Green ICT Systems (SmartGreens 2021) was held April 27-29, 2021, in conjunction with the ICEIS, VEHITS, and CLOSER conferences. The conference, originally planned in Prague, Czech Republic, was held in digital format. It was chaired by Professors Markus Helfert (Maynooth University, Ireland), and Matthias Jarke (RWTH Aachen University) together with Dr. Cornel Klein, Siemens Germany. In one of the keynote talks, Prof. Markus Eisenhauer, former department chair at Fraunhofer FIT, presented the concept of a planned nation-wide Digital Twin for the state of Luxemburg. More information on the conference can be found under www.smartgreens.org.

Autonomous Systems Program Back on Campus in WS 2021/22

With the news that classes would be taking place on campus in the WS 2021, over fifty MAS faculty, staff and students got together for a picnic in the courtyard of the Sankt Augustin campus on September 20, 2021. For many students, who joined the program over the past three semesters, this marked the first time they had spent time together on campus!

b-it Alumni Lecture Series

Three alumni of the b-it master's program took part in the inaugural b-it Alumni Lecture Series which was launched in the SS 2021. Dr. Olga Bodet, now at Zerogravity in Finland, delivered her talk "From molecules to satellites". Olga is a b-it alumna of the master's program of Life Science Informatics. The talk gave an overview of her life and career journey from her Bioinformatics degree in LSI, PhD in Medical Physics & Biophysics to a corporate job and starting her own business. It reflected the career transition from the academic world to Data Science & Strategy as well as steps that lead to starting an own space tech startup. Her startup won a variety of European space agency prizes and is an alumni of European Space Agency business incubator.

Dr. Ajay Abishek Paul George, currently with Biosolvit in Sankt Augustin, talked about "Half a Decade of Life Lessons after Life Science Informatics". Ajay obtained his B.Tech. in Biotechnology from VIT University, Vellore India (2009). After a three-year stint as software developer at Cognizant Technology Solutions in Chennai, he moved to Germany for higher education. He obtained both his M.Sc. in Life Science Informatics (2016), and his PhD (2020) from the University of Bonn, under the supervision of Prof. Dr. Diana Imhof. He is currently the Product Owner for Computer-Aided Drug Design software at BioSolevIT GmbH, a premium provider of molecular modeling and drug discovery software based out Stankt Augustin. In this talk, Ajay looked back at how b-it and the LSI program grounded his interests in molecular modelling and computational chemistry. He also discusses his experiences and lessons learnt in the process of transitioning from a student, to a research scholar to now, a Product Manager driving the development of BioSolevIT product portfolio SeeSAR and infiniSee.

The closing talk of the series was delivered by Gabriela Cortés, a research scientist for Alexa AI at Amazon in Berlin and was titled "Alexa, how do I become a scientist?". Gabi obtained her B.Eng. in Mechatronic Engineering from the Universidad Autónoma de Guadalajara in Mexico, along with her M.Eng. in Robotics before obtaining her master's degree in Autonomous Systems from H-BRS in 2019. In her talk, Gabi discussed her path as a student as well as her current research working with the Natural Language Understanding (NLU) team of Alexa AI.

Research @ b-it

Troisdorf Companies Test 5G Technology

Industrial applications of 5G campus networks will be studied in the IndustrieStadtpark Troisdorf, started in February 2021. The BMVI is funding this project which is carried out by a consortium consisting of Fraunhofer FIT and six partners. The first use case under study is a 5G-based information and guidance system for forklifts. It will be used to determine routes, process assignments and monitor vehicle status. The second use case is a 5G toolbox for a range of mixed reality applications. The focus here is on remote support for installation, commissioning and maintenance of systems, and on enabling home office work for technical personnel.

## Professor Sebastian Houben joins the Autonomous Systems Program

Prof. Sebastian Houben.

Prof. Sebastian Houben studied mathematics and computer science at the FernUniversität in Hagen and graduated in 2009. After completing his doctorate at the Ruhr-Universität Bochum, he joined the Autonomous and Intelligent Systems Group at the University of Bonn as a postdoc. In 2017, he was appointed Junior Professor of Applied Computer Science at Ruhr-Universität Bochum and accepted a position as Senior Researcher at the Fraunhofer IAIS. From October 2021, he joined the program as a full professor of computer science with a focus on autonomous systems and machine learning at the Hochschule Bonn-Rhein-Sieg. Prof. Houben conducts research in the field of machine learning, in particular in the area of computer vision and environment perception in autonomous robotics, primarily with applications in the area of automated driving. His research addresses the question of how machine learning, and, by extension, the systems based on it, can become less data-dependent, interpretable, more robust and overall more reliable.

SciRoc – Smart City Robotics Challenge

The second Smart City Competition in the context of the EU-funded SciRoc project was held in Bologna Italy in September 2021. Teams from nine different universities participated in this event to get their robots benchmarked in a total of five episodes. Deebul Nair and Sven Schneider from H-BRS organized Episode 05: "Shopping Pick and Pack". This episode also featured a remote event in which four teams participated from their robotics labs in UK, Germany and Italy. The onsite event was won by Team AutonOHM from Technische Hochschule Nürnberg, whereas Team Cranfield from University of Cranfield was victorious in the online event. Team b-it-bots also participated in the remote competition and secured the third position. The event was an overall success, majorly to reboot the robotics competition community post the pandemic with a combination of on-site and online events. Team b-it-bots revitalized itself with new team members joining the team and participating in their first international robotics event. The new team members are Mihir Mehta, Michael Stolarz, Ludovico Scarton, Malika Navaratna, Syed Ibrahim Shakir and Kishan Ravindra Sawant.
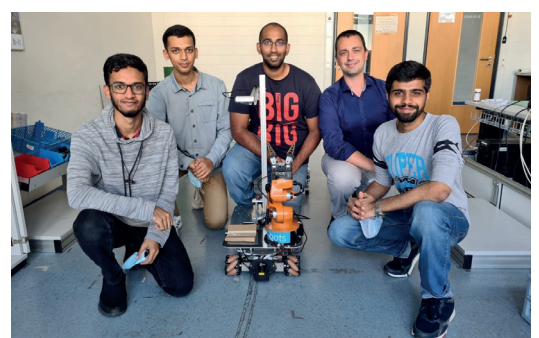
MigrAVE – New Project for the Autonomous Systems Group

MigrAVE is a cooperative project between H-BRS, FH Münster, and University of Applied Science, Cologne (RFH), that runs from Oct. 2020 until Sep. 2023. The project's objective is to create technologies supporting children with Autism Spectrum Disorder (ASD), whose families may potentially have a migration background. The project aims to create two complementary technologies in this context: (i) an info portal for ASD with detailed information about the disorder and therapy procedures, and (ii) a robotic therapy assistant that supports the learning of everyday skills which are challenging for children with ASD, such as basic motor skills and social interactions. HBRS works on the development of the robotic assistant.

The b-it-bots are vice-world champions in the @Work league at the RoboCup World Championship which took place in June 2021.

Due to Covid-19, the championship was conducted entirely online this year, with teams setting up test arenas in their own laboratories and live streaming their runs online. Despite limited access to the labs, the small team of new students of the Autonomous Systems program worked hard to achieve the second place, in addition to winning two of the technical challenges. In order to complete the tasks, the robots navigate autonomously, recognize industrial objects, and transport them to different locations in the test arena, which is set up like a smart factory environment. The b-it-bots also participated in the Domestic Standard Platform League and placed fifth in the competition, which was conducted in simulation this year. The team is supervised by staff members and the computer science professors Paul Plöger and Nico Hochgeschwender.

Prof. Dr. Andreas Pinkwart, Minister of Economic Affairs, Innovation, Digitalization and Energy of the State of North Rhine-Westphalia, and Prof. Wolfgang Prinz, deputy director of Fraunhofer FIT. © BMWi

Funding for Blockchain Reality Lab

The transformation of the Rhineland coal mining region towards the Green Deal goals poses great challenges to North Rhine-Westphalia but also offers a once-in-a-century change for innovation. In the next years, the state and federal governments will make significant structural funds available for numerous projects on central issues such as climate protection, energy, digitalization, and sustainable business. As the very first project within the SofortprogramPLUS of these initiatives, the Blockchain Reality Lab in Hürth near Cologne has been awarded funding from the STARK program of the Federal Ministry of Economic Affairs and Energy (BMWI). I5 Professor Wolfgang Prinz, Deputy Executive Director of Fraunhofer FIT, achieved the initial € 4.7 mio. funding notice on March 12, 2021, from NRW Minister of Economics, Innovation, Digitalization, and Energy (MWIDE) Professor Andreas Pinkwart, BMWI State Secretary Elisabeth Winkelmeier-Becker, and Torsten Safarik, President of the Federal Office for International Business and Export Controls (BAFA).
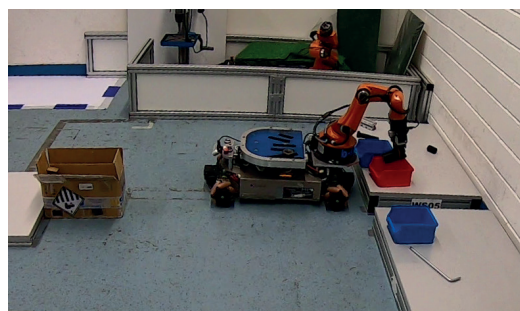
Prof. Dr. Jan Borchers,
Media Computing

Prof. Dr. Thomas Rose,
Media Processes

List of employers of MI Alumni
(Universities & Research):
Airport Research Center GmbH, b-it, b-it Research School, Centro Nacional de Investigaciones Cardiovasculares, CERTH, Charité Berlin, Chinese Academy of Science, COSBI, Czech Technical, ETH Zurich, Fraunhofer FGAN, FIT, FKIE, FOKUS and IAIS, FSU Jena, Hasso-Plattner-Institut, HHI Berlin, Imperial College, INRIA, Institute of Molecular Medicine, Karlsruhe Institute of Technology (KIT), K. U. Leuven, Max Planck, Microsoft Research (Cairo), National University of Computer & Emerging Sciences, National University of Ireland Maynooth, National University of Sciences and Technology, Research Center Jülich, Robert Bosch Foundation, RWTH Aachen, Suez Canal University, Swiss Federal Institute of Technology, Uniklinik Aachen, Uniklinikum Bonn, Universidad Tecnologica de Panama, Universitätsspital Basel, University Clinic Carl Gustav Carus; Universities of Agder, Arab American Jenin, Asia and the Pacific, Atma Jaya Yogyakarta, Augsburg, Bahria, Bonn, Cambridge, Düsseldorf-Essen, Dresden, Duisburg-Essen, Edinburgh, Engineering & Technology Peshawar Pakistan, Ghent, Göttingen, Hamburg, Hasselt, Heidelberg, Houston, Oldenburg, Ireland, Maynooth, Ienes Kepler, Kiel, Leipzig, Mainz, Münster, Paris, Rotterdam, Sud, Stuttgart, Tilburg, Tirana, Toronto, Trento, Tübingen, Washington, Waterloo, Western Australia, West Indies, Zurich; TU Darmstadt, TU Dresden, TU Eindhoven, TU Munich

b-it Programs

Master Program in Media Informatics

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 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, and 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.

24 Media Informatics students have completed their degree in the academic year 2020-2021. The graduates quickly found interesting positions either as doctoral students in Germany and abroad, or in attractive companies. The incoming class of 2021 comprises 27 students, selected from 290 applications. The new students come from 14 countries and include 52% females and 48% males.

Dr. N. Deniz Sarier

N. Deniz Sarier joined Media Informatics in 2005 with a Double Major Degree in Mathematics / Industrial Engineering of Istanbul Technical University (ITU). During her master studies with DAAD / TEV Scholarship, she enjoyed the exciting nature of computer security and cryptography, which has shaped the future of her academic career.

With a b-it Research School scholarship, she started her PhD education in Computer Security Group (Cosec) of b-it under the supervision of Prof. Dr. Joachim von zur Gathen and graduated with summa cum laude in 2013.

After working in a private university in Istanbul as an Assistant Prof. of Computer Engineering, in 2018, she was offered a Senior Researcher position in Blockchain Research Lab of TUBITAK BILGEM, where she worked till 2020 in parallel to lecturing on Blockchain Technologies in ITU Informatics Institute.

Currently, she is applying for a habilitation degree in ITU and continues her academic work as an external researcher of Cosec, b-it, with recent publications in Q1 journals.

Dr. Sarah Suleri

Originally from Pakistan, Sarah Suleri moved to Germany to pursue her master's degree in Media Informatics in 2014. During her studies, she worked as a UX research assistant in Fraunhofer FIT for 1.5 years.

After graduation, she joined Fraunhofer FIT as a UX research associate and worked on various H2020 research projects. Besides her full-time job at Fraunhofer, she pursued her doctoral research on "The impact of technological support on the workload of software prototyping" under the supervision of Prof. Matthias Jarke. During her PhD, she has published in numerous tier-1 conferences such as CHI, IUI, DIS and MobileHCI. She finished her doctoral research in less than four years and graduated with summa cum laude (distinction).

Acknowledging her academic excellence, she was awarded the Borchers Badge and the Springorum Commemorative Coin 2021. Sarah continues to pursue her passion for UX design in the industry. She is currently working at Scanbot as a Senior Designer.

List of employers of MI Alumni (Business): 4tree GmbH, 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, awato Software GmbH, Bank of Mexico, Bayer Technology Services, BCA Auctions, BCA Europe, Bertelsmann, Bertrandt Ingenieurbüro GmbH, BESA GmbH, Blimp.Mx, Bombardier Inc., Brainloop, BTC Business Technology Consulting, Capgemini, Capitaworld Platform Pvt. Ltd., CAS, CBC Cologne Broadcasting Center, Cellent AG, CGI, CIGNA, Cloudberrytec, CMLabs Simulations, Cognizant Technology Solutions, COMNEON, Contentteam, Crytek, CSC India, Daedalic Entertainment, Daimler, Deloitte AG, Delta Engine, Demax, Deutsche Bank AG, Deutsche Telekom, devolo AG, Dolby Laboratories, DP ITServices GmbH, Dynevo (Bayer), Ericsson, Euromoney Institutional Investors, European Computer Telecoms, Evimed Online, Exact Software, Facebook, Famous Group, Finantix Srl, Forth corporation, Fox Chase, Game Analytics ApS, GIVE.sg, Global Crop Diversity Trust, Goodyear, Google, Grandcentrix, GTT Technologies, Hewlett Packard Enterprise, HITS, Huawei, Humance, i22 internetagentur, IBM, IdeaObject Softwares, Ilypsys, IMC BV, IMC Financial Markets, Infineon, Inforcept Networks, Internet Company, IP Labs, iPharro Media, ISRA Surface Vision GmbH, ITBrainiacs, IVU Traffic Technologies, IW-One, Johnson Controls, Keynote SIGOS, Kisters, Kuveyt Turk Participation Bank, Lakshmi Technology and Engineering Industries, LHS Telekommunikation, Ligatus GmbH, Lufthansa Systems, Lycos, MarAnCon, Merck, Mastercard, MeVis Medical Solutions AG, Microsoft, Mobilab Solutions, moneymeets GmbH, Monsanto, Movilizer, NAVTEQ, Nato Communications and Information Agency, Nemetschek AG, NeuroSky, Inc., Nexcom IT Services, Next Level Integration, Novartis, NTT Data, NVIDIA, Oando Plc, Oracle, Patersons, PCI Geomatics, Pepsi, Philips, Plinga, PricewaterhouseCoopers, Qiagen, Qosmotec Software Solutions, QSC, ReadSoft, Recogizer Group, Recommind, Roamworks Research & Development GmbH, Robert Bosch GmbH, Roche, S&P Capital IQ, Samsung Electronics, SAP, SD Inspiring Travel, sd&m, SE Consulting, Secat, Shell, SHS VIVEON, siCAT, Siemens, Siemens Healthcare, SIGOS, Simfy, Sogou Inc., Solnista, Solutions 4 Media, Sony, Steinberg Media Technologies, Sytel Reply, T-Systems, TeamViewer, Teleca, Telemotive, Tessella, Texas State - Health and Human Services (HHSC) Agency, Thomson Reuters, TravelTainment, Turk Telekom, Twitter, Vantage Labs, Viacom, vmware, Vodafone, Wacom Europe, Werum Software & Systems, Westwing Home and Living GmbH, Whowish, Widespace AB, Wieden+Kennedy, Workplace Systems, World Bank, Xerox Research Centre Europe, Yahoo!, Yieldlab AG, Zalando

Prof. Dr. Jürgen Bajorath, Life Science Informatics

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

List of employers of LSI Alumni *(Business): 4GATC Biotech, Accenture, Accura Gen, Alcimed, Arbern GmbH, Asahi Kasei, ASI Data Science, Astra Seneca, BASF SE, Bayer, Bayer Monsanto, BenevolentAI, bigspark, BioSolevIT, Boehringer Ingelheim, Centogene, Clariant, Ericsson, carpooling.com GmbH, Clue Points, Comma Soft AG, Coty Germany, Curetis, Dairy Data Warehouse, Dassault Systèmes, Deutsche Post, DFind Science and Engineering, DHL, Diapharm, ecSeq Bioinformatics, Ennovation VC, epitome GmbH, Fast Focus BV, Freeletic, Fresenius Kabi, G42, Galilleo Press, Gamomat GmbH, GAMOMAT Development GmbH, GATC Biotech, Generali Deutschland AG, Genestack, Genome Biologics, Glaxo Smith Kline, Hamilton Medical, HealthCare Global, Heraeus, Hoffmann-La Roche, Hype Innovation, IBM, IIT Bangalore, ITTM S.A., Interpretomics, IQVIA, Johnson & Johnson, KWP Inside HR, LabVantage Solutions Inc., Land of Lakes Inc., Lead Discovery Center, Leaf Bioscience, LHS Telecommunications, LinkTechnica, L'Oréal, Lufthansa Cargo, MacKinsey, MarAnCon, Mastercard AG, Max Dellbrück Center Berlin, MBition, McKinsey, Mediengruppe RTL, Medsciences Biotech, Medtronic, Micro biolytics, Miltenyi Biotec, Molecular Devices, Molecular Health GmbH, Molecular Connections Private Limited, Merck, Monsanto, msg systems ag, Nestlé Institute of Health Science, Novartis, Novo Nordisk, Octapharma, Omnicom Media Group, Perkin Elmer, Pfizer, parlamind GmbH, Postbank, Philips Research North America, PQE Group, ProfileXpert, Protagen AG, Publicis Group, quintly Inc., real.digital, Rewe, Recogizer, Roche, Schlumberger, Sciex, Seassoon Information Technology, StepStone, Syeneos Health, Synechron Ltd., Syngene Ltd., United Brands Marketing, Tubs System LLP, Zerogravity*

Master Program in Life Science Informatics

The Master`s 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, chemirmatics, 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 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 last years have contributed to strengthen ties with scientists of the region. Several interesting Master thesis have been carried out in collaboration with them. 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 18 students successfully graduated from the Life Science Informatics program and about 25 new students from 9 different countries ranging from Ethiopia to the United States will start their studies in Winter Semester 2021/2022 carefully selected from more than 170 applications.

LSI Success Stories

This year the LSI program presents two alumni, instead of current students of the program. Looking at the career paths of alumni will provide insights which effect the program had on the career of its graduates. One alumnus, Dr. Lei Gu, works in academia whereas the other, Dr. Ajyay Abishek Paul George, decided to join industry. Looking at the careers of these two alumni shows a very typical element in the career paths of LSI alumni: 85% of students strive to get a PhD first and then they decide for a career path either in industry or in academia. Both were invited to the b-it Lecture Series 2021 and gave insight into their careers. They also reflected on their work in times of the COVID pandemic.

DR. LEI GU

Lei Gu joined the LSI program in 2008 as a junior staff scientist from the Chinese Academy of Science (CAS) – Max-Planck Institute (MPG) Partner Institute for Computational Biology (PICB), Shanghai, China. He completed the LSI program in 2008 with a Master's degree and worked as a work-study-student in b-it partner institute Fraunhofer SCAI. The b-it work study program is aimed at excellent students who want to get research exposure during their studies. Lei completed the program with a Master's degree and started his PhD thesis at German Research Center (DKFZ) in Heidelberg. Having received his PhD with Magna cum laude in Heidelberg, Lei started in 2014 a postdoc position at the Boston Children's Hospital and Cell Biology Department, Harvard Medical School, Broad Institute of MIT. In 2019 he additionally became instructor in Pediatrics at the Division of Newborn Medicine at Harvard Medical School. Since 2021 he heads his own group "Epigenetics" at Max-Planck-Institute for Lung and Heat Research in Bad Nauheim.

Dr. Gu showed how he managed to unravel a – so far unknown – pathway that contributes to the formation of skin cancer (melanoma) with a combination of wet lab and computational methods. In 2021, he was invited to present his current work in b-it Lecture Series. Current students of the LSI program and all other b-it programs took the opportunity to not only discuss the results of his current work, but also his career paths that took him from China to Germany, then to the United States of America and now back to Germany again.

DR. AJAY ABISHEK PAUL GEORGE

Ajay graduate with a Bachelor in Biotechnology from Vellore Institute of Technology in India. After graduation he chose to get some work experience and joined Congizant Technology Solution for two years first. In 2012, Ajay joined the LSI program to further his education. In 2015, he became a student assistant and in 2016 a research assistant in the group of Professor Diana Imhof, group of Pharmaceutical Biochemistry and Bioanalytics at the Pharmaceutical Institute of the University of Bonn. In 2020, Ajay graduated with a PhD. His PhD focused on novel algorithm (SeqD-HBM) as a programmatic solution stemming from complex experimental consensuses and a web application (HeMoQuest) that uses machine learning to predict transient heme-protein interaction affinities, thus introducing and applying machine learning methods in this field.

Upon his graduation in March 2020, the COVID pandemic hit, when he was just about to start looking for an employment. In September 2020, he joined BioSolvIT in Sankt Augustin, Germany, as a product owner.

In the b-it Lecture Series 2021 Ajay shared his insights about studying in the LSI program, transitioning from Biotechnology to Biomedical Data Science in the Chemoinformatics field and landing a job in difficult times. He states: "The LSI alumni have found great success in their careers both in academia and industry. I do not say this in a general obligatory sense, but I do know that all my own former batchmates are doing very well in careers now. LSI has been a fundamental stepping stone to all of our success."

List of employers of LSI Alumni (*Universities & Research*): *Alan Turing Institute, Berlin Institute of Health, Biotech Research & Innovation Centre (BRIC), b-it Research School, Boston Children's Hospital, Centro Nacional de Investigaciones Cardiovasculares, Charité Berlin, Children's Cancer Research Hospital, Christian-Albrechts-Universität Kiel, Czech National Centre for Biomolecular Research, ELI Beamlines, European Molecular Biology Laboratory, ETH-Domain, ETH Zürich, European Bioinformatics Institute, European Bioinformatics Institute, Fraunhofer FIT, Fraunhofer IAIS, Fraunhofer IME, Fraunhofer SCAI, Fundación Centro Nacional de Investigaciones Cardiovasculares, German Center for Cancer Research (DKFZ), German Center for Neurodegenerative Diseases, German Institute of Human Nutrition, Hasso Plattner Institute, Heidelberg Institute of Theoretical Studies (HITS), Helmholtz Centre for Infection Research, Helmholtz Zentrum München, Hertie Institute for Clinical Brain Research, Hospital of the University of Bale, Hotkiss Brain Institute, IFOM, IIT Jodpur, Imperial College London, India University of Copenhagen, Institut Pasteur, Institute of Pysics of the Academy of Science of the Czek Republic, King Abduly City for Science and Technology, Leibniz Institut für Ostseeforschung, Massachusetts General Hospital, Max Planck Institute for Biophysical Chemistry, Max Planck Institute for Molecular Biomedicine, Max-Planck-Institute for Molecular Genetics, 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, Microsoft Research-University of Trento Centre for Computational and Systems Biology (COSBI), MPI fo Cognitive and Brain Science, MPI for Molecular Genetics, National Centre for Biological Sciences, National Centre for Biomolecular Research, National University of Ireland, National Technical University of Singapore, NIH, Philipps, Princess Nora Bint Abdulrahman University, Radboudumc – University Clinic Centre of the University of Nijmegen, Research Center Jülich, RWTH Aachen, South University of Science and Technology of China, Swiss Federal Institute of Aquatic Science and Technology, TRON, TU München, Twincore – Centre for Experimental and Clinical Research, University Clinic Gustav Carus Dresden, Universitätsklinikum Schleswig-Holstein, University College London (UCL), Western University, ZBMed, and the universities of Alberta, Amsterdam, Bonn, Bern, Cambridge, Cologne, Copenhagen, Dresden, Düsseldorf, Ghent, Kiel, Leipzig, Leon, Luxemburg, Macquerie, Mainz, Marburg, Münster, Oxford, Sheffield, Tübingen, Utrecht, Western Australia, Vienna, Wageningen, Western Onatario, Würzburg, Zürich.*

Master Program in Autonomous Systems

Prof. Dr. Paul Plöger,
Autonomous Systems

Prof. Dr. Erwin Prassler,
Autonomous Systems

Prof. Dr.
Nico Hochgeschwender,
Autonomous Systems

Prof. Dr.
Sebastian Houben
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. Numerous robot platforms are used for educational and research purposes, including the Toyota Human Service Robot, 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 2020/21, 35 students joined the MAS program from an applicant pool of 577 candidates. The MAS program has always attracted the interest of students all over the globe, as can be seen from the 10 different nationalities of the 35 new students.

The program is offered by the b-it Applied Science Institute (b-itAS) in the Department of Computer Science at the Hochschule Bonn-Rhein-Sieg (H-BRS). 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 four professors (Paul G. Plöger, Erwin Prassler, Nico Hochgeschwender and Sebastian Houben), two research associates (Iman Awaad and Alex Mitrevski) as well as researchers who have been recruited through various projects, namely: SciRoc, ROPOD, RoboLand, METRICS, SAFEMUV, VeriComp, SESAME, MigrAVE, E2x (E-Assessment), Robot Refurbishment, and Intelligent Human-Understandable Quality Control for Assisting Drivers in Testing of Vehicle Dynamics. These researchers are Dr. Anastassia Küstenmacher, Alex Mitrevski, Tim Metzler, Deebul Nair, Minh Nguyen, Argentina Ortega, Sven Schneider, Santosh Thoduka, Djordje Vukcevic, and Mohammad Wasil.

The faculty and staff are actively involved in many scientific activities, including memberships in technical committees of IEEE as well as numerous program committees of workshops and scientific conferences such as IROS, ICRA, ICAR, ICMA, and AAMAS.

MAS Success Stories

NGA TRAN

Software Developer, Google

I joined the Autonomous Systems program in 2018. After a year, I applied for the dual degree program between H-BRS and UNB. In 2021, I graduated with two degrees, an M.Sc. in Autonomous Systems and an M.Sc. in Computer Science. The dual degree has provided me with an opportunity unmatched by any others. Currently, I am a software developer at Google at the Waterloo branch in Canada. I am working on the Google Cloud Marketplace to enhance the user experience when using the platform.

MARC VINCI

Researcher, German Research Center for AI (DFKI)

I joined the Autonomous Systems program, because I wanted to learn about robotics, how to make them intelligent and how to solve complex real-world tasks. The program answered these questions extensively by providing various topic choices. I focused my studies on AI, Machine Learning and Task Planning which gave me the knowledge I wanted. Additionally the program taught me to research and solve real-world challenges. All of this combined sparked my interest in doing research in this field and after my graduation in 2021 I chose to continue research, which is why I am now working as a Researcher at DFKI in the department for Plan-Based Robot Control.

PRITESHKUMAR GOHIL

Software Engineer, Expleo Germany GmbH

I would like to begin with a big "Thank You" for all the opportunities, learning and development I had during my master's studies. The journey was not easy, but it was worth it. Joining this program has been a life-changing decision for me – I got the chance to learn about AI and apply it to real-world applications. My R&D project on multimodal machine learning has helped me to secure a master's thesis in the automotive industry on the topic "Object Detection for Autonomous Parking". Currently, I am working as a Software Engineer and also acting as an ML-Lead for one of our customers in the automotive industry. "Be Bold, Be Courageous, Be Your Best".

AMIR H. PAKDAMAN

Data Scientist, Next Kraftwerke GmbH

After starting my studies in the Autonomous Systems program, I soon realized that it is an advanced program that is well worth putting all my effort into. Throughout the program, I learned more than I was expecting, had the chance to play a greater part as a TA, and managed to orient my research into the field of embedded deep learning. Before finishing my studies, I received a permanent job offer from Next Kraftwerke GmbH. I currently work there as a data scientist. Besides that, I am continuing my research with the support of Professor Hochgeschwender and Deebul Nair. I think that to stay current, I should not leave the academic environment.

List of employers of MAS Alumni *(Business):*
Ableton, Aeolus Robotics, Amazon, anessa, ANYbotics, ASIMOV Robotics, Banksoft, BitTwister Informationstechnik GmbH, BMW, Boston Consulting Group, Boston Dynamics, Cerence GmbH, Cerence Inc., CHRONEXT, cyber:con GmbH, Delphi, Wuppertal, DEUTA-WERKE GmbH, Elektrobit, ETAS GmbH, Exciera Technologies, Extor GmbH, Faro GmbH, Stuttgart, Fetch Robotics, Gade Autonomous Systems Private Limited, Google/Alphabet, GPS, IBM, Informatica, Ingen Robotics, Ingen Robotics, India, inmation Software, KBR/NASA , KELO Robotics GmbH, Kuka Roboter GmbH, LMX, Locomotec GmbH, Lucid Motors, M2P Consulting, Magazino, MeasX, M-Files Corporation, NTT Data, Nuance Communications, Rapyuta Robotics, RBOT, Recogizer, Rethink Robotics GmbH, Rfrnz Gmbh , Robert Bosch GmbH, RoBoTec PTC GmbH, Robots Alive Consulting, Shadow Robot Company, Siemens, Systemantics India, TBA Group, The MathWorks, TomTom, Trivago, Düsseldorf, vantago GmbH, VMware, xIndustry AI

List of employers of MAS Alumni *(Universities & Research):*
Hochschule Bonn-Rhein-Sieg – Autonomous Systems Group – Graduate Institute, DFKI, DLR, FAST-NUCES, Fraunhofer FKIE, Fraunhofer IAIS, Fraunhofer SCAI, Freie Universität Berlin, Heriot-Watt University, Institut für Sicherheitsforschung, Instituto Superior Técnico (IST) – Universidade de Lisboa, Jacobs University, KU Leuven, LAAS-CNRS, National University of Computer and Emerging Sciences, Norwegian University of Life Sciences, Örebro University, Osnabrück University, Rhine-Waal University of Applied Sciences, RWTH Aachen, TU Delft, TU Wien, TUBITAK-UZAY Space Technologies Research Institute, TUBITAK-UZAY Space Technologies Research Institute, Universidad Anáhuac Mayab in Mérida, University Jaume I, University of Bielefeld, University of Bonn, University of Hertfordshire, University of Western Australia, Vienna University of Technology

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 35,000 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 4,500 students from foreign countries are enrolled in Bonn. Their presence underlines the international character of the university and enriches both academic and social life in Bonn. Living up to its long tradition as a classical university with a full range of academic disciplines, the University of Bonn offers 200 different subjects and degrees. In 2019, the University of Bonn was elected as one of the 11 "elite universities" within the German excellence program, after having already received the record number of six "Excellence Cluster" grants in 2018.

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 47,200 students. RWTH offers 150 courses of study (undergraduate and postgraduate). The RWTH master programs educate engineers who are keen to engage in R & D, innovation, and entrepreneurship. Since 2007, RWTH Aachen was elected and re-elected three times as one of the "elite universities" within the German excellence program. In the current Times Higher Education Ranking, RWTH Aachen University is placed 165th among the several thousand evaluated universities.

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 600 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

For about 40 years, the Fraunhofer Institute of Applied Information Technology Fraunhofer FIT has been conducting R&D on user-friendly smart solutions that blend seamlessly in business processes. Fraunhofer FIT is your partner of choice for digitization, Industry 4.0 projects and IoT solutions. In Life Science Informatics the institute focuses on image-based navigation systems, information-intensive optical instruments, visual information analysis, multi-parametric molecular sensor technology and diagnostics as well as bio-analogue analysis of changing images. 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 combines know-how in mathematical and computational methods, with a focus on the development of innovative algorithms and their take-up in industrial practice – bringing benefits for customers and partners.

SCAI's research fields in Computational Science include machine learning and data analysis, optimization, multiphysics, energy network evaluation, virtual material design, multiscale methods, high performance computing, and computational finance.

SCAI's department of Bioinformatics offers its customers comprehensive services in information extraction (text mining) from the scientific literature and real world data sources such as electronic patient records (EHRs). Major applications of the team are the creation of a new knowledge space with analysis tools and information about COVID-19 (covid19-knowledgespace.de) as well as modeling and mining in the context of neurodegenerative diseases like Alzheimer's or Parkinson's disease. Collaborative research and development projects deliver solutions to the pharmaceutical industry, the biotech industry and to the life science software industry. The department of Bioinformatics also takes part in the education of students of the Life Science Informatics curriculum of the b-it.

Birlinghoven Castle campus: One of its strategic goals is helping to shape the development of 5G applications and their ecosystems for SMEs. Companies can use our 5G campus network that implements the latest network standards to test the viability of innovative services based on 5G functionality before wider roll-out of 5G technology. We work closely with our clients in the iterative processes of developing and testing 5G infrastructures. The application fields we focus on include production and remote maintenance, BIM processes in construction, mobile edge computing, the Internet of Things, and mixed reality.

b-it Applied Science Institute

Hochschule Bonn-Rhein-Sieg

Founded in 1995, the Hochschule Bonn-Rhein-Sieg 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 2021, the different departments accommodate more than 9,500 students.

The Department of Computer Science offers a bachelor's in computer science, another in Cybersecurity and, in cooperation with the Departments of Business Administration, a bachelor's program in Business Information Systems. At the graduate level, the department offers a master's in Computer Science and another in Visual Computing and Game Development. The master's program in 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.

Fraunhofer IAIS

As part of the largest organization for application-oriented research in Europe, the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS is one of the leading scientific institutes in the fields of Artificial Intelligence, Machine Learning and Big Data in Germany and Europe. With its approximately 300 employees, the institute supports companies in the optimization of products, services, processes and structures as well as in the development of new digital business models. Fraunhofer IAIS thus shapes

Hochschule Bonn-Rhein-Sieg.

the digital transformation of our working and living environment.

Fraunhofer IAIS is at the center of a strong research network. Since 2014, the Fraunhofer IAIS has been coordinating the Fraunhofer Big Data and Artificial Intelligence Alliance, which bundles the cross-sector expertise of more than 30 Fraunhofer Institutes in the fields of Big Data and Artificial Intelligence. It is also an important driver of the International Data Space initiative with more than 100 participating companies and organizations, which aims to create a secure data space that enables companies of all sizes and from different industries to manage their data assets confidently. In addition, there are long-standing close cooperations in research and teaching with the Excellence University of Bonn.

In 2018, Fraunhofer IAIS further expanded its strategic network and plays a leading role in important initiatives at state, federal and EU level. Fraunhofer IAIS is heading the Competence Platform for Artificial Intelligence in North Rhine-Westphalia KI.NRW. Together with the University of Bonn, TU Dortmund, and Fraunhofer IML, Fraunhofer IAIS is a leading partner of the Competence Center Machine Learning Rhine-Ruhr (ML2R) – one of four nationwide nodes for cutting-edge research and transfer in machine learning. At European level, Fraunhofer IAIS plays a leading role within the initiative "A European AI On-Demand Platform and Ecosystem" (AI4EU).

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. Depending on the particular b-it program, a proficiency level of B2 or B2+, per the Common European Framework of Reference for Languages, is required.
- 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

Semester fees of around 300 € 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 has 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.