

**b-it**

Bonn-Aachen  
International Center for  
Information Technology

Annual Report  
**2023**

## Foreword by the Chair of the b-it Foundation



**Gonca Türkeli-Dehnert**  
*State Secretary at the  
Ministry of Culture  
and Science of the  
German State of North  
Rhine-Westphalia.*

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The advent of ChatGPT was a signal to the world capturing the capabilities of artificial intelligence. Such innovations underscore the role that institutions like b-it play in today's rapidly changing technological landscape. A particular success of b-it is the transition of the competence center ML2R to the Lamarr-Institute for Machine Learning and Artificial Intelligence.

The Bonn Aachen Institute of Technology (b-it) stands out for cultivating the next generation of researchers, scientists, and technologists. In an era marked by an ongoing labor shortage in Germany, particularly within the ICT sector, the challenge is not only to educate but also to retain talent. b-it's approach goes beyond conventional education; by fostering a deep connection between students and the region, it strategically positions the North Rhine-Westphalia area as a hub for innovation and expertise. The accomplishments of b-it's students and staff speak volumes about the institution's caliber.

Prof. Dr. Thomas Schultz, in collaboration with Dr. Theodor Rüber from the Clinic and Polyclinic for Epileptology at the University Hospital Bonn, has been honored with the inaugural "Modelling for Life and Health" Transdisciplinary Research Prize, a testament to the fusion of diverse research areas to address pressing health challenges. In addition, two b-it students won first and second place in the AFCEA Study Award this year. Our Founding Director, Prof. Dr. Matthias Jarke, has been re-elected for a second term as Chairman of the Board of TH Köln, underscoring his enduring influence in shaping the academic landscape of the region. The b-it-bots@Work team has won the RoboCup@Work competition at RoboCup 2023.

Beyond these achievements, b-it has been a nexus for stimulating discourse and knowledge exchange. The recent "AI in the Life Sciences" symposium, commemorating the 20th anniversary of the Life Science Informatics curriculum, brought together industry stalwarts and alumni in leading roles, fostering a bridge between academia and the corporate world. Additionally, our presence at the Web3 Convention in Hürth, centered around the future of the internet, stands as a testament to b-it's commitment to staying at the forefront of technological evolution.

I am also delighted to welcome new faculty members who are set to enrich our academic landscape: Lucie Flek is helping the Data Science and Language Technologies group, while Rafet Sifa is leading the Applied Machine Learning Lab. Both are now Professors at the University of Bonn. I especially say thanks for Prof. Dr. Nico Hochgeschwender, who served as a director of b-it and is continuing his career at the University of Bremen, and welcome Prof. Dr. Alda as a new Director of b-it.

As we look ahead, I am confident that b-it will continue its trajectory of excellence, pioneering research, and unwavering commitment to the broader community. Once again, I would like to thank the b-it directors, study program coordinators, faculty, staff, and the b-it students for their contributions to this outstanding success.

Gonca Türkeli-Dehnert  
State Secretary, Ministry of Culture and  
Science NRW  
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.

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RWTH Aachen University, Fraunhofer FIT

*Prof. Dr. Sascha Alda*

Hochschule Bonn-Rhein-Sieg

*Prof. Dr. Stefan Wrobel*

University of Bonn, Fraunhofer IAIS

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## Report by the Scientific Directors

Just as ChatGPT has brought to light the capabilities of AI, b-it is proud to have played a pivotal role in establishing the Lamarr-Institute. The widespread integration of AI in society is anticipated to effect profound societal transformations. We take pride in the fact that data science and AI form one of the foundational pillars of b-it's education and research. This places b-it in an advantageous position to address the imminent challenges presented by these advancements.

In collaboration with the University of Bonn, RWTH Aachen University, Bonn-Rhein-Sieg University, and Fraunhofer, b-it consolidates the educational and research prowess of the region. The state of North-Rhine Westphalia deserves commendation for its visionary approach, having championed and supported b-it for over two decades.

Throughout its journey, b-it has not only fostered the professional growth of its professors but has also been a magnet for new talent. For instance, Prof. Dr. Nico Hochgeschwender was recently recognized with a full Professorship for Software Engineering for Cognitive Robots and Systems at the University of Bremen. Prof. Dr. Sascha Alda has become a part of our directorial team. We're also pleased to announce that Prof. Dr. Lucie Flek has joined b-it, heading the Data Science and Language Technologies group. Additionally, Prof. Dr. Rafet Sifa is leading the Applied Machine Learning Lab. Dr. Britta Essing from Fraunhofer FIT received an honorary professorship at Bonn-Rhein-Sieg University.

The enduring success of b-it can be attributed to the unwavering dedication and enthusiasm of its staff and students.

In this report, you will discover highlights of b-it's research and teaching from the past academic year, along with insights into the b-it study programs. We hope you find the read enlightening!

### Stefan Decker

RWTH Aachen University and Fraunhofer FIT

### Prof. Dr. Sascha Alda

Hochschule Bonn-Rhein-Sieg

### Stefan Wrobel

University of Bonn and Fraunhofer IAIS



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



**Prof. Dr. Sascha Alda**  
Hochschule Bonn-Rhein-Sieg



**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.

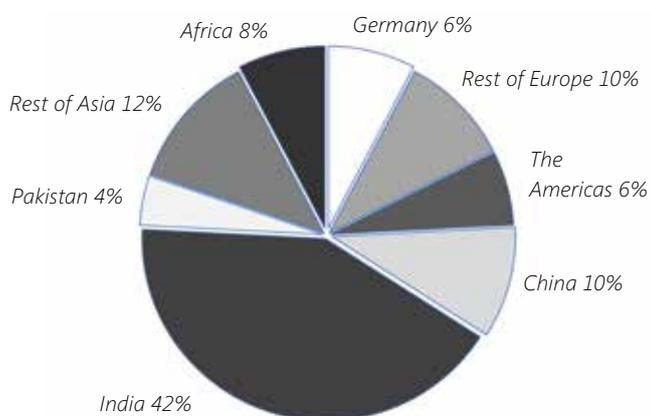
b-it offers highly selective international master's programs in Applied IT, as well as summer / winter schools for qualified undergraduate computer science students. The b-it Research School offers doctoral training. Since 2018, most courses take place in the newly erected b-it building on the Poppelsdorf 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



Prof. Plöger with the award winners Ahmed Faisal Abdelrahman and Sushant Vijay Chavan.

## 1st and 2nd place at AFCEA Study Award 2023

Two students from the MAS program won first and second place in the study award of the User Forum for Telecommunications, Computers, Electronics and Automation (AFCEA) this year. Ahmed Faisal Abdelrahman was the winner of the entire competition with his master's thesis "A Neuromorphic Approach to Obstacle Avoidance in Robot Manipulation". Sushant Vijay Chavan won second place with his Master's thesis "Coins Map – Composible ontology based indoor semantic map".

## Transdisciplinary research prize for b-it Professor Thomas Schultz

Professor Thomas Schultz (Visualization and Medical Image Analysis Group at b-it and Institute of Computer Science) and Priv.-Doz. Dr. Theodor Rüber from the Clinic and Polyclinic for Epileptology at the University Hospital Bonn are the first winners of the "Modelling for Life and Health" Transdisciplinary Research Prize, which is presented by the Modelling and Life & Health Transdisciplinary Research Areas (TRAs) at the University of Bonn. The €120,000 award funds

highly innovative research projects at the interface between mathematics or computer science on the one hand and the topics covered by the TRA Life & Health on the other. They will use the prize money to work on improved approaches to diagnosis prior to epilepsy surgery.

Life Science Informatics graduate Justus Bisten will carry out his PhD in this project. He completed his excellent master thesis in the LSI program in the group of Professor Thomas Schultz (b-it and Visualization and Medical Image Analysis Group, University of Bonn).



Professor Thomas Schultz.

## b-it Founding Director Matthias Jarke re-elected for a second period as Chairman of the Board of TH Köln

On March 15, 2023, NRW Minister of Culture and Science Ina Brandes reappointed Professor Matthias Jarke to the Board of Governors (Hochschulrat) of Cologne University of Applied Technology Arts, and Sciences (TH Köln) for the period 2023-2028. The newly appointed board re-elected him for a second period as Chairman of the Board.



Justus Bisten.

## Best paper award at the RoSE 2023 Workshop

At the recent International Workshop on Robotics Software Engineering (RoSE), which was co-located with the IEEE/ACM International Conference on Software Engineering (ICSE), Minh Nguyen, Prof. Hochgeschwender, and Prof. Wrede (Bielefeld University) presented a paper with the title "An analysis of behaviour-driven requirement specification for robotic competitions." For this work, they were awarded a best paper award at the workshop!



Prof. Dr. Matthias Jarke.

# Events and Visits



*Prof. Dr. Mihaela van der Schaar, Cambridge Centre of AI in Medicine University, University of Cambridge, UK*

of them are now in leading positions in the biotechnology- and pharmaceutical industries.

The 20th anniversary of the Life Science Informatics (LSI) curriculum at b-it prompted us to organize an industry symposium with top-ranking keynote speakers (from both, academic and industrial research) and alumni of our LSI curriculum and collaboration partners who are now in leading positions in industrial research.



*Prof. Dr. Dr. h. c. Michael Hoch, Rector of the University of Bonn.*

## Major translational event: AI in the Life Sciences – an industry symposium

When the b-it was founded, the mission was clear: b-it was supposed to focus on translational research that should address and solve problems in the biotechnology, the medical technology, and the pharmaceutical industry. The resulting University of Bonn educational programs included the international Life Science Informatics (LSI) Master program and the doctoral program Computational Life Sciences (CLS), both of which were conceptualized and founded at the b-it and continue to be administered there.



*Dr. Bryn Roberts, Roche Pharma.*

From the beginning, b-it groups (headed by Professor Jürgen Bajorath, Professor Hofmann-Apitius and Professor Holger Fröhlich) involved in the LSI/CLS curriculum were very successful in collaborating with the commercial sector. Most importantly, our Master and PhD students got involved in industrial research projects early-on. Considerable funding directly from the pharmaceutical and biotechnology industry has helped to grow the LSI research groups. Some of our students have taken the route into leading academic research institutions, but an even larger number has joined industrial research and quite a number

The organizers also invited major stakeholders of the b-it and the LSI curriculum in particular. From the political arena we convinced former State Secretary Thomas Sattelberger to talk about innovation and AI; and the Rector of the University of Bonn, Prof. Michael Hoch, was sharing his notion of the central role the Life Science Informatics curriculum plays in the University of Bonn for all Life-Science – related AI & Data Science.

Presenters of the scientific program included (among others) Professor Mihaela van der Schaar (Cambridge University, UK), Dr. Bryn Roberts (Roche Pharma) and research scientists from nearly all major pharma companies as well as two medium sized pharma/biotech companies from Germany who are world leaders in their respective fields (hidden champions). Most recent topics from the fields of Chemical and Pharmaceutical Data Science were discussed in the symposium. This nicely shows that the Life Science Informatics staff managed to build a lighthouse of science in the field of Life Science Informatics and Medical and Pharmaceutical Data Science as requested at the foundation of b-it and at the inception of the Life Science Informatics program.



*b-it Alumni Dr. Shweta Bagewadi-Kawalia, BASF.*



## **b-it-bots win RoboCup@Work world championship title at RoboCup 2023**

Our b-it-bots@Work team has done it again – the team has won the RoboCup@Work competition at RoboCup 2023 in Bordeaux, France! This is the second world championship title for the b-it-bots in the @Work league, after winning the first title at RoboCup 2019 in Sydney. The following members participated in the competition: Kevin Patel (team leader), Gokul Chenchani, Ravisankar Selvaraju, Shubham Shinde, Vamsi Kalagaturu, Vivek Mannava, and Santosh Thoduka. They were supported by others who did not attend the competition, including Sathwik Panchangam, Kishan Sawant, Hamsa Datta Perur, Chaitanya Gumudala, Deebul Nair, and Mohammad Wasil. Congratulations to our world champions!

## **Successful performance by the b-it-bots at the ERL Smart City Competition 2023**

At the ERL Smart City competition, which took place between September 18th-21st in Milton Keynes, UK, our b-it-bots@Home team had a very successful performance with our robot Lucy and brings back multiple trophies as a result! The team won the challenges “Through the Door” and “Socially Acceptable Item Delivery”. As a result of the victories in these challenges, the team also won a joint best team trophy, shared with the team LASR from King’s College London, UK.



## **Web3 Convention at Blockchain Reallabor**

On September 6, 2023, the Blockchain Reallabor of Fraunhofer FIT invited to this year’s Web3 Convention in Hürth. Numerous presentations and workshops focused on the central topics concerning the future of the Internet. Mona Neubaur, Minister for Economy, Industry, Climate Protection and Energy of North Rhine-Westphalia opened the event with a video message. At the Web3 Convention, numerous people attended, both privately and in business, to deepen their knowledge of Web3 in workshops, to exchange ideas with like-minded people and to make valuable new contacts. Renowned experts gave presentations on how companies are already benefiting from Web3. During the presentations, audience members were able to participate interactively and, for example, receive their own NFT.

Telekom presented its Web3 strategy, the transition to Society 5.0 was discussed from the international side, and the Ethereum Foundation presented its future plans for more sustainability through lower energy consumption. There were also contributions on the regulation and tracking of crypto exchanges as well as on NFTs and their application for new business models.

*Prof. Wolfgang Prinz, head of the Blockchain Reallabor and deputy director of the Fraunhofer Institute for Applied Information Technology FIT.*

# Research @ b-it



Professor Sascha Alda.

## Professor Sascha Alda becomes Scientific Director at b-it

Professor Sascha Alda becomes new Scientific Director on the part of the Hochschule Bonn-Rhein-Sieg (H-BRS) and succeeds Professor Nico Hochgeschwender, who is leaving the university. Alda is currently Dean of the Department of Computer Science at the H-BRS and is the fourth Scientific Director of b-it from the ranks of the Department of Computer Science. Prof. Dr Kurt Ulrich Witt, one of the founding directors of b-it, was succeeded by Prof. Dr Paul Plöger in 2016, followed by Prof. Dr Nico Hochgeschwender in 2022, who will leave the university in September 2023. A suitable successor has been found in Professor Alda, who was a lecturer at b-it in the field of software engineering from 2005 to 2006 and is already well networked as a result. His aim is to shape the digital transformation in exchange with business and society and to focus on data science and its application areas media, life sciences and autonomous systems.



Professor Lucie Flek.

## We welcome Lucie Flek and Rafet Sifa as new professors at b-it

Lucie Flek is a Full Professor at the University of Bonn, Department of Computer Science, leading the Data Science and Language Technologies group. Her main interests lie in machine learning research for Natural Language Processing (NLP), including AI robustness and safety. The application areas range from conversational systems and large language models, across clinical NLP and mental health research, to misinformation detection and social media analyses. Her teaching strives to make AI more inclusive, organizing e.g. coding summer schools "Women for Women" and cross-disciplinary seminars such as AI Ethics or Computational Social Science. Previously, Professor Flek has been active both in academia and industry – managing natural language understanding



Professor Rafet Sifa.



November 7th, 2022: (from left) University President Hartmut Ihne appointed Britta Essing in the presence of Professor Stefan Decker (Director, Fraunhofer FIT) and Professor Dirk Schreiber (Director, Institute of Management).

research programs in Amazon Alexa and contributing to the Google Shopping Search launch in Europe. In her academic work at TU Darmstadt, University of Pennsylvania, and University College London, she has worked on user modeling in AI systems and incorporating expert semantic resources into ML models.

Lead by Prof. Dr. Rafet Sifa, the Applied Machine Learning Lab focuses on addressing the challenges involved in implementing machine learning models in real-world settings while developing novel methods for pattern analysis and representation learning. The lab's primary area of investigation is based on constructing hybrid, interpretable and resource aware learning systems with practical applications in text mining, behavioral analytics and medical informatics. Additionally to his position at b-it as professor for Applied Machine Learning Dr. Sifa is head of the Media Engineering Department at Fraunhofer IAIS. Rafet Sifa received his Bachelor in Computer Engineering from the Middle East Technical University in Ankara, Turkey, and his Master in Computer Science and his PhD at the University of Bonn.

## Britta Essing new honorary professor at the Institute of Management of Hochschule Bonn-Rhein-Sieg

A 50-year-old song sums up quite well what Prof. Britta Essing believes is important, which is why she has already opened a lecture with music. In the dystopia "In the Year 2525", the duo Zager and Evans address the progressive dependence of people on technology. Essing pursues the opposite approach and deals with the human-centered design of technology – as head of Human-Centered Engineering & Design department at the Fraunhofer FIT and in also as honorary professor at the Hochschule Bonn-Rhein-Sieg. Essing studied psychology and computer science at the University of Bonn, a very unusual combination in the 1990s. She earned her doctorate at the University of Cologne with a topic on the transfer-friendly design of further occupational training.

## Professor Teena Chakkalayil Hassan has taken over the leadership of the Institute for Artificial Intelligence and Autonomous Systems (A2S) at H-BRS

The A2S Institute bundles research, transfer and teaching at the Hochschule Bonn-Rhein-Sieg (H-BRS) on the topics of AI and autonomous systems. Hassan follows in the footsteps of the outgoing chairman Prof. Dr. Nico Hochgeschwender and will advance the areas of human-robot interaction, hospital logistics, AI for healthcare and environment perception through machine learning. She completed her Master's degree in Autonomous Systems in 2014 with an excellent Master's thesis on "Dynamic facial expression estimation by means of model fitting" in the Department of Computer Science at the H-BRS and then began her professional career. She made stops at the Fraunhofer Institute, at the University of Bielefeld and then at the University of Bamberg for her doctorate. From there, she went on to University of Bremen and

then returned to the H-BRS as a professor for "Mathematical Foundations of Autonomous Systems".

The goal is to strengthen and accelerate AI and robotics in research and transfer at the institute. To achieve this, Hassan and her team rely on the internal network of the university involving various stakeholders and interested parties as well as the involvement of external experts from industry and academia. As one of the Institute's core values, Hassan wants to promote not only the scientific-technical but also the human-related aspects in AI and robotics.

## Successful performance by the b-it-bots at the ERL Smart City Competition 2023

At the ERL Smart City competition, which took place between September 18th-21st in Milton Keynes, UK, our b-it-bots@Home team had a very successful performance with our robot Lucy and brings back multiple trophies as a result! The team won the following challenges at the competition: "Through the Door", during which the robot had to open a hinged door and move through it. And, "Socially Acceptable Item Delivery", where the objective of the robot was to bring an item to a person. As a result of the victories in these challenges, the team also won a joint best team trophy, shared with the team LASR from King's College London, UK.

## Congratulations to Xuanshi Liu

Xuanshi Liu graduated from the Master's Program in Life Science Informatics in 2011 and received her PhD in 2015 from the University of Leipzig. She became a research fellow at Boston Children's Hospital and then a post-doctoral fellow at Harvard Medical School. In 2018, she joined the Beijing Children Hospital as scientific researcher. In 2022, she became associate professor at the Beijing Children Hospital. b-it directors and staff congratulate Professor Xuanshi Liu on her professorial position.



*The Autonomous Systems Group was joined by a new professor on March 1st, 2023: Prof. Teena Hassan.*



*b-it-bots at the ERL Smart City Competition 2023.*



*Xuanshi Liu.*



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 Univer-  
sity of Ireland Maynooth, National  
University of Sciences and Technolo-  
gy, Research Center Jülich, Robert  
Bosch Foundation, RWTH Aachen,  
Suez Canal University, Swiss Federal  
Institute of Technology, Uniklinik  
Aachen, Uniklinikum Bonn, Uni-  
versidad Tecnológica de Panama,  
Universitätsspital Basel, University  
Clinic Carl Gustav Carus; Universi-  
ties of Agder, Arab American Jenin,  
Asia and the Pacific, Atma Jaya Yo-  
gyakarta, Augsburg, Bahria, Bonn,  
Cambridge, Düsseldorf-Essen, Dres-  
den, Duisburg-Essen, Edinburgh,  
Engineering & Technology Peshawar  
Pakistan, Ghent, Göttingen, Ham-  
burg, 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.

A total of 13 Media Informatics students have completed their master's degrees in the academic year of 2022-2023. The graduates quickly found interesting positions either as doctoral students in German or foreign universities / institutes or in top IT companies. The incoming class of 2023 comprises 20 students selected from 166 applications from 8 different countries, where 50% of students are females and 50% are males.



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## Deployment of AgriVoltaic for a Sustainable Transition towards Renewable Energies

The development of renewable energy resources is a pivotal challenge for society and economies. Solar radiation and wind are attractive sources for producing renewable energies inside Germany in first place. However, differences of economic attraction for investments in photovoltaic panels versus wind turbines are pretty evident across Germany. The North and South unveil different attractivity levels with regard to production effectivity, while East and West show differences in economic efficiency.

These studies have been part of Lab Courses and Thesis Work by the department of Microsimulation and Econometric Data Analysis headed by Thomas Rose.

The question arises, what are the driving forces for promoting the use of photovoltaics (PV). PV is certainly a highly attractive means for changing energy consumption towards sustainability. Studies provide scientific evidence that only 4% of agricultural areas inside Germany would be sufficient to produce sufficient levels of energies with PV for Germany. However, an economic separation (or discrimination) of agricultural use versus use of farmland for energy production

with PV facilities is critical. Use of land for PVs might appear more attractive in a revenue-based perspective, but societal barriers might push a different story.

Our focus has been on the utilization of means for data analytics to explore the economic potential of dual land use: agricultural use as well as the production of renewable energies. Positive impacts on water management will be ignored for the moment. Taxation-based incentives (such as Gewerbesteuerhebesätze in German) have not proven as silver bullet. AgriVoltaic (AV) open a new window of opportunities: dual use of farmland. On the one hand, farmland will be maintained for agricultural use generating societal acceptance. On the other hand, land can be used for the installation of PV once appropriate designs for stands are in place.

We have recently developed a decision tree-based tool, that supports farmers in their economic considerations for investment in AV. One crucial criterion is the farming efficiency with regard to economic yield: some growths benefit from sunlight and weather protection while others suffer from protective shields. Soil conditions have to be considered additionally. Hence, the decision process is not merely based on taxation rules and economies of scale.

### 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, Bertrand 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, Neuro-Sky, 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, Recognizer Group, Recommend, 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, Tessler, 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-  
Aptius, Life Science Informatics

#### List of employers of LSI Alumni

(Business): @Wise (Estonia), 3B Pharmaceuticals, 4GATC Biotech, AbbVie, Accenture, Accura Gen, Alcimed, Aldi Süd, Arber GmbH, ARBERN L.L.C-FZ, Asahi Kasei, ASI Data Science, Astra Seneca, atai Life Sciences AG, BASF SE, Bayer, Bayer Monsanto, BenevolentAI, bigspark, BiosolveIT, blue BEYOND GmbH, Boehringer Ingelheim, Bristol Myers Squibb, carpooling.com GmbH, Centene Corporation, Centogene, Clade Therapeutics, Clariant, Clue Points, Coca Cola HBC, Comma Soft AG, Comuny GmbH, ConfigCar GmbH, Coty Germany, Curetis, Dairy Data Warehouse, Dassault Systèmes, Deutsche Post, DFind Science and Engineering, DHL, Diapharm, DuPont, eSeq Bioinformatics, Edelweiss Connect, Enhanc3d Genomics Ltd, Ennovation VC, Enveda Biosciences, epitome GmbH, Ericsson, Esprit, ESSEC & MANNHEIM EXECUTIVE EMBA, Evotec, Fast Focus BV, Finsbury Glover Hering, Freeletic, Fresenius Kabi, F-Star Therapeutics Inc., G42, Galileo Press, GAMOMAT Development GmbH, Gamomat GmbH, GATC Biotech, Generali Deutschland AG, Genestack, Genome Biologics, Germany Market Vector Indexes, Germany Smart4Diagnostics, Glaxo Smith Kline, Glover Hering, Hamilton Medical, Health-Care Global, Hearts & Science, Heraeus, Hoffmann-La Roche, Hype Innovation, IBM, IIT Bangalore, Interpretomics, IQVIA, ITTM S.A., Johnson & Johnson, KWP Inside HR, LabVantage Solutions Inc., Land O'Lakes Inc., Lead Berlin, Lead Discovery Center, Leaf Bioscience, LHS Telecommunications, LinkTechnica, L'Oréal, Lufthansa Cargo, MackKinsey, MarAnCon, Mastercard AG, Max Dellbrück Center Berlin, MBiton, McKinsey, Mediengruppe RTL, Medsciences Biotech, Medtronic, Merck, Micro biolytics, Miltenyi Biotec, Mimacom Flowable, Molecular Connections Private Limited, Molecular Devices, Molecular Health GmbH, Monsanto, msg systems ag, Nestlé Institute of Health Science, Netceera Software matters, Novartis, Novo Nordisk, numa, Nuvisan ICB GmbH, Octapharma, ok future, Omnicom Media Group, parlamind GmbH, Perkin Elmer Inc., Pfizer, Philips Research North America, Phillips, Postbank, PQE Group, ProfileXpert, Protagen AG, Publicis Group, quintly Inc., Rancho BioSciences, real.digital, Recognizer, Rewe, REWE Digital, Revvity Signals, Roche, RTL, SAATHII, Schlumberger, ScieX, Seasoon Information Technology, Siemens Digital Industries Software, Smart-4Diagnostics GmbH, SOPHIA GENETICS, Statista, StepStone, SumUp, Syneos Health, Synchrotron Ltd., Syngene Ltd., Synthego Corporation, The Janssens Pharmaceutical Company, Tubs System LLP, UAE Omnicom, UBS, Union Chimique Belge (UCB Pharma), United Brands Marketing, Zerogravity

#### b-it Programs

## 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, pharmaceuticals and computer science. The curriculum consists of three main blocks: Computer Science and Mathematics for life scientists; Basic principles of Life Science Informatics; Biology of the cell and systems biology.

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

that bioinformatics can offer. The program is characterized by a significant share of research lab courses embedded in both basic and applied research of the participating Fraunhofer Institutes 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 more than 320 students applied to the Master program of Life Science Informatics (2022: 230 applications). Twenty nine students started their studies in this program in October 2023.

## LSI Success Stories

### ASTGHİK SARGSYAN



We have presented Astghik the b-it annual report of 2020. She joined the LSI program from Armenia with a medical condition. Therefore, she had to take studies at her pace. In the meantime, she has,

despite the medical condition, managed to publish 5 research papers and most of them as first author in research journals before her master thesis. Her first publication – during the COVID pandemic, where she was the main driving force to develop a COVID ontology, appeared in a highly reputed Bioninformatics journal. Astghik was the driving force behind the COVID-19 ontology work which was not only her first paper but also a first author paper for her. Her medical condition has improved significantly and she is meanwhile the mother of two children. A 6th publication is expected after completion of her Master thesis. Now, she is finalizing her thesis work. She is an inspiration of the entire LSI staff and all students in her dedication to science, to research and to life. b-it Professor Hofmann-Apitius, whose group she has joined and where is currently carrying out her thesis work, states about Astghik: "Here at b-it, she is a prime example of what you can achieve in the right environment."

### DANQI WANG



Danqi joined the LSI program in 2020. Before coming to b-it, she graduated with a Master's degree from Tsinghua University in Beijing, China. In 2022,

she joined Fraunhofer SCAI in the group of Professor Holger Fröhlich where she carried out her Master thesis. During this time, she also worked in the Franco-German research project AIOLOS (Artificial Intelligence Tools for Outbreak Detection and Response) on

the construction of ALERT models for the COVID 19 pandemic. After the completion of the Master thesis and her graduation from the program in April 2023, she joined Professor Fröhlich's group until July 2023 as a Data Scientist to work on the construction of MONITOR models for COVID-19 pandemic with the use of NPI (Non Pharmacological Interventions) related tweets.

### SANJANA SRINIVASAN



Sanjana Srinivasan is now a LSI program graduate, completing the program with an excellent master thesis. She also participated in the 20 anniversaries celebrations of b-it last year as a student member

with her presentation "Influence of feature weight correlation in potency prediction of multi-target machine learning models". Now, as a graduate, Sanjana joined the group of Professor Jürgen Bajorath as PhD student where she will continue her academic education. In the context of her training as a PhD student, Sanjana will additionally work as a tutor in the field of visualization and analysis of medical imaging within the LSI program where she will teach current LSI students.

### ELENA XERXA

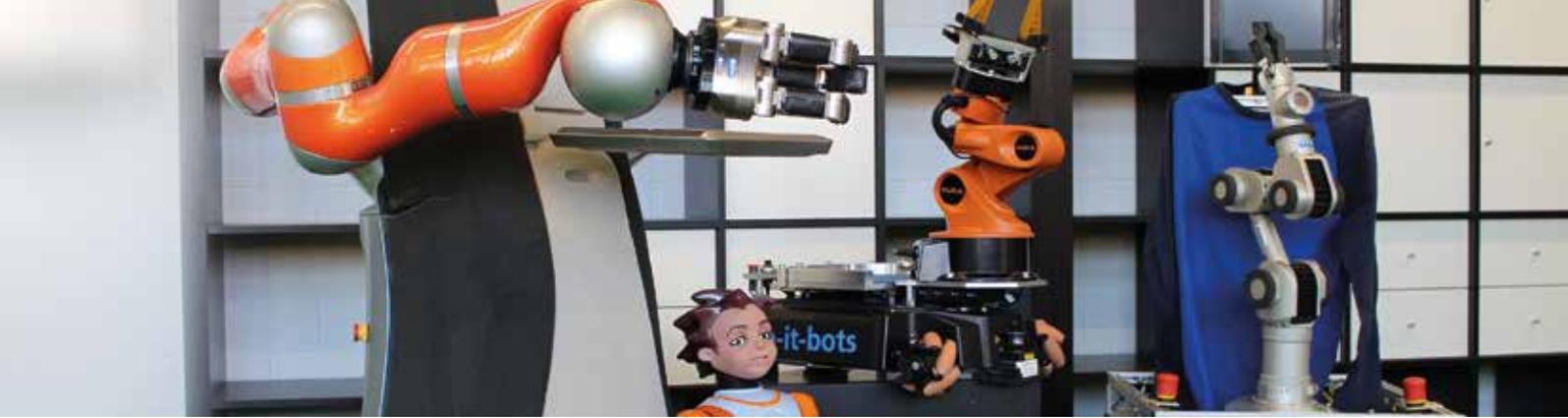


Elena obtained her PhD in Functional and Structural Genomics at the International School of Advanced Studies (SISSA) in Trieste, Italy. Subsequently, she worked as postdoctoral

fellow at the International Centre of Genetic Engineering (Trieste, Italy). Beside her interest in biology, during her research experience she matured a growing interest in computational biology and decided to join the Life Science Informatics Master program in 2020. She carried out her Master thesis project at Professor Bajorath's group, which was completed in April 2023. Now she works in the same lab as a Research Fellow.

## 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, Centre for Molecular and Biomolecular Informatics (CMBI), Centro Nacional de Investigaciones Cardiovasculares, Centre for Molecular and Biomolecular Informatics (CMBI), Charité Berlin, Children's Cancer Research Hospital, Christian-Albrechts-Universität Kiel, Czech National Centre for Biomolecular Research, DKFI, ELI Beamlines, European Molecular Biology Laboratory, ETH-Domain, ETH Zürich, European Bioinformatics Institute, European Bioinformatics Institute, Fraunhofer FIT, Fraunhofer IAI, Fraunhofer IME, Fraunhofer ITMP, Fraunhofer SCAI, Fundación Centro Nacional de Investigaciones Cardiovasculares, German Center for Cancer Research (DKFZ), German Center for Neurodegenerative Diseases, German Institute of Human Nutrition, Harvard Medical School, 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 Physics of the Academy of Science of the Czech Republic, Karolinska Institut, King Abdul City for Science and Technology, King Faisal Specialist Hospital and Research Center, Leibniz Information Center for Science & Technology (TIB), Leibniz Institut für Ostseeforschung, Massachusetts General Hospital, Max Planck Institute for Biophysical Chemistry, Max Planck Institute for Heart and Lung Research, Max Planck Institute for Molecular Biomedicine, Max-Planck-Institute for Molecular Genetics, Max Planck Institute for Neurobiology of Behaviour, 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 for Cognitive and Brain Science, MPI for Molecular Genetics, National Center for Advancing Translational Sciences (NCATS), National Centre for Biological Sciences, National Centre for Biomolecular Research, National University of Ireland, National Technical University of Singapore, NIH, Nuvisan Innovation Campus Berlin, Philipps, Princess Nora Bint Abdulrahman University, Radboudumc – University Clinic Centre of the University of Nijmegen, Research Center Jülich, Research Institute for Farm Animal Biology, RWTH Aachen, SCK CEN (Belgian Nuclear Research Centre), South University of Science and Technology of China, Swiss Federal Institute of Aquatic Science and Technology, The Alan Turing Institute, TRON, TU München, Twincore – Centre for Experimental and Clinical Research, University Clinic Gustav Carus Dresden, Universitätsklinikum Schleswig-Holstein, University College London (UCL), University of Nebraska Medical Center, Western University, ZBMed, and the universities of Alberta, Amsterdam, Bonn, Bern, Cambridge, Cologne, Copenhagen, Dresden, Duisburg-Essen, Düsseldorf, Edinburgh, Erlangen-Nürnberg, Ghent, Iowa, Kiel, Leipzig, Leon, Luxemburg, Macquarie, Mainz, Marburg, Münster, Netherlands, Oxford, Sheffield, Tübingen, Utrecht, Western Australia, Vienna, Wageningen, Western Ontario, Würzburg, Zürich.



b-it Programs

## 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*



*Prof. Dr.  
Teena Hassan  
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 artificial intelligence and robotics. 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 necessary for 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, machine learning, probabilistic reasoning, and human-robot interaction. 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 obtained the special ASIIN accreditation label and the Euro Inf Label from the European Quality Assurance Network for Information Education (EQANIE).

In the academic year 2022/23, 42 students joined the MAS program from an applicant pool of 586 candidates. The MAS program has always attracted the interest of students from all over the globe, as can be seen from the long list of countries from which the students have come from.

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 Jordan.

The program is managed by five professors (Nico Hochgeschwender, Paul G. Plöger, Erwin Prassler, Sebastian Houben and Teena Hassan), two research associates (Iman Awaad and Dr. Alex Mitrevski) as well as researchers who have been recruited through various projects, namely: METRICS, SESAME, MigrAVE, E2x (E-Assessment), and Robot Refurbishment. These researchers are Dr. Alex Mitrevski, Tim Metzler, Deebul Nair, Minh Nguyen, Argentina Ortega, Sven Schneider, Santosh Thoduka, Djordje Vukcevic, Mohammad Wasil, Michal Stolarz and Samuel Parra.

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, AAMAS and ICAPS.

## MAS Success Stories

### Proneet Sharma



*Reseracher, DFKI*

I currently work as a researcher at DFKI. I completed my M.Sc. in MAS in June 2023. During the time in the MAS program, my R&D

thesis on "Uncertainty Estimation in Time Series Classification" and the Bayesian Inference course captured my attention, leading me into the field of probabilistic machine learning. The focus of my master's thesis, centered around few-shot learning, further fueled my passion for this evolving field. Currently, my research centers on leveraging neurosymbolic AI and probabilistic machine learning to enhance robot vision applications. I'm committed to contributing to the advancement of robotics through these pursuits.

### Ahmed Faisal Abdelrahman



*Research Associate, Munich Institute of Robotics and Machine Intelligence (MIRMI), Technical University of Munich (TUM)*

I graduated from H-BRS in 2022 and went on to join

the MIRMI in Munich as a research associate. The MAS program was a great opportunity to contribute to applied research in robotics and machine learning. Through informative courses, participation with the b-it-bots team, and my own research projects, I gained skills that far exceeded my expectations. With the support of my mentors, I pursued research that excited me and which culminated in my first publication at an international scientific conference, demonstrating a reinforcement learning application, and my thesis on neuromorphic techniques, which has since won both the AFCEA prize as well as the university's sponsorship award. At TUM, I conduct research into safe machine learning for robot control as part of my doctorate studies.

### Deepan Chakravarthi Padmanabhan



*Deep Learning Researcher, NavInfo Europe*

After completing my M.Sc. in MAS, I began my career at NavInfo Europe. Within just 1.5 years I have progressed

to the role of Senior Machine Learning Engineer at Nike. I must credit this swift progress to the solid foundation I obtained. As someone from a foreign nation with limited coding skills but a strong interest in machine learning, MAS provided the essential skills I needed. Additionally, the opportunities for student jobs in Bonn, both in research and industry, helped me adapt to diverse work environments. The b-it-bots team allowed me to gain practical experience in addressing real-world robotics challenges. The supportive atmosphere and exceptional mentors at MAS played a crucial role in enabling me to publish two papers at prestigious international conferences.

### Alex Mitrevski



*Postdoctoral Researcher, Institute for Artificial Intelligence and Autonomous Systems, Hochschule Bonn-Rhein-Sieg*

I completed my master's degree in MAS in 2016 and then went on to do a PhD (in joint cooperation with the Knowledge-Based Systems Group at RWTH Aachen), which I completed in January 2023. In my PhD project, I developed learning-based methods for representing the robot execution process and analyzing failures should they occur. During my PhD, I had the opportunity to work with a variety of robots in the context of hospital logistics (EU project ROPOD), robot-assisted therapy for children with autism (BMBF project MigrAVE), as well as domestic robotics (RoboCup@Home). I am currently focusing on extending and generalizing the ideas from my PhD to other robots and domains.

### List of employers of MAS Alumni (Business):

Ableton, Aeolus Robotics, Inc., Agile Robots, Amazon, anessa, ANYbotics, ASIMOV Robotics, Banksoft, BitWister Informati-onstechnik GmbH, BMW, Bosch, Boston Consulting Group, Boston Dynamics, Cerence Inc., CHRO-NEXT, cyber:con GmbH, DEUTA-WERKE GmbH, Delphi, Wuppertal, Elektrobit, ETAS GmbH, Exciera Technologies, Expleo Germany GmbH, Cologne, Extor GmbH, Faro GmbH, Stuttgart, Fetch Robotics, Gade Autonomous Systems Private Limited, Google/Alphabet, GPS, IBM, Informatica, Ingen Robotics, inmation Software, Intrinsic (an Al-phabet company), idealworks, KBR/ NASA, KELO Robotics GmbH, Kuka Robotics, LMX, Locomotec GmbH, Lucid Motors, M-Files Corporation, M2P Consulting, Magazzino, MeasX, MHP Management- und IT-Bera-tung GmbH, MYBOTSHOP GmbH, NavInfo Europe, Neobotix GmbH, Next Kraftwerke GmbH, Köln, NTT Data, Nuance Communications, RabbitAI, Heidelberg, 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, Ubica Robotics, VM-ware, Wingcopter, 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, Instituto Superior Técnico (IST) – Universidade de Lisboa, Jacobs University, KU Leuven, LAAS-CNRS, National Univer-sity of Computer and Emerging Sciences, Norwegian University of Life Sciences, Orebro University, Osnabrück University, Rhine-Waal University of Applied Sciences, RWTH Aachen, TU Delft, TU Wien, TUBITAK-UZAY Space Technologies Research Institute, Universidad An-áhuac Mayab, University Jaume I, University of Bielefeld, University of Bonn, University of Groningen, Uni-versity of Hertfordshire, University of Western Australia

## 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 33,000 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 47,000 students. RWTH offers 170 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 99th 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 applying computer science to the digital transformation of society with main locations in Birlinghoven, Bayreuth and Aachen. Methodologies developed in FIT combine the two areas Human-Computer centric research and Data centric research and applying them to areas of societal importance such as Digital Energy, Digital Health, and Digital Business – with a special focus on infrastructure and applications of data spaces as an emerging corner stone of the digital society. FIT is housing the NRW Blockchain Center, the Fraunhofer W3C representation, the Fraunhofer Personnel Certification Authority, and playing a leading role in the Fraunhofer Center for Digital Energy.



*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.*

### Fraunhofer SCAI

The Fraunhofer Institute for Algorithms and Scientific Computing SCAI contributes to the Life Science Informatics curriculum at b-it through the Department of Bioinformatics at SCAI. Two professors teaching at b-it are leaders in this department: Prof. Dr. Martin Hofmann-Apitius and Prof. Dr. Holger Fröhlich. Both are experienced in translational research with a focus on scientific challenges in the pharmaceutical and biotechnology industry. Therefore, research in the department represents the entire data- and knowledge-based value chain of translational biomedical research.

Semantic technologies, including Natural Language Processing and information extraction based on Large Language Models, help to represent biological and medical knowledge in rich, disease-specific knowledge graphs. These graphs represent, e.g., neurodegenerative diseases such as Alzheimer's or Parkinson's or neuro-psychiatric diseases such as Major Depression or Schizophrenia in computable cause-and-effect models. AI and Data Science technologies are applied applications, including models for improving treatments for patients (precision medicine) and drug discovery.

SCAI involves students from the LSI curriculum early on in collaborations with industry partners. This gives students a first glimpse of industrial research.

# b-it Applied Science Institute

## Bonn-Rhein-Sieg University of Applied Sciences

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 2022, 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



*Hochschule Bonn-Rhein-Sieg.*

business models. Fraunhofer IAIS thus shapes 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](http://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](http://www.daad.de).

## Studying in Bonn

Most of the teaching in b-it is concentrated in Bonn and its eastern neighbor, Sankt Augustin. Newcomers to Bonn soon grow very fond of the city – a fact confirmed by thousands of students and academics, German and foreign, who have come here to learn, teach or research. Since the German Bundestag moved its seat and parts of the Federal Government to Berlin in 1999, Bonn 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.





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