

HITeC ANNUAL REPORT 2020

HITeC e.V. - an initiative of the Department of Computer Science
Faculty of Mathematics, Informatics and Natural Sciences
University of Hamburg

Hamburger Informatik Technologie-Center HITEC e.V.

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1. OVERVIEW

HITeC is the research and technology transfer center of the Department of Computer Science at the University of Hamburg. Due to its independent status, HITeC offers flexible and professional cooperation opportunities. HITeC solutions are based on the latest research results and provide advantages through innovative technologies.

HITeC is a registered, non-profit association supported by members of the Department of Computer Science at the University of Hamburg. The association is linked to the University of Hamburg by an agreement.

HITeC sees its main tasks in the:

-  Implementation of application-oriented research projects
-  Dissemination of application-oriented research results
-  Realization of seminars and workshops
-  Mediation of contacts between companies and students
-  Improvement of the practice-oriented education in the university
-  Support for business start-ups from the university
-  Education of students especially through including them in cooperation projects

In 2020 HITeC had five sponsoring members, these are companies and institutions that support HITeC. The number of active personal members of HITeC is more than 50.

HITeC's project volume in 2020 was approximately 1.9 Million Euro.








The following changes were made to the Executive Board in 2020: Wiebke Frauen left the Executive Board. The Executive Board and the Board of Directors thank her sincerely for the very good cooperation over the past years, in particular for the clarification of formal processes at HITeC. Dr. Lothar Hotz was elected sole Managing Director as of 2020.

HITeC conducts application-oriented research in the general field of Computer Science and research in the field of technology transfer. In contrast to basic research, application-oriented research is scientific Computer Science research whose results can be used directly in practice. On the one hand, the results of basic research are incorporated into cooperative projects; on the other hand, new questions for basic research arise through research on applications, which decisively further stimulate this research. This is a method also known as Action Research, in which scientists go into the concrete, real conditions in practice in order to gain knowledge for further basic research. In ad-

dition, this way back into basic research (which essentially takes place at the university) is a very important part of the application-oriented research at HITEC, in order to fertilize this basic research in a completely new way, so that it can later find better application-relevant results for practice.

Hence, application-oriented research at HITEC takes up the results of basic research at the Department of Computer Science and explores their possible applications in special application projects (often with partners).

Some selected projects and activities in 2020:

-  Start of the research project Future Transport Hamburg (FTH) in the field of Blockchain, which develops, applies, and tests an open freight exchange for an increased utilization of trucks.
-  Several industry projects in the areas of distributed IoT systems, digital transformation for health insurers, use of IT in chemical informatics, and development of APPs for the energy industry using new software development methods.
-  Several projects in the field of application of Artificial Intelligence methods: new workshop series in cooperation with the Artificial Intelligence Center Hamburg e.V. (ARIC), implementation of a web service for the prediction of the metabolism of active ingredients, scientific consulting service collection of spoken language data, automatic transcription of spoken language data, autonomous adaptive machines, meeting minute bot and AI consulting, RoboCup-AG - Hamburg Bit-Bots, AI systems for marketing content for the automobile industries.
-  Several projects in the field of eHumanities aiming at the dissemination, collection, presentation, and long-term archiving of cultural objects: Portal for Philosophical and Hebrew Terminology, adaptable university bibliography with MyCoRe, matriculation portal, distributed software development in heterogeneous groups.
-  Several projects in the area of Digital Transformation and Digital Literacy as well as support in the organization of the ITMC Conference at the Faculty of Computer Science with approx. 150 participants.
-  Many smaller projects, mainly with companies and research institutions from the Hamburg region.
-  Participation in a working group of the founding initiatives of all Hamburg Universities as well as cooperation with ahoi.digital, ARIC, and Hamburg Innovation.

Publications of HITEC are listed on the websites of the university of the respective professors and project collaborators. An overview of project activities provides <https://hitec-hamburg.de>.

2. PROJECTS OF HITEC

The following sections provide a brief overview of the projects implemented in 2020. A summary of the activities in the respective project area precedes these project overviews.

HITeC focuses with project areas on sub-areas of computer science, which stand out due to special activities at HITeC, e.g., in the form of cooperation projects.

In addition to the projects listed, there were a number of smaller activities that are not mentioned here.

2.1 IS - INTELLIGENT SYSTEMS

The project area "Intelligent Systems" (IS) emerged from the "Laboratory for Artificial Intelligence", in which innovative methods of Artificial Intelligence have been developed and applied in cooperation with companies since its foundation in 1988. Characteristic for the work of IS is a scientifically founded and at the same time practice-oriented approach. The rich wealth of experience ranges from expert systems, configuration and diagnosis, monitoring and event recognition as well as cognitive systems to machine learning (including deep learning and clustering), big data, knowledge discovery, image processing, and other current topics of Artificial Intelligence. IS offers the preparation of studies as well as prototype development in direct cooperation with companies. Furthermore, IS is often a partner in funded projects, especially in national and EU funding programs.

Head:



Lothar Hotz

2.1.1 Information Register - Portal for Implementation of the Transparency Law

The Hamburg Transparency Act came into force on October, 6th 2012. §1 states: "The purpose of this law is to protect the interests of the public through a comprehensive right to information. The information available to the authorities referred to in Article 2(3), while complying with the provisions of the protection of personal data, shall be made directly accessible to the public and to disseminate them in order to promote the formation of democratic opinion and wills and to monitor governance acts." Under §2 paragraph 3 almost all authorities are addressed. To implement this law, the financial authorities, HITeC, and partners designed and developed a web portal, the "Information Register" (Info-Reg). As essential functions thereby the collecting ("harvest"/"Harvesten") of existing documents and data from the authorities, the searchability from the Web portal and the machine access to the information objects are provided. This work belongs to the research areas "Open-Gov-Data" and semantic search.

In the project year 2020, HITeC supported cultural authorities, as current partner, in its further development of the portal. For this purpose, concepts for the cooperation of developer and operation teams (DevOps) at different, partly public institutions were further developed on an organizational (e.g., cooperation processes) and technical level (e.g., for the cloud infrastructure). As special research topic new deployment and test strategies were introduced in the portal project, as well as the evolution of the software architecture was continued and preliminary developments for a geographic search module were processed.

Cooperation partners



Free and Hanseatic City of Hamburg, Department of Culture and Media,
State Archives Office



Dataport AöR

Staff



Elwin Beck, Christian Bähnisch, Lothar Hotz, Malte Johannsen, Björn
Kulas, Melvyn Linke, Anja Richter, Dennis Rupnow, Yibo Wang

Link: <http://transparenz.hamburg.de/transparenzgesetz-hamburg/>

2.1.2 Document and Upload Workflow for the Hamburg Transparency Portal

Various city authorities fed documents and data into the Hamburg Transparency Portal (HmbTG Portal). The City of Hamburg is developing a new document and upload workflow for entering metadata, data, and documents. HITeC supports this development scientifically in the preparation phase of the quality assurance as well as in the use of tools and workflows. Important points were the support of the blackening process and the quality assurance for the essential planning documents.

1. Concept for the support of the HmbTG Portal's blackening process

Requirements analyses in 2018 had shown that the blackening process in the workflow of the HmbTG Portal is time-consuming for the employees of the authorities. In that time, up to 10 working hours per document are blackened manually. For the re-creation of the blackening process, the methods used were checked and requirements were met, and a concept for a semi-automatic blackening process was developed.

2. Scientific support of the project management for the implementation of the HmbTG workflow

Support of the project management with quality measures with regard to

- Quality management of all planning documents, in particular design of user stories in the backlog.
- Quality assurance for usability; including the consolidation of existing findings (Evaluation 2018 - Usability Analysis and User Survey, Yen Dieu Pham, 2018), derivation of user perspectives and anchoring of findings for project implementation.

Cooperation partners



Free and Hanseatic City of Hamburg, Department of Culture and Media, State Archives Office

Staff



Christine Issleib, Lothar Hotz

Link: Transparenzportal Hamburg: <http://transparenz.hamburg.de/>

2.1.3 3S - Schul-Support-Service for Hamburg Schools

The School Support Service is a cooperation between HITEC e.V., the Department of Informatics at the University of Hamburg and the Hamburg Authority for Schools and Education (BSB).

The goals of the cooperation are: the development of low-maintenance IT structures in Hamburg schools, the training of students, and the implementation of research activities. The common overarching goal of the cooperation partners is to develop solutions in line with the BSB's IT strategy.

Student employees relieve the teachers at the general education schools in the elimination of faults and the implementation of necessary maintenance work on the computer systems and networks used for teaching. Through their work, the students have the opportunity to gain practical experience and knowledge about professional IT support. For the schools, the project is a great support in order to be able to teach smoothly in the increasingly complex and larger networks.

3S celebrates its anniversary this year: In December 2000, the cooperation agreement between the then Authority for Education and Sports (now Authority for Schools and Vocational Training, BSB) and HITEC e.V. was signed. At that time, five students supervised 27 schools in a six-month phase with the aim of gaining experience about costs, use of support, and the nature of technical problems in schools. The response of the pilot schools to the work of 3S and the concept was so positive that the main phase could begin in the summer of 2001. In the meantime, about 35 students and research assistants employed at HITEC successfully support about 150 schools as well as new concepts for educational IT infrastructure developed and explored.

Cooperation partners



Hamburg Ministry of Education (Behörde für Schule und Berufsbildung (BSB)).



University of Hamburg (Universität Hamburg (UHH))



Hamburg University of Applied Sciences (Hochschule für Angewandte Wissenschaften (HAW))



State Institute for Teacher Training and School Development (Landesinstitut für Lehrerbildung und Schulentwicklung (LI Hamburg))

Staff



Wiebke Frauen, Marc Heydorn, Ogeigha Koroyin, Kai von Luck, Anja Richter, Arne Springborn, and others



Approximately 35 students

Link: <https://www.3s-hamburg.de/>

2.1.4 IP Address Change in Hamburg Schools

In the fall of 2018, a special campaign began that was planned together with the Authority for Schools and Vocational Training and is being successively implemented in the schools supported by the School Support Service (3S). In this action, an IP address changeover is carried out in the school networks and the changed IP infrastructure is tested in regular operation in the schools. Each school will receive its own IP range.

This changeover will provide the schools with a larger IP range for more devices in the future and prepare them for the expansion of the WLAN infrastructure that is currently underway. For 3S, the IP address changeover offers the advantage of enabling simultaneous visibility of all clients connected to the city network in the school networks. The goal is to be able to reach all school networks simultaneously from the central software distribution server. 3S will thus be able, for example, to distribute updates to all clients in the schools from the central lab, install software on a school's computers, or obtain an overview of both the inventory and the up-to-dateness of the clients. This special campaign was preceded by a test phase in the summer of 2018, during which the IP switchover was initially implemented in the 3S test lab. With approximately 20% of schools served by 3S having been converted by the end of 2018, the rate is now in 2020 over 90%. The campaign will end in summer 2021 with the conversion of the last schools.

Staff



Wiebke Frauen, Marc Heydorn, Ogeigha Koroyin, Anja Richter, Arne Springborn, and others



Approximately 30 students

Link: <https://www.3s-hamburg.de/>

2.1.5 Distributed Software Development Based on the Example of CoSI

At the Hafen City University (HCU), a prototype was developed in the CoSI project – Cockpit for Urban Infrastructure (Cockpit städtische Infrastruktur) - that shows statistical data of a city (e.g., kindergarten) on a map for social planners.

The prototype was further developed and extended as part of a joint cooperative development project of the CSL (CityScienceLab) at the HCU and the LGV (State Office for Geographic Information and Surveying) as part of an agile development process based on SCRUM.

A development team, which was only intermittently active at the HCU and the LGV, carried out further developments. The data and requirements to be integrated were developed in a fortnightly workshop with a newly formed inter-district and inter-agency working group "AG CoSI Sprint". The working group was directly involved in the further development of the tool as part of the agile development process.

For the successful collaboration in a team of distributed developers and a group of heterogeneous stakeholders (represented by the members of the working group AG CoSI Sprint), a development process was defined and planned. This included, beside others, Communication channels, roles, repository use, stakeholder feedback, multi-institutional development, and planning.

During the development of the tool, particular attention was paid to the long-term usability, operability, and interoperability with the existing master portal established by the LGV.

The developments in the *Distributed Software Development project based on the example of CoSI*, were connected with other projects to form a new process model for software development based on heterogeneous groups.

Cooperation partners



Hafen City University



Council of the Hamburg Borough of Hamburg Nord

Staff



Lothar Hotz, Ogeigha Koroyin

2.1.6 Distributed Software Development in Heterogeneous Groups

As part of the "Urban Data Hub" project, the need for a digital tool for planning urban infrastructures with which a wide variety of participants from the FHH districts and authorities can analyze and plan urban infrastructures has been identified. As part of a

cooperative development project, HITeC, CSL (CityScienceLab) at the HCU (HafenCity University), and the LGV (State Office for Geographic Information and Surveying) further developed the prototype and extended it into a working system. The development was carried out as part of an agile development process based on SCRUM (see the description of the project *Distributed Software Development based on the example of CoSI*).

In this environment, special research questions arise in the agile development process, specifically for the roles of the Scrum Master and project manager. These roles must coordinate, reflect, support, evaluate, and plan the distributed development partners and stakeholders who work with different resources (e.g., specific roles of those involved, distinct time budgets for the development group) on the development process. At the same time, these roles are intended to ensure that the involvement of the HCU in the implementation of the project, scientific knowledge and methods on questions of social space and urban planning are consistently applied.

In this project, we will develop a first concept for distributed software development in heterogeneous groups by considering and evaluating specific case studies. The focus is on the roles of Scrum Master and project manager, which complements the work in the project *Distributed Software Development based on the example of CoSI*. The results of other development projects at HITeC will furthermore be incorporated into the project.

The results will be the basis for further research projects as well as further cooperation projects in the area of software development in public administration and open data.

Cooperation partners



Hafen City University

Staff



Lothar Hotz, Christine Issleib, Ogeigha Koroyin, Nicola Stradtman

2.1.7 Yard Planning in Seaport Container Terminals

At a container terminal, equipment for handling and transporting containers during loading and unloading processes has to be synchronized. In a specific use case, quay cranes for executing vessel (un)loading processes, truck trailers for transporting containers horizontally from/to quay cranes to/from the container storage block, and rubber tyred gantry cranes (RTGs) for picking up and dropping down containers in the block are used. For smooth processes, different priorities of containers and therefore equipment have to be taken into account. Furthermore, planning with a rolling horizon reflects the current and upcoming complex situation at the terminal. Therefore, a recalculation is required frequently (e.g., each minute).

This project is aiming at developing a concept for process control. Plans should be recalculated frequently, so that algorithms as well as human planners and decision-makers are provided with real-time information. The plans have to incorporate all jobs to be executed in the next planning period and reflect all given restrictions. The result is an assignment of equipment to jobs/containers including decisions on the storage place (slot) for inbound containers within the yard. However, typically changes have to be made during operation (due to new unforeseen jobs to be served, machine failure etc.), and changes at one point can result in a chain-reaction of necessary changes at other points. It can be assumed, that the complex situation cannot be solved to a proven optimum quickly enough, therefore the approach will be a rule-based one. Solution candidates have to be identified and evaluated systematically (with respect to a target criteria, e.g., time) in a search tree, and finally a satisfactory or "best" solution should be found within the set of some or all appropriate and valid solutions.

Cooperation partners



EUROGATE GmbH

Stuff



Dr. Kai Brüssau, Michael Kuls

2.1.8 Intelligent Decision Support for Truck Route Planning in Ports

Container transfers are indispensable for linking locations (e.g., container terminals, depots, repair) and logistics nodes in the port area and hinterland. In the port of Hamburg, about 90% of these transports between the terminals are carried out by truck and contribute significantly to high traffic volumes and long waiting times at the gates. The ever-increasing size of container ships, which leads to peak loads with regard to the provision and transport of containers, will exacerbate this effect. Often, transports are planned centrally by dispatchers and assigned to independent haulage contractors.

This cooperation project develops a software component to support route planning and scheduling using combinatorial optimization methods (e.g., heuristics, metaheuristics). The software component enables an automatic planning of truck tours to available truck drivers under consideration of various temporal, local, and organizational restrictions (e.g., dangerous goods transports, driver qualifications). The availability and the necessary change of chassis are also included in the planning. The dispatcher can configure the optimization procedure and pursue different optimization goals (e.g., reduction of distance and empty runs, fair distribution of transport orders). The software component is integrated with a map service in order to be able to optimize routes on the basis of real route and real-time data on the traffic situation. Rolling planning is also

supported in order to integrate new orders into existing plans and to be able to react to deviations/disruptions in operations.

Compared to manual planning, the optimization results demonstrate that automatic planning leads to improved planning results. It could also be shown, even for days with high transport volumes, that the number of possible transports per day can be increased. Accordingly, the intelligent decision support enables higher productivity on the part of EUROGATE Intermodal on the one hand and an improved order volume for the participating haulage contractors on the other.

Cooperation partners



EUROGATE Intermodal GmbH

Staff



Dr. Kai Brüssau

2.1.9 SmartSquare – Analysis of Social Media Texts

The HCU carried out a project at the Domplatz in Hamburg, in which different services with cultural content for the passenger were offered (including cultural events, chatbot, audio tours, digital signage installations). These are primarily topics of the Archaeological Museum Hamburg, especially with reference to the Hammaburg and the Hamburger Domplatz. The purpose of this project was to conduct an investigation of the relationships between the changes induced by the project in social media communication through the provision of the content and its penetration, especially through Twitter.

For this purpose, HITEC designed and implemented a natural language processing pipeline as well as clustering and cluster analysis methods (including visualizations), and a concept-centered analysis. In 2020, HITEC explores research in the area of SPAM detectors in Twitter tweets.

Cooperation partners



HafenCity University Hamburg

Staff



Christian Bähnisch, Chris Biemann, Lothar Hotz, Sarah Kohail, Gitanjali Nair, Stephanie v. Riegen

2.1.10 Cooperation with ARIC

HITeC co-founded the Artificial Intelligence Center Hamburg e.V. (ARIC) in September 2019. ARIC's mission is to bring topics from the field of Artificial Intelligence (AI) into the economy and society. ARIC develops formats such as networking events, workshops, use case identification, and project initiation with HITeC. In the reporting period, HITeC conducted internal and publicly accessible AI workshops with the support of ARIC.

Cooperation partners



Artificial Intelligence Center Hamburg e.V.

Staff



Lothar Hotz, Sven Magg, Mohammad Zamani

2.1.11 UNEVIS - AI Systems for Marketing Content in the Automotive Industry

HITeC started the project "AI Systems for REACT and SOLID" with the UNEVIS GmbH in May 2020. In this project, development processes of large companies, especially in the automotive industry, are to be optimized. In order to obtain representations of products such as cars in glossy brochures for marketing purposes, these products are nowadays no longer photographed in the conventional way, but rendered from CAD descriptions and a suitable background image. However, this process, which is necessary for product presentation, today consists of a time-consuming and costly chain of error-prone conversion steps. HITeC supports Unevis in this project in the area of

- Quality assurance (checking for consistency and completeness of data)
- Uniform presentation of surfaces (different render engines require different configurations to ensure a uniform appearance)
- Optically optimized fitting of background images to achieve more realistic reflections on the products, mimicking the 3D structures of background objects and enabling parallax effects.

For this project, we use and further develop suitable methods from the field of Artificial Intelligence, in particular machine learning. The project is funded by the Innovations und Förderbank of Hamburg (IFB), the European Regional Development Fund (ERDF), and by the Freie und Hansestadt Hamburg.

Cooperation partners



Unevis GmbH

Staff



Christian Bähnisch, Rainer Herzog, Lothar Hotz, Sven Magg, Mohammad Ali Zamani

2.1.12 Determination of Skin Parameters by Image Analysis

Different sensors can be used to detect skin features such as wrinkles, redness, age, or impurities. If special equipment can be omitted to determine skin parameters, these can be collected on a larger scale. The aim of this project was to determine the same parameters using RGB image data alone. For this purpose, image material of skin areas, taken at the same time as the measurements of the corresponding parameters, was made available.

After reviewing and cleaning up incomplete data sets, neural networks of different promising structures were trained on the basis of PyTorch, which initially could only predict one output parameter at a time. After further adjustments of the network structure, the simultaneous output of all parameters was achieved. In contrast to the currently common object recognition based on neural networks, in which objects to be classified are divided into discrete categories, a special characteristic of this project was that the values of all output parameters are within continuous intervals. In addition to various metrics used to illustrate the prediction quality, also backward propagation was used to highlight the image areas that contributed most to the result. Finally, the hyperparameters of the net were systematically adjusted based on Bayesian optimization.

Cooperation partners



Beiersdorf AG

Staff



Rainer Herzog, Lothar Hotz, Sven Magg, Mohammad Ali Zamani

2.1.13 Prediction of the Skin Sensitization Potential of Small Molecules

Exposure to small molecules such as preservatives and fragrances can trigger allergic contact dermatitis in humans. So far, the skin sensitization potential of substances has primarily been determined by animal experiments, which, for ethical reasons, should be replaced as far as possible by alternative test methods such as in vitro tests and computer-based predictions. Cosmetic companies are obliged to renounce animal testing due to new legislation.

Within the scope of this cooperation with Beiersdorf AG Hamburg, new in silico models for the prediction of the skin sensitization potential of small organic molecules are being developed as alternatives to animal models. Main research areas include the estimation of the confidence of predictions and the definition of the scope of the models. These aspects are of fundamental importance for the acceptance of computer-based predictive models by national and international regulatory authorities.

As a result of this cooperation, two computer models for the prediction of the skin sensitization potential of small molecules, "Skin Doctor" and "Skin Doctor CP", have been published in leading scientific journals in 2019 and 2020, respectively. Skin doctor is accessible via a web service hosted by the University of Hamburg at nerdd.zbh.uni-hamburg.de.

Cooperation partner



Beiersdorf AG

Staff



Johannes Kirchmair, Jochen Kühnl, Anke Wilm

2.1.14 Speech Data Collection Scientific Consulting

The project deals with the research area of Artificial Intelligence. Spoken language can contribute essential markers in the psychometric and also other early detection of pathologies, as well as in the evaluation of therapeutic measures. In particular, this concerns diseases of the central nervous system such as schizophrenia, PTSD, Alzheimer's or Parkinson's disease. It is therefore obvious that speech data should be collected in the development of new drugs in the context of Phase 2 clinical trials. For this collection, the necessary technical and organizational requirements, the contents to be collected, as well as possibilities for subsequent evaluation are being developed in the project through expert workshops. As the project partner has other priorities due to the Corona pandemic, the project is currently on hold.

Cooperation partners



Böhringer Ingelheim

Staff



Timo Baumann

2.1.15 ADAM - Autonomous Adapting Machines

In mechanical and plant engineering, there is the general challenge of achieving flexibility in order to process changes in the requirements or operating conditions of a machine on site at the machine operator. Changes to the machine and its configuration require intensive interaction between the operator and the machine builder (or plant builder in the case of several machines) and, if necessary, with its suppliers. In this project, adaptation possibilities are to be developed during the machine runtime, which reduce these efforts by the machine independently recognizing and preparing meaningful changes and supporting and - as far as possible - implementing the changes.

The goal in the ADAM project is, in addition to the delivery of a machine (consisting of several components) or the delivery of a component, to also deliver so-called autonomous agents. These have the task of monitoring the machine and to adapt it in case of changes in requirements. The machine together with the autonomous agent form the autonomous adapting machine.

In 2020, further use cases were compiled and analyzed and the architecture for autonomous adapting machines were designed and partly implemented. Furthermore, approaches for distributed configuration models were designed. The project is assigned to the research area Industry 4.0 and focuses especially on the following research topics: ontologies, constraints, modeling, and the Asset Administration Shell (AAS).

ADAM is funded by the German Federal Ministry of Education and Research.

Cooperation partners



University of Hamburg, Encoway GmbH, Lenze SE, Remmert GmbH

Staff



Rainer Herzog, Lothar Hotz, Stephanie von Riegen

2.1.16 PESHAT - Portal for Philosophical and Hebrew Terminology

Up until Spring 2016, HITEC helped transfer an existing web application for philosophical and scientific Hebrew terminology over to the content-repository application “My-CoRe”. By means of this transfer, a permanent application was created, aimed to last throughout the project term of “PESHAT in context” and beyond.

After a comprehensive review by the German Research Society (DFG) at the end of 2019, the project “PESHAT in context” has been extended for another 3 years. A number of improvements and enhancements are set to be realised in cooperation with HITEC by the end of 2022.

Over the course of 2020, various large projects in the research area "Digital Humanities" were implemented. This includes the support of the cooperation of PESHAT with various other projects, including "The Historical Dictionary Project" (<https://maagarim.hebrew-academy.org.il>) or "Mispar" (<http://mispar.ethz.ch/>). In this respect, HITEC acted as interdisciplinary mediators in close cooperation with all participating scholars, provided assistance on questions of practical and theoretical computer science, and helped to promote standardized data exchange by means of machine-processable formats between the web-portals.

The highlight of 2020 was the conception and implementation of a web editor-based prototype to support PESHAT researchers in the annotation of Hebrew texts. The jointly developed annotation format is based on the TEI meta-language (<https://tei-c.org/>), but tailored to the needs of PESHAT researchers. The prototype has been in a test phase since the end of 2020 and will continue to be developed successively throughout 2021. In the near future, the annotated texts are to be used as a basis for machine learning methods, from which PESHAT and other projects in the sense of the Digital Humanities are to benefit.

Cooperation partners



Institute for Jewish Philosophy and Religion at the University of Hamburg

Staff



Lothar Hotz, Duru Zynep Kececi, Pascal Rost

Link: <https://peshat.gwiss.uni-hamburg.de>

2.1.17 Matrikelportal Hamburg - Digitalization of Matriculation Registers from the Early History of the University of Hamburg

For this project, in the context of the anniversary "100 years University of Hamburg" in early 2019, the matriculation registers that were passed down from the centre for the History of the University where digitalized, presented on a website, and made searchable. This part of the matriculation registers span from the beginnings of the University of Hamburg in the year 1919 to the year 1935. The technical implementation of the corresponding website and repository of the digital copies were implemented with the content-repository system "MyCoRe". The project was extended at the end of 2019 with the aim of also digitizing the students' matriculation cards over the aforementioned period and integrating them into the matriculation portal. The role of HITEC in both parts of the project was not only the technical implementation, but above all the

cooperative, interdisciplinary development of suitable structures for storing the metadata with regard to publication, long-term archiving, and subsequent use in the sense of the "FAIR data" principles of the research area of research data management.

The web-portal "Matrikelportal Hamburg" was successfully completed in time for Hamburg's university anniversary in 2019. Even before the project was completed, the staff of the University Archives approached us to plan an extension of the matriculation portal under the heading "Matriculation Cards". In addition to the matriculation books, the so-called "matriculation cards" are now to be digitized and displayed on the matriculation portal. The digitized matriculation books are to be linked with the matriculation cards in a meaningful way. In doing so, the students of the matriculation records from the books are to be linked with the students recorded on the matriculation cards, while duplicates needed to be avoided. The technical fundamentals and the practical and theoretical assistance of HITEC for the extension of the matriculation portal with matriculation cards was completed at the end of 2020. However, due to the time-consuming work, specifically the creation of high-quality digital copies of the matriculation cards and the acquisition of their metadata, the publication of the enhancements has been delayed. The new publication date is planned for the first quarter of 2021.

Cooperation partners



Archive of the University of Hamburg

Staff



Rainer Herzog, Lothar Hotz, Pascal Rost, Arne Springborn

Link: <https://www.matrikelportal.uni-hamburg.de/>

2.1.18 Adaptable University Bibliography with MyCoRe

In this project, the university bibliography of the University Duisburg-Essen (UDE), which is already in productive use in Duisburg-Essen, was modularized in cooperation with the "Verbundzentrale des gemeinsamen Bibliotheksverbunds" (GBV), with the aim of making it adaptable and reusable in accordance with the theories and findings from the research areas of identity management and "FAIR" data. The basis of the Duisburg-Essen implementation is the open source framework MyCoRe, and the underlying data model is the Library of Congress metadata standard MODS4.

After the theoretical foundations and resulting practical interfaces were created in 2019 to realize identity links of employees of the respective universities between (their) publications and arbitrary identity services (login/user management systems),

the practical connection to LDAP and WebOfScience systems, among others, was implemented and tested in the first quarter of 2020. Since the second quarter of 2020, several university bibliographies based on this project are in an internal pilot test phase, including TU Ilmenau, FSU Jena, TH Köln, and Fernuniversität Hagen.

Cooperation partners



Central office of the joint library network (Verbundzentrale des gemeinsamen Bibliotheksverbunds - GBV)

Staff



Lothar Hotz, Pascal Rost

2.1.19 MUGI - Music and Gender in the Internet

The internet portal MUGI is an online encyclopedia of the Hochschule für Musik und Theater Hamburg (HfMT) that has been in existence since 2003 and deals with research questions in the field of musicological gender studies and makes them publicly accessible. Due to increasing lack of maintainability, MUGI could only be hosted in a "frozen", i.e., static state since April 2019 and was at risk of being taken offline in the near future. Over 17 years of research would then have been lost. The goal of this project is to secure the research data (encyclopedia entries) available in MUGI in the sense of (long-term) data archiving (with the help of research data management practices) and to transfer the application into a web framework that is easy to maintain and designed for long-term maintainability. The research output of the MUGI portal includes not only the encyclopedia entries, which include very detailed biographies, but also various multimedia presentations of different authors in diverse formats, some of which are no longer supported (for example Flash). Another part of this project is to develop and implement concepts in cooperation with the musicologists on how to preserve these presentations so that they can be presented to the public on the MUGI website in the future.

In 2020, in three project phases, first the outdated software stack of the MUGI application was transferred to a dedicated virtual environment to bring the old application back to a locally runnable state. On this basis, a procedure was then developed in close cooperation with the musicologists of MUGI to export the very fragmented data stock and to convert it from the proprietary data format into a modern format based on the "FAIR" data principles. In the second project phase, a new foundation for the web presence and editor activities of MUGI was developed on the basis of the content repository framework "MyCoRe". In a third project phase, all multimedia presentations of MUGI were analyzed in detail and theoretical concepts were developed concerning how the

presentations in question could be conserved and hosted on a modern internet platform. A release of MUGI based on the new software stack and modern (meta-)data-formats (project phases 1 and 2) is expected in the first quarter of 2021.

Cooperation partners



HfMT Hamburg, Editors of MUGI

Staff



Lothar Hotz, Pascal Rost, Arne Springborn

Link: <https://mugi.hfmt-hamburg.de/>

2.1.20 NICO – 3D Printing for the Humanoid NICO Platform

In the Project “NICO”, HITEC offers special expertise on 3D printing and CAD-design in the context of human-robot interaction to the Knowledge Technology Group of the Universität Hamburg. The work consists of design, improvement, prototyping, and printing of specific parts for the humanoid NICO platform, especially in the context of adaptation of body parts for specific human-robot interaction experiments. The research focus in this project was the iterative design and test of novel components within the given constraints (experimental requirements, utility, and visual appearance). In 2020, several tasks have been finished:

- Stresstests in AutoDesk Inventor for new arm parts
- Complete assembly of a new NICO robot with improved components (shoulders, arms, electrical components in the head)
- Adaptation of joints to utilize new motors MX64AT
- Improved design for bigger NICO head (with focus on eye socket design, neck, and better mounts)
- Design studies for printable legs and feet, following the improved design schema.

Staff



Sven Magg, Christian Wermter

2.1.21 AI Workshops

Following requests by projects partner and companies, HITEC has started to offer a series of AI Workshops to teach the basics of AI and especially neural network implementation. The workshops cover a wide area, starting with basic concepts of Machine

Learning, all the way to Hyperparameter Optimization with Bayesian Optimization. After a successful start with a 3-session workshop on Image Processing with Convolutional Neural Networks (CNNs) and Hyper parameter Optimization with BOHB, a series of 5 workshops was offered on a regular basis. The first, “AI for Deciders”, introducing the basic concepts of AI to people without computer science background, was successfully held three times, and led to new contacts and even further HITeC projects. The workshops will be further improved and offered also as tailored workshops for companies for specific topics.

Staff



Sven Magg, Mohammad Ali Zamani

Link: <https://hitec-aric.eventbrite.de>

2.1.22 MBJ – Classification of Faults in Photovoltaic Cells

In this short project, mbj Solutions has contracted HITeC to research, whether a novel image processing component, based on neural networks, can be developed to detect and classify faults in photovoltaic cells. This project thusly is based in the research area AI & Image Processing. The task was to train a CNN architecture and explore, whether, or under which circumstances, such system can achieve a higher error detection rate than the system currently used in the electroluminescence inspection units from mbj. The specific constraints were a small number of training examples, the already high detection rate of the base system, and the short time for processing the images of a whole cell panel. Detected faults also had to be localised in the image using bounding boxes. The tasks were addressed following a 2-step process: Design of a small and efficient classifier for the classes of two provided datasets, and then training a bounding box regressor on top of the classifier. The outcome of this process was a training and optimization pipeline for both steps, which, given the short time, could not yet fulfil the quality requirements as required, but can now be further improved by mbj Solutions.

Cooperation partners



mbj Solutions

Staff



Sven Magg, Mohammad Ali Zamani

2.2 DSL – DISTRIBUTED SYSTEMS LAB

The project area "Distributed Systems Lab" (DSL) cooperates closely with the Research Group for "Distributed Systems" (Verteilte Systeme, VSYS) of the Department of Computer Science at the MIN Faculty of the University of Hamburg. VSYS focuses on distributed systems as well as related information systems, and cooperates, among others, with industrial companies that are active in the area of distributed information and communication systems and their applications. Current activities include, e.g., support and implementation of joint R&D projects, innovative software development, technology consulting, training and concept analysis and evaluation etc. in a holistic approach, which, in addition to current or future technologies, also considers internal processes and organizational forms of software development and takes into account corresponding interactions. Active areas are, currently, e.g., the field of "Service-Oriented Computing" (SOC) or "Service-Oriented Architecture" (SOA), technical support and the organization of operational procedures and processes (Business Work-flows) as well as the coordination of autonomous and mobile services and processes (including social media) as well as cloud and sensor-based services. Technologies used include (multi) agent technology, as well as software development techniques based upon them. On the application side, especially long-lived software applications as well as techniques of self-organization (autonomous computing) or sensor-based applications are considered – such as in the area of the "Internet of Things" (IoT) or "Smart Cities".

Consequently, various aspects of distributed system technology are in the focus of DSL re-research: e.g., middleware, service-oriented computing, web services, clouds, agent and component-based software development, self-organization or event-based systems etc. and their diverse fields of application – such as electronic service markets, e-commerce / e-business / e Services, mobile / ubiquitous application scenarios, control of operational processes including workflow management, logistics, computer-aided cooperative work and application-related user support, production automation etc. The totality of these techniques provides a solid technical basis for many practice-oriented and current distributed applications, based on modern internet and intranet technologies.

Head:



Winfried Lamersdorf

Link: <https://vsis-www.informatik.uni-hamburg.de/vsys/main/index>

2.2.1 Blockchain Projects

Prior project partners for the DSL project “HITeC Blockchain” were the Hamburg-based companies Ponton and ppi AG. Corresponding joint projects have been carried out together with students from the Department of Computer Science at the University of Hamburg. The aim here was to analyze and evaluate existing Blockchain technologies, to find out respective advantages and disadvantages of these technologies, and to evaluate it practically. As first results, respective prototypes of, e.g., Blockchain applications in the insurance industry have been designed, built, and evaluated jointly with ppi AG. Concrete examples for practical application areas have been supplied by the industry partner. In another former Blockchain project of HITeC DSL together with the Hamburg-based company Ponton, Blockchain Technologies have been developed and applied in the area of energy supply and trade in the framework of the project „Enerchain“.

Currently, HITeC DSL is engaged in a Blockchain project together with „Lufthansa Industrie Solutions“ (LHIND), Hamburg, which is sponsored by “Hamburgische Investitions- und Förderbank” (IFB Hamburg) in its „Program for Innovation (PROFI) – Modul PROFi Environment Transfer“. Here, innovative Blockchain technologies are applied to logistics applications in form of a realization study which also includes conception and prototypical realization of an open freight market „Future Transport Hamburg“ (FTH) which is developed, applied, and evaluated in this joint project.

This project aims at a Blockchain-based, decentralized, and platform-less open market place for freight (of all kind) which combines specific characteristics such as openness and independence from particular providers with an offer of (unlimited) additional (so called “servelet”) applications. Here, the Blockchain technology enables, e.g., a tamper-proof cryptographic „distributed ledger“ for all transactions which substitutes the – so far mostly centralized – freight coordinator and, in addition, a secure protocol of exchanged data as well as transparency of content (as far as needed), reliability, and security. In addition, several other logistics application can also be integrated.

In this feasibility study, LHIND and HITeC evaluate jointly, how a Blockchain-based open market place for freight can be realized both technically as well as economically. Finally, a substantial part of this study concentrates on ecological issues, such as (reduced) energy consumption as well as reduction of CO₂-emissions by increasing the average load of transport vehicles based on decentralized overall load optimization.

Cooperation partner



Lufthansa Industrie Solutions (LHIND), Hamburg

Staff



Heiko Bornholdt, Philipp Kisters, Winfried Lamersdorf, Wolf Posdorfer

2.2.2 Smart City Projects

Other current HITEC DSL projects in the area of distributed system software, concentrate on support for "Smart Cities", i.e., sensor-based system components which are designed, developed, and used for networked applications in the area of intelligent and "smart" cities. This is also the focus of the state-funded project "Smart Networks for Urban Citizens' Participation" (SANE) which is carried out as part of the "ahoi.digital" digitalization initiative by the city of Hamburg together with partners from both Hamburg University and Hamburg University of Applied Sciences. Such activities open up new opportunities for citizen participation (citizen science/ education) by, among other things, providing, disseminating, analyzing, and sharing diverse (e.g., environmental) data for citizens and institutions. Technical challenges of this approach include the integration of large amounts of data from heterogeneous sensors and devices, the network-based, distributed analysis, and processing of information and also guarantees for security, resilience, privacy, and trust. At all levels, these are particularly important for the acceptance and, thus, for the use of such an information space and, thus, represent a unique selling point of the results achieved using this approach.

As part of a German Federal BMI (Bundesministerium des Innern) funding application by the City of Hamburg as a "Smart City", technical aspects of a corresponding application design and formulation have been supported – also in cooperation with other Hamburg universities.

Cooperation partners



Working group „IT-Sicherheit und Sicherheitsmanagement“ (ISS), FB Informatik, Hamburg University (Matthias Fischer et al.)



Working group „Internet Technologies“ (inet), HAW Hamburg (Thomas Schmidt et al.)

Staff



Heiko Bornholdt, Philipp, Kisters, Winfried Lamersdorf

Link: <https://sane.city>

2.2.3 Future Transport Hamburg

Together with Lufthansa Industry Solutions GmbH & Co. KG, the project "Future Transport Hamburg" (FTH) started at HITEC on July, 1st 2020. The project is funded by

the Hamburgische Investitions- und Förderbank (IFB) as a cooperation project within the framework of the programme "PROFI Umwelt Transfer".

The overall objective of the project is to avoid empty truck journeys in Germany by creating an optimized match between freight offers and freight requirements.

The funded feasibility study enables an analysis and evaluation of the planned project and lays the foundation for the subsequent development and establishment of a Blockchain-based provider-neutral freight exchange. Through an open plug-in architecture, other service providers should also be able to provide additional services on the freight exchange. In addition to prototypical development and usage simulation, the feasibility study also focuses on ecological and legal aspects.

HITEC "Distributed Systems Lab" (DSL) supports as a research project partner especially in the areas of system architecture and in all topics related to centralized marketplaces, Blockchains, and distributed ledger technologies.

Cooperation partners



Lufthansa Industry Solutions GmbH & Co. KG

Staff



Heiko Bornholdt, Philipp Kisters, Winfried Lamersdorf, Wolf Posdorfer

2.3 ITMC - IT-MANAGEMENT AND CONSULTING

The project area ITMC works in close cooperation with the corresponding work area at the university. ITMC pursues with its research the vision: "Driving Innovation with Service". The aim of design oriented research is to contribute to better methods and tools for the development and management of complex, socio-technical service systems. We call this focus Service Systems Engineering. We apply this approach both to innovative, IT-enabled services in specific application domains and to the management of IT as a service.

Head:



Tilo Böhmann

Project Manager:



Paul Drews

Links:



<https://www.inf.uni-hamburg.de/inst/ab/itmc/home.html>



<https://www.inf.uni-hamburg.de/inst/ab/itmc/research/themes.html>

2.3.1 ITMC-Conference – Conference of the Informatics Course ITMC

Students of the Master's program IT Management and Consulting (ITMC) organized an exchange forum between IT business and science in June 2020.

This year, the conference was held virtually under the motto "Survival of the Digital Fittest - Tomorrow's Survivalists". For years, digitalization and digital transformation have been continuing in the global economy, forcing many companies and industries into a struggle for survival. This circumstance is also referred to as "digital Darwinism". What is meant by this? Darwinism refers to the natural selection process that takes place automatically. If companies and industries are unable to adapt quickly enough to the rapidly changing conditions caused by the digital transformation, they will be "weeded out" by the market. The motto is "survival of the digital fittest". The Corona crisis and its consequences have once again brought this selection process to the fore. This year's ITMC Conference was based on this central theme, as this event was not left untouched by the crisis. The speakers at the ITMC Conference interpreted and dealt with the topic in different ways that were both topical and controversial.

In specialist lectures and workshops, the participants were given the opportunity to get to know the course of study, to deepen their knowledge, and to share it with other interested parties. They were also given the opportunity to network or to meet old friends from their studies in the "Alumni Space".

Staff



Many students of the ITMC course

Link: <https://www.inf.uni-hamburg.de/de/inst/ab/itmc/studies/prospects/conference.html>

2.3.2 Study „Digital Platform Management“

Companies in all industries face the challenge of digital transformation. Driven by the far-reaching impact of IT, IT megatrends, digital start-ups, and international competition, enterprises have to develop and implement suitable strategies. So far, however, the direction of this transformation is unclear. In the first project, "Digital Excellence", we explored together with Sopra Steria from 2014 to 2015 the dimensions of this transformation goal. The results of this cross-industry study were published in various forms: The main report "Digitale Exzellenz: Eine Bestandsaufnahme zur Digitalisierung deutscher Unternehmen und Behörden" was published in summer 2015.

From 2015 to 2016, we conducted a qualitative-empirical follow-up study on "data-driven agility". In this study, we examined this dimension of the digital excellence model in depth. The results were published in November 2016.

In 2018, the series of studies on digital excellence continued. The focus of the study published at the beginning of 2019 is the topic "Digital Platform Management". Expert interviews and a survey were conducted in a qualitative and quantitative empirical project. The study provides a systematization of digital platforms as well as an overview of the current challenges and initiatives for digital platforms in companies and public authorities. In 2020, planning for the continuation of the work was carried out.

Cooperation partners



Sopra Steria SE

Staff



Linda Becker, Tilo Böhmman, Paul Drews, Martje Feddersen, Mathias Kerkhoff, Corvin Meyer-Blankart, Katharina Schuh, Alena Störmer, Andreas Zolnowski

Link: <https://www.soprasteria.de/digitale-exzellenz>

2.3.3 CUDIT - Competence Centre Customer and User-Driven IT

Businesses face challenges of increasing requirements regarding the IT support provided for their services, as staff and clients project their expectation regarding the usage of digital services across all business areas.

Clients expect digitally available offers and services. Staff expect the utmost support for personal information management at the workplace. Due to the digital transformation, IT competence in departments is increasing. These challenges lead to the conclusion that IT in many businesses is set to evolve into a “Customer and User Driven IT” (CUDIT) which can better react to the increasing requirements and expectations of stakeholders inside and outside a business.

The competence center CUDIT takes on these challenges, and organizes and undertakes applicable research in this field. Participating businesses (partners), the University of Hamburg and HITEC aim to take on these challenges together and investigate possible courses of action for CUDIT.

Cooperation partners



Beiersdorf Shared Services GmbH



Hamburg Port Authority AöR

Staff



Tilo Böhmann, Paul Drews, Corvin Meyer-Blankart, Ingrid Schirmer, Jöran Tesse

2.3.4 Management of Digital Ecosystems

The starting point for this collaboration is the increasing dissemination and networking of digital services, especially in the healthcare sector. On the one hand, players in the healthcare sector are faced with the challenge of opening up to a large number of new partnerships in order to enable competitive user experiences and promote digital innovations. On the other hand, networking poses significant risks. Networking partners in turn use other digital services. As a result, data flows in such highly networked and dynamically evolving digital ecosystems are difficult to keep track of. Individual examples show that critical personal data can diffuse in such ecosystems, presumably without any particular intention. This may be the - presumably unintended - consequence of using cloud-based tools to support the development and operation of smartphone apps in the context of application performance management or user activity tracking. Even very granular functionality, such as two-factor authentication or

street name completion in address fields, can be easily implemented today using external services. The decision about the integration of such services can be in the hands of a single software developer. This level of networking complexity and dynamics is insufficiently addressed by existing methods and tools for analyzing and assessing partnership relationships.

Research area and question: Platform economy: How can the governance of actors in meshed platforms be realized? Privacy and data protection: How can user data be used reliably and privacy-preserving in meshed ecosystems? Service systems: How can services be designed, integrated and controlled that operate with the dynamic help of other actors?

Cooperation partner



German Health Insurer







Stuff:



Tilo Böhmann, Martin Semmann, Christian Kurtz

2.4 BUSINESS INFORMATION SYSTEMS

The project area Business Information Systems at HITeC deals with topics at the interface between computer science and business administration. The focus is on topics that can be researched in an application- and practice-oriented way in the sense of a design-oriented business informatics. A special concern of the department, however, is not only the execution of application and practice-oriented research projects, but also the transfer into practice up to the spin-off of companies, which transform current research results into marketable products and services. The transfer takes place via the heads involved. Topics and activities in the field of transfer are among others:

-  Business process management and IT support for business processes
-  Productivity of services through IT
-  Hybrid value creation through product service systems
-  Usability of business management systems
-  IT support for auditing tasks (auditing, internal audit)
-  Standardization projects at the German Institute for Standardization (Deutsches Institut für Normung)

Head:

-  Markus Nüttgens

2.4.1 ITE - IT-Entrepreneurship

Together with the Hamburg Research Center for Information Systems (HARCIS) at the University of Hamburg, the IT-Entrepreneurship program for undergraduate students is offered every summer semester. Topics from the field of IT-based start-up management are dealt with in multiple perspectives. The course run in the summer semester 2020 was dedicated to innovative solutions for overcoming the Corona crisis.

Contents of the course are:












- Economic significance of start-ups for the economy and society
- basic concepts of start-up management (founding ABC)
- methodical approaches to the development and implementation of ideas and innovations in IT-based products and services (including Design Thinking)
- critical success factors for technology-oriented and knowledge-intensive start-ups (opportunities and risks)
- Forms of financing and participation for company founders and risk / capital providers (investors, business angels, promotional banks, etc.)

- Process models and best practices for IT-based business start-up and consolidation (case studies and guest lectures)
- Creation and evaluation of business plans (business plan competition)
- Presentation of a business idea to an expert jury

Hereby the following aims are pursued:

- Knowledge of the theoretical foundations of IT-oriented start-ups
- Knowledge of founding from a regional, national, and international perspective
- Learn the basics of digital business models and innovations and how to translate them into IT-based products and services
- Applying a systematic and scientifically sound approach for establishing and consolidating young IT-oriented companies
- Case study-based preparation of a business plan
- Presentation of a business idea in a compact pitch

Contributors to the 2020 ITE round included representatives from:

-  Office for Knowledge and Technology Transfer (AWITT) of the University of Hamburg with the field office Hamburg Innovation (HI)
-  TUTECH
-  ICS Hamburg
-  HITeC
-  Neuhaus Partners
-  IFB Hamburg
-  Grenius Lawyers
-  zapliance
-  Shortcut
-  eBlocker Open Source
-  Entrepreneurs from the metropolitan region

Staff

-  Eva Glanze, Markus Nüttgens

Link: <https://www.bwl.uni-hamburg.de/harcis/03-lehre/bachelor/it-entrepreneurship.html>

2.4.2 Exploring New Development Techniques for of Mobile Applications - an Example for the LPG Engine Technology "GasTronic[®]"

With the hydraulic gas system, Direct GasTec GmbH is setting new standards in the field of LPG systems, so that even vehicles with state-of-the-art direct-injection petrol engines can be expanded by the lower-emission LPG mode. In order to provide the end user and car workshops with a modern and user-friendly operation and maintenance of the LPG system, a mobile application is being developed in cooperation with HITEC, which connects via Bluetooth to the LPG system installed in a vehicle. The app is primarily used by the end user to control and monitor their gas system. The service workshops are supported in the initial set-up and maintenance of the gas system. Furthermore, the app can be used to find cheap gas stations in the area. In addition to the app, a web-based administration environment is being developed, which can be used to maintain the configurations and software of the gas systems as well as user and technician master data.

The project explores new ways of software development, especially the development of mobile applications. The methodology is agile Scrum and prototyping is used to develop mock-ups and prototypes. There was also a strong focus on usability and open-source technologies. The project evaluates methods and technologies as well as a framework concept for "additive software production."

Cooperation partners



Direct GasTec GmbH

Staff



Stephan Leible, Markus Nüttgens, Frank Rump

Link: <https://www.bwl.uni-hamburg.de/harcis/03-lehre/bachelor/it-entrepreneurship.html>

2.5 INDIVIDUAL PROJECTS

2.5.1 Lecture2Go

The Language Technology group of the Department of Computer Science supported the video platform Lecture2Go, which is used and maintained by the University of Hamburg, in the prototypical realization of an automatic subtitling of lecture videos.

In the wake of the corona pandemic, Lecture2Go has grown rapidly in 2020, with numerous lecture and instructional videos made available to Hamburg students on this platform, in some cases publicly accessible. To ensure accessibility, the goal is to subtitle all videos - but this is difficult to do manually due to the now larger amount of video material.

The Speech Technology workspace has been developing and maintaining German open source speech recognition models trained with the open source framework Kaldi since 2015. In this project, we were able to demonstrate the practicality of our models, which now makes it possible to provide good quality automatic transcription in many cases. A particular challenge in the creation of automatic subtitling is a suitable segmentation of the subtitles in terms of content, so that breaks occur at places suitable for the content. Here appropriate segmentation procedures were developed, as well as further models trained for an automatic enrichment of the transcripts around punctuation for reaching a good reading flow.

In addition to further general optimizations for subtitles, we also tested the extent to which adapted speech recognition could be realized, with which the speech recognition model could be optimized with the help of previously submitted documents (e.g., presentation slides). We hope to continue the research in 2021. The results so far will be published at ESSV 2021 with the title "Open source automatic lecture subtitling", and the open source software (including models) can be obtained from <https://github.com/uhh-lt/subtitle2go/>.

Cooperation partner



Universität Hamburg

Staff



Timo Baumann, Robert Geislinger, Irina Lindt, Benjamin Milde

2.5.2 Meeting Minute Bot and AI-Support

The Language Technology (LT) group of the Department of Computer Science maintains a close cooperation with Telekom AG in order to establish methods and applications in the field of Artificial Intelligence and machine learning for various internal processes of Telekom AG and, thus, to increase the productivity of the company. LT acts as a consultant and evaluator and develops prototype components in the areas of speech recognition, information extraction, and processing as well as in the area of business intelligence.

Last year, the focus was on the further development of a prototype solution for recording and summarizing meetings, which will be presented at a trade fair in spring 2021. In the solution, which is characterized by locally running speech recognition software, which is an important security precaution especially in the business sector, the course of the meeting can also be displayed with keyword summaries in addition to the transcriptions.

The components developed in this project were also used in teaching in 2020: In a Master's project, students used the speech recognition components to extend the open-source meeting software BigBlueButton.

Furthermore, we continue our consulting activities in the area of text classification and speech recognition. Further cooperation is planned for the next few years.

Cooperation partners



Telekom AG

Staff



Saba Anwar, Chris Biemann, Tim Fischer, Benjamin Milde, Steffen Remus, Michelle Sandbrink, Soniya Vijayakumar

2.5.3 OPENREQ: Requirements Engineering, Big Data, Recommendation Technologies

Funded with 4.6 million Euro by the European Commission, our Horizon 2020 research project, involving nine research and industry partners - including multinational companies and leading open source communities - from five European countries in order to develop novel context-aware Requirements Engineering approaches and tools as well as intelligent recommendation and decision technologies for community-driven Requirements Engineering, was successfully completed by February 2020.





After the mid-term review with the European Commission in Brussels in September 2018, where all relevant results were presented to and positively evaluated by an international jury, the final audit and review took place in Brussels in February 2020, including a final project meeting and rehearsal of all the project partners.

With positive feedback by the European Commission, the project was accepted. The most remarkable results of the project are the Open Source Repository containing the OpenReq Code (<http://github.com//openrequeu>) as well as the Knowledge Base on the project's website (<https://openreq.eu/knowledge-base/>).

Within the duration of the project (2017 – 2020), 58 publications, 9 doctoral degrees, 8 master degrees as well as 8 bachelor degrees have been successfully completed.

Formally, the project has finally been reviewed and accepted by an auditor of the European Commission.

Cooperation partners

-  Engineering Ingegneria Informatica S.p.A. (ENG), Italy
-  The Qt Company (Qt), Finland
-  Siemens AG Österreich (SIEMENS), Austria
-  Technische Universität Graz (TUGraz), Austria
-  University of Helsinki (UH), Finland
-  Universitat Politècnica de Catalunya (UPC), Spain
-  vogella GmbH (VOGELLA), Germany
-  Wind Tre S.p.a. (Windtre), Italy

Staff



-  Davide Fucci, Walid Maalej, Lloyd Montgomery, Christoph Stanik

Link: <https://openreq.eu/>


2.5.4 Data Protection Compliant Collection of Patient Data for Medical Research

The project IDOMENEO, carried out by the department for vascular medicine of the University Medical Center Eppendorf (UKE), evaluates the success of treatments for peripheral arterial disease (PAD) patients. The required data is gathered in a centralized platform, which is implemented in collaboration with HITEC. The platform utilises innovative techniques from the fields of cryptography and privacy by design to safeguard sensitive medical data while providing this data for medical research.

Cooperation partners

-  University Medical Center Eppendorf (UKE)
-  Barmer GEK

Staff

-  Hannes Federrath, Tobias Müller, Tom Petersen

2.5.5 Latency-based Forwarding in Metropolitan Area Networks

Latency-based forwarding (LBF) is a distributed approach to make bounded, regional packet networks capable of meeting deadlines. Packets carry deadline information and its forwarding is prioritized according to the remaining time contingent at each hop.

In this project, we implement LBF in a discrete event simulation platform and study its impact on the TCP congestion control loop.

Cooperation partners

-  Futurewei

Staff

-  Mehmet Cakir, Philipp Meyer, Thomas C. Schmidt

2.5.6 RIOT Open Source Community Bulding

RIOT, the friendly operating system for the IoT, was co-founded by HAW Hamburg with FU Berlin and INRIA Paris in 2013 and, since then, has evolved to a global, open source ecosystem, the community of which being managed by the three founding institutions. A central block of community building is the yearly RIOT summit, which brings together RIOTers from industry and academia, makers and freelancers, application designers, and core system developers. In 2020, the summit was held as a virtual event with a Hamburg hub and about 100 contributors from four continents. The keynote was given by Prof. Andrew Tanenbaum, founder of MIMIX.

Cooperation partners

-  Ericsson

Staff

-  Thomas C. Schmidt, Matthias Wählisch

2.5.7 Orientation in Digital Transformation - Understand Digitisation and Shape it Sustainably

The project wants to bring together different disciplines in order to understand digitisation and shape it sustainably. We want to strengthen the judgement and orientation of students, for whom there is hardly any time left today in the shortness of every day university life. The expectation is to strengthen judgment and orientation for students of (business) computer science, for which there is hardly any time left in today's short-winded university routine. That's why we press the technologies with their registered values (Digitisation in context), the challenges, opportunities, consequences, and sustainable realisation by value- and interest-oriented design. We call this Digital Literacy.

Stuff



Lothar Hotz, Mathias Kerkhoff, Arno Rolf, Tim Runge

Link: <https://mikropolis.org>

2.5.8 Chemical Informatics for the Analysis of Chemical Spaces

Within the project there is an exchange on chemical informatics technologies with a focus on handling and searching in large chemical structure sets and on 3D methods. The work is assigned to the research area of bio- and cheminformatics.

Cooperation partners



BioSolveIT GmbH, Sankt Augustin

Staff



Matthias Rarey

2.5.9 Data-driven and Networked Non-linear Predictive Control

The aim of the project is to develop and test nonlinear predictive control strategies for networked applications as well as for applications with data-driven models. In recent years, new methods for fast nonlinear predictive control have been developed at the Institute for Control Technology (IRT) of the TUHH, which are based on a quasi-LPV model of the nonlinear controlled system. These methods are to be further developed for use in the above-mentioned applications.

Cooperation partners



IAV GmbH, Berlin

Stuff



Herbert Werner

2.5.10 Modelling and Automation of Enterprise Processes

Our project partner is an industrial service provider that operates a large chemical park. From time to time, incidents occur that require the knowledge of selected employees. In order to operationalize this knowledge for a larger group of employees, the corresponding processes are modeled on the basis of a previously conducted feasibility study and stored in an open source process engine so that they can be executed using the existing sensors, among other things. The number of these processes will be extended step by step in order to establish the Process Engine as a general tool for the automation of business processes in the company. From a research perspective, the results of this project form an important basis on which further activities in the field of process analysis can be implemented.

The project is assigned to the research area of digital transformation in companies and focuses on the automation and analysis of business processes.

Cooperation partners



Yncoris GmbH & Co. KG

Staff



Ulrike Steffens

2.5.11 RoboCup-AG - Hamburg Bit-Bots

The student working group "Hamburg Bit-Bots" has been participating in the international science competition RoboCup since 2012. The competition aims at advancing research in Robotics. The rules of the RoboCup football leagues are continuously increased to meet the proposed goal to beat the human world champion team by the middle of this century. The competitions are a place to share knowledge and compare approaches while providing an incentive for further development.

The Hamburg Bit-Bots compete in the Humanoid Kid-Size League. Since 2012, they have qualified every year for the World Championship. Since physical events were out of the question this year, the team participated in two online competitions. In the Running Robot Competition in China, they placed third place with their approach based on Reinforcement Learning. In the RoboCup Brazil Open, they achieved second place.

Besides their participation in the competitions, the team has become the university's flagship student project. When the federal minister of science Karliczek visited the UHH in January 2020, the team was presented as a showcase student project. As part of the funding of student projects within the excellence initiative (de: Exzellenzinitiative), the Hamburg Bit-Bots were able to secure funding for the academic year 2020/2021. Since 2015, the members of the team have made eight scientific publications. In 2020, five theses that resulted from work in the RoboCup AG were completed successfully. Furthermore, seven former members of the team are now working at universities, four of them at the Universität Hamburg.

The group's research focus lies in the integration of many complex systems in the field of humanoid robotics.

A presentation video with further information can be found here: <https://www.youtube.com/watch?v=16JhWI9DK6A>

Cooperation partners



RoboCup AG „Hamburg Bit-Bots“

Staff



Marc Bestmann, many students

Link: <https://bit-bots.de/>

2.5.12 M-Lab 2019/2020 (Teaching and Innovation Project)

Within the learning and innovation project “M-Lab”, Bachelor and Master students have the opportunity to develop smartphone apps and services using the newest technologies, working in small teams (4-6 members) for real clients from the industry with real deadlines.

The students can experience software engineering technology and methods, such as for example object-oriented analysis or design and implementation of mobile applications. Furthermore, they gain experience in teamwork, project management and communication with clients.


Due to the COVID-19 pandemic, we launched the first virtual version of M-Lab; physical meetings and presentations are taking place via Zoom.

After the clients presented their respective problems in a kick-off meeting, the students had to choose one out of five clients: Jetlite, StayIn, UKE Hamburg, Qurix, Universität Hamburg.


Within the Client-Acceptance-Test concluding the project, the students present their applications for mobile devices such as smartphones and tablets. All the developed apps come with a poster, a product video, a website and a live presentation by the responsible students.

The students received the project with great enthusiasm. This year's focus was also mainly on creative processes and solutions. The students had the possibility to attend an additional workshop in order to improve their skills and optimize their strategies and workflows.

Cooperation partners (practice partners)

-  Jetlite
-  StayIn
-  UKE Hamburg
-  Qurix Technology
-  Universität Hamburg (SE1-App)

Staff

-  Volodymyr Biryuk, Abir Bouraffa, Marlo Häring, Walid Maalej, Daniel Martens, Lloyd Montgommery

Link: <http://uhh.de/mlab>

2.5.13 Representation Expenses of the Department

In close cooperation with the Department of Computer Science, HITEC regularly supports scientific research and teaching events of the department, such as colloquia or closed conferences.

Cooperation partners

-  Department of Computer Science at the University of Hamburg

Staff

-  Professorships of the Department of Computer Science


2.5.14 Computer Science Orientation Unit

In close cooperation with the Department of Computer Science and in particular through the committed cooperation of many students of computer science, HITEC regularly organizes the Orientation Unit Computer Science.

Cooperation partners

-  Department of Computer Science at the University of Hamburg
-  Student Council of Computer Science at the University of Hamburg



Staff

-  Many students in the field of computer science

2.5.15 Business Information Technology Studies Orientation Unit

In close cooperation with many students of the bachelor and master degree courses Information Systems and the master course IT Management & -Consulting HITeC regularly organizes the orientation for the Information Systems and ITMC courses.

Cooperation partners

-  Department of Informatics at the University of Hamburg
-  The University of Hamburg's student association of Information Systems and ITMC

Staff

-  Many students in the field of Information Systems and ITMC

2.5.16 Hamburg Informatics Computer Museum

Since his retirement, Prof. Horst Oberquelle has built up a computer museum in the Department of Computer Science at the university, where you can see an interesting selection of groundbreaking inventions from the beginnings of mechanical computing, desktop and pocket calculators, hardware from Konrad Zuse to mainframes, the development of workstation systems and home computers to large and smallest portable computers. Data transmission from the Morse key, via teleprinters and telephones to smartphones, writing and printing from the mechanical typewriter to the laser printer as well as the development of storage media are also thematised. Some devices will be demonstrated live. A special aspect is the importance of innovation and design in Apple computers and the development of interaction techniques in mice, joysticks, trackballs, and other input devices.

In addition to members of the department, the Computer Museum also addresses alumni clubs, schools and the general public. Prof. Oberquelle regularly offers guided tours. In 2020, however, planned tours had to be cancelled due to Corona. The museum remained largely closed.

The museum finances itself almost exclusively through donations and gifts and thanks HITEC for its support in acquiring interesting exhibits.

Staff



Horst Oberquelle

Link: <https://www.inf.uni-hamburg.de/home/about/museum.html>

3. OUTLOOK

As a guiding theme, HITEC is involved in research and technology transfer projects in the field of digitization of urban tasks, digital transformation in economy and society, secure distributed systems as well as the application of Artificial Intelligence in enterprises. This is intended to bundle current and future projects in this field and to increase the visibility of HITEC.

In 2021, projects with research institutions, authorities, and industry will continue to be carried out and advanced. In particular, further projects are planned in the area of Artificial Intelligence, also in cooperation with ARIC, as well as in the area of secure, data protection-friendly system developments.