ANNUAL REPORT / 2022

BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF INFORMATION TECHNOLOGY

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Photo front cover: FILMONDO

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Photo: Michal Fanta

Introduction

The year 2022 is over. We were all certainly hoping that it would not be a negative part of history like 2020 and 2021, which were marked by the COVID-19 pandemic. Unfortunately, this was not the case, and 2022 will go down in history as perhaps an even worse year. The tragic Russian invasion and the war in Ukraine began. However, 2022 was a positive year for our faculty, despite the turbulent developments in the world. We celebrated its twentieth birthday and it was quite a successful year professionally. I believe that the faculty „went in the right direction" in this anniversary year.

Today, FIT has over 2,500 students, who are the main focus of our work, is very successful in research and is positively evaluated both in the Czech Republic and abroad.

In 2022, students were able to go back to school after the COVID-19 pandemic and the faculty finally came „alive". But the world has changed since the pandemic and there are some students who like online learning and rely on video streaming of lectures, even though they can go to school. I fear that's the way it's going to stay.

In 2022, we managed to build on the well „started" international exchange of students, teachers and researchers from before the COVID-19 pandemic, the interest in studying in the English programme has increased, and the war in Ukraine is leading to a strong increase in the interest of Ukrainian students.

In the future, I would like to see our faculty as a world-renowned one, as a universally sought-after one for collaboration on teaching and research projects, where students are enthusiastic and proud of their achievements and where the atmosphere is pleasant, the facilities are good, and the services provided to students and staff are of high quality. Hopefully we were close to that in 2022 and hopefully I think, as I said, we were „going in the right direction" in 2022 and that we will continue to „go in the right direction".

Pavel Zemčík, Dean of FIT BUT

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Photo: Jitka Janů

Profile of the faculty

The Faculty of Information Technology is a modern, internationally recognised university and a centre of excellence for research in various areas of information technology - from hardware to intelligent systems to multimedia. In a modern campus with unique facilities, it offers students a highly valued IT education at all levels of study: three-year Bachelor's, two-year Master's and four-year PhD.

Tradition

The faculty has had a tradition in teaching information technology since 1964, when the Department of Automatic Computers of the Faculty of Electrical Engineering of BUT was founded, which gradually developed and became an independent faculty in 2002. Today, nearly 2,500 students study there.

Science and research

More than twenty research groups work at the faculty. Many of them are celebrating great success not only at home but also abroad. FIT is involved in national and international scientific projects - independently and in collaboration with other universities, research institutes and renowned companies and institutions. The faculty also includes the Information Technology Research Centre. This is part of the IT4Innovations Centre of Excellence, which includes the National Supercomputing Centre.

Teaching and experience

The faculty emphasises quality theoretical preparation corresponding to university studies in the technological field. However, we are also aware of the importance of the link with experience. The faculty has its own industry council through which it maintains regular contact with industry leaders and thus brings the latest knowledge from experience into its courses of study. That is why FIT graduates are in great demand on the labour market and have the highest starting salaries of all BUT graduates.

Campus

The faculty campus is a unique combination of a sensitively reconstructed historic site of a former Carthusian monastery from the 14th century and new modern buildings. The reconstruction and completion took place between 2006 and 2013, and leading Brno architects used the latest knowledge about the creation of university teaching spaces. The campus includes not only excellently equipped lecture halls and laboratories with the latest technology, but also facilities for relaxation and rest, catering facilities and facilities for cultural and leisure activities.

Management

prof. Dr. Ing. Pavel Zemčík

Dean

Ing. Bohuslav Křena, Ph.D.

Vice Dean for Effectiveness and Academic Affairs

Ing. Vítězslav Beran, Ph.D.

Vice Dean for External Relations

Ing. Jaroslav Dytrych, Ph.D.

Vice Dean for Educational Activities in Bachelor's Degree

doc. Ing. Richard Růžička, Ph.D., MBA

Vice Dean for Educational Activities in Master's Studies

prof. Ing. Tomáš Vojnar, Ph.D.

Vice Dean for Science and Research

Ing. Petr Hajduk

Secretary of the Faculty

Heads of institutes and centres

doc. Dr. Ing. Dušan Kolář

Institute of Information Systems

doc. Dr. Ing. Petr Hanáček

Institute of Intelligent Systems

prof. Dr. Ing. Jan Černocký

Department of Computer Graphics and Multimedia

prof. Ing. Lukáš Sekanina, Ph.D.

Department of Computer Systems

prof. Ing. Tomáš Hruška, CSc.

Information Technology Research Centre

Ing. Rudolf Čejka

Computer Centre

Employees

total number of employees	**300**
academic staff and researchers	191
other employees	109

Photo: Jitka Janů

2022 at FIT

2022 AT FIT

Faculty of Information Technology celebrated its 20th anniversary

On the first of January 2022, the Faculty of Information Technology BUT celebrated its special "birthday". It is exactly 20 years since the faculty was founded on the foundations of the Institute of Computer Science and Computer Engineering of the then Faculty of Electrical Engineering and Computer Science (which was split into FIT and FEKT in 2002). The culmination of the anniversary celebrations was the FIT Festival held on the last Saturday of April 2022 on the faculty campus. It attracted over 1,100 visitors from the ranks of students, industry partners and the general public, and besides the spring, there was a slight optimism in the air that the covid era was finally over.

Photo: FILMONDO

People

In 2022, 13 new Ph.D. degree holders received their diplomas

In the neo-Baroque auditorium of the Rectorate Building, 9 FIT graduates received their diplomas in June and 4 in December.

- **Ing. Ondřej KLÍMA, Ph.D.**
- **Ing. Jozef KOBRTEK, Ph.D.**
- **Ing. Michal KULA, Ph.D.**
- **Ing. Lenka TUROŇOVÁ, Ph.D.**
- **Ing. Ondřej ČEKAN, Ph.D.**
- **Ing. Vojtěch HAVLENA, Ph.D.**
- **Ing. Radek HRANICKÝ, Ph.D.**
- **Martin KOLÁŘ, Ph.D. et Ph.D.**
- **Ing. Jiří KUČERA, Ph.D.**
- **Ing. Petr MUSIL, Ph.D.**
- **Ing. Jakub PODIVÍNSKÝ, Ph.D.**
- **Ing. Janka PUTEROVÁ, Ph.D.**
- **Ing. Tomáš RICHTA, Ph.D.**

Photo: Jan Prokopius

Two new associate professors:

In September, the Rector of BUT appointed 2 new associate professors from FIT:

- **doc. Ing. Petr Matoušek, Ph.D.**

- **doc. Aamir Saeed Malik, Ph.D.**

In addition to the new appointees, those who had been using the title of associate professor since 2020 or 2021, but for whom due to the epidemiological situation it was not possible to hold the ceremony earlier, received the title of associate professor during a ceremony held on Thursday, 15 September 2022 in the neo-Baroque auditorium of the Rectorate of Brno Technology.

The most popular teachers according to the evaluation of students of FIT are again Dana Hliněná and Jiří Jaroš

For the academic year 2021/22, the top 3 for undergraduate studies were voted as the most popular teachers according to student ratings:

1. **doc. RNDr. Dana Hliněná, Ph.D.**
2. **Ing. Filip Orság, Ph.D.**
3. **prof. Dr. Ing. Jan Černocký**

and the top 3 for the Master's degree:

1. **doc. Ing. Jiří Jaroš, Ph.D.**
2. **doc. RNDr. Milan Češka, Ph.D.**
3. **prof. Ing. Lukáš Sekanina, Ph.D.**

Jan Černocký is once again a member of the Scientific Council of GA CR

On 28. 12. 2022, Jan Cernocký was appointed by the Government on the proposal of the Council for Research, Development and Innovation as a member of the Scientific Council of the Grant Agency of the Czech Republic. This is the second time he will take on this role for a four-year term.

Photo: Michal Fanta

Lack of people is the greatest obstacle to faster IT development

In the 1990s he founded an IT company which today is the international holding Solitea with a turnover of several billion. He employs 1500 people and his company is behind the creation of systems such as eRecept, iDoklad and Dotykačka. For his contributions in the field of information technology he received the medal of the Dean of FIT BUT. But he recalls his entrepreneurial beginnings modestly - I was an IT guy in a sweater with a lack of managerial experience. It could have gone the other way.

You have been declared the Entrepreneur of the Year of the South Moravian Region, the Personality of the Year of Czech Informatics, and in the media you are referred to as the king of accounting systems. What do you think of that?

The moment you represent the company, you kind of take the credit for your employees. These awards are the result of the work of the entire team that works with me. I've been lucky to have incredibly good people for the last 20 years. If it weren't for them, there would be no awards.

The Czech labour market has been suffering from an employee shortage for a long time - are you still able to find quality people for your company?

It is not a problem to find top managers, but it is a huge problem to find normal employees. The IT market faces the biggest problem - the only people who aren't working, are those who don't want to. I'm now curious to see how the war in Ukraine will be reflected in this. We have a similar language to the Ukrainians. We are happy to employ them and help them through this challenging time. Of course, we will also help ourselves through this. I am convinced that, especially in IT, the lack of employees is the biggest obstacle to faster development.

Is the conflict in Ukraine affecting your business in other ways?

have Ukrainian suppliers, for example. However, in time, the war in Ukraine will be felt by all - whether primarily because they have trading partners there, or secondarily because of sanctions. On the other hand, war has always been the engine of progress in the history of mankind. If the Ukrainian crisis is resolved quickly, it could kick-start the economy. Companies will seek to rebuild what has been destroyed, and these opportunities will generate economic growth.

You founded an IT company and were the founder of Solitea Holding, which today is one of the largest regional software producers. But you yourself did not study computer science at the BUT. Why?

It's a rather complicated history. My grandfather was an airline pilot and taught aircraft engines in a machine shop. He was my role model, so I applied for my first degree at the FSI BUT. After half a year of studying, I sat down at the mainframe and found that I enjoyed programming more than drawing gears. I stayed there for two years, then I tried to switch to the electro faculty and start programming. But I went into the army instead. The year 1990 followed and I founded the company Cígler Software in January and left the electro faculty immediately.

There was no one to learn the business from. I worked at the Research Institute of Veterinary Medicine and after the Velvet Revolution, veterinarians had to go into the private sector. I wrote them a price list for veterinary procedures on the first computers. And they said - hey, that's great, but we still need to invoice it. So I wrote another program called Invoice Plus. That's simply how it started. But I wasn't the only one. Other programmers also discovered a gap in the market - hundreds of thousands of start-up entrepreneurs lacked accounting programs. That's how all the programmers started doing them. There were about 500 companies at the Invex exhibition at the time, all offering their own simple accounting programs. It was a one man show - everyone on the street was selling their own software.

In your opinion, is it harder to start an IT business nowadays?

The 1990s were a strange and difficult time, but those who managed to find their place found it easier than today. The lack of managerial skills back then was compensated for by market demand. It's hard to come up with something today that hasn't been done before. I envy the students of the Faculty of Business at the BUT because they have the opportunity to study a mix of subjects that will prepare them for

entrepreneurship. And I see the mistakes I made, and if I had avoided them, I could have been somewhere else. I was just an IT guy in a sweater. I lacked managerial skills and the ability to motivate employees.

How does a Brno company become the international holding Solitea with a turnover of several billion?

That's a good question. If you had asked me in 1995 whether I could imagine having the 1,500 employees I have today, I would have said no. The growth of the company to its first hundred employees was by chance and better business instinct. But the creation of Solitea was a managed process. In 2005, I realised that we needed to expand abroad - and that it would be easiest to buy foreign companies rather than to set up our own subsidiaries there. We have also made dozens of acquisitions of Czech and Slovak companies. However, we are growing steadily, with approximately 10% being organic growth and 20% being acquisition growth. And there is still room to progress - Solitea has a turnover of around 3 billion today, but the Czech IT market is orders of magnitude larger.

Are you still involved in the development of accounting systems?

Mostly yes - we also do programs that manage internal processes. So not only accounting, but also CRM systems or business intelligence. One of the best known products is iDoklad, which was launched in 2006 and is now used by a third of Czech entrepreneurs. It's a nice example that even nowadays you can find a gap in the market. All cloud billing systems were created around 2006 - before that, it was not possible because web browsers were not fast enough. It was just a matter of guessing the right moment and launching a functional product that would make people's lives easier.

You once mentioned that Brno is a golden ship of IT. Why?

Yes, Brno is said to be the Czech Silicon Valley. There are tons of universities that turn out quality graduates. And there are a lot of foreign companies that benefit from that, and that ecosystem creates opportunities. I have to say that Brno universities are producing better and better graduates. Approximately one third of our employees are graduates of the BUT. We have developers coming in and they already know how to code because they have done big projects in the work experience they had during their university studies. And that's very good. I am also involved in mentoring at JIC because I want to share my experience with skilled graduates. I am helping not only them, but hopefully also the Czech Republic to move on from that assembly plant. And I'm also helping myself, because mentoring energizes me.

But you are also energized by things that few could stand.

Okay (laughs). You must be referring to my Dakar Rally projects. It came about completely by accident - I have experience in expedition travel and have visited dozens of countries. So one day I was approached by some friends who asked if I would like to join them on the Dakar Rally as the driver of an escort vehicle. I was very afraid of the first Dakar, but it was good. The beginning was painful, but then you learn - and that's the way it is with everything. I really enjoy driving because for 3 weeks all you have to deal with is eating, sleeping and driving. There's nothing else to do. I return home sleep-deprived, but with a head full of business ideas. It's a digital detox for me in the truest sense of the word.

(mar)

Awards

Dean of FIT receives honorary doctorate from Finnish Lappeenranta-Lahti University of Technology

The Honorary Doctorate was received by the Dean of the Faculty of Information Technology Pavel Zemčík. The Finnish Lappeenranta-Lahti University of Technology (LUT) gave him the award for his contribution to mutual long-term cooperation.

At the ceremony, the university awarded honorary degrees to nine Finnish personalities from the world of science and technology and seven distinguished international partners, including FIT Dean Pavel Zemčík. „These are personalities who have been our partners for many years. We would like to thank them for their successful cooperation and to strengthen our strategic partnerships in the future," said LUT Vice-Rector Jaana Sandström.

Pavel Zemčík established cooperation with the Finnish university more than twenty-five years ago, initially during three research and teaching fellowships he completed in Lappeenranta between 1996 and 1999. Gradually, the cooperation between FIT BUT and LUT began to deepen, and today they are important partners in research, education and exchange visits of students and academics.

„The honorary doctorate is an award that I appreciate very much. I consider LUT to be a top university and I am glad that I could be at the beginning of a partnership that is very strong today. I see this as an appreciation of the entire cooperation between our faculty and our Finnish partners, and when I look at the results that have come out of our cooperation, I believe that joint work on research projects and study programmes will bring many useful things to both parties in the future," says Pavel Zemčík.

The two universities share a research interest, especially in the field of image processing. Researchers from both institutions have been involved in projects such as multispectral image processing, quality monitoring in wood production and plankton assessment. The University of Brno and the Finnish university even have a joint Master's double degree programme inComputer Vision and are currently preparing a joint PhD programme.

Rector honoured distinguished academics and students at the Academic Assembly of the BUT

At the 23rd Academic Assembly, the Rector presented awards to personalities of Brno University of Technology. A total of six gold medals, eight silver medals and ten commemorative medals were presented. During the ceremony, the Rector also congratulated the winners of the student survey Best Teacher according to the evaluation of students at the BUT, who again were Assoc. RNDr. Dana Hliněná, Ph.D. for Bachelor's studies and doc. Ing. Jiří Jaroš, Ph.D. for the follow-up Master's degree, and presented the Rector's Awards to graduates of Bachelor's and Master's degree programmes and young academic staff.

The award winners for our faculty are doc. Dr. Ing. Petr Hanáček, who was awarded the gold medal for his merits for the development of Brno University of Technology and for his significant contribution to the development of interfaculty cooperation while serving on faculty and university bodies at Brno University of Technology.

The silver medal was awarded to doc. Ing. Jan Kořenek, Ph.D. for his long-term team research activities and for his contribution to Brno University of Technology in the area of establishing spin-off companies and Professor Heikki Kälviäinen for the long-term and beneficial cooperation between the Faculty of Information Technology and Lappeenranta-Lahti University of Technology.

The commemorative medal was awarded to Mgr. Sylva Sadovská for many years of excellent results in organisational activities for science and research at the Faculty of Information Technology and Ing. Mieczyslaw Szydlo for his many years of outstanding work, especially in the care for the faculty campus.

For outstanding results in bachelor studies awards were given to Bc. Barbora Šmahlíková and Bc. Michal Hečko.

Photo: Jan Prokopius

Vojtěch Havlena from FIT won 3rd place in the Joseph Fourier Prize

Vojtěch Havlena from the Faculty of Information Technology at the BUT, where he works at the Institute of Intelligent Systems, impressed the jury of the 12th annual Joseph Fourier Prize, which traditionally recognizes young talents in the field of computer science. In his work, he was involved in the development of efficient automated techniques in terms of program verification and network security. He has succeeded in developing new approaches that further advance the practical applicability of finite automata in real-world applications and enable, for example, more effective detection of network attacks and anomalies.

On 23 June 2022, Atos, in cooperation with the Embassy of France in Prague, honoured young IT specialists. The first prize was awarded to Valdemar Švábenský from Masaryk University for his research on methods to support teaching of cyber security. The winners received their awards at a ceremony at the French Embassy in Prague attended by Nobel Prize winner Jean-Marie Lehn. The winners were rewarded with a financial prize and a scholarship for a one-month research internship, the special prize was 50,000 computing hours on a supercomputer at the IT4Innovations centre in Ostrava.

The Joseph Fourier Prize aims to recognize outstanding scientific work with a special focus on artificial intelligence, computer systems and networks, cybersecurity, database systems, human-computer interaction, graphics, numerical analysis, programming languages, software engineering, bioinformatics and computer theory. „With the Joseph Fourier Prize, it is confirmed every year that we have many talented young people in the field of computer science whom we are very happy to support. Every year it is also more challenging to select the best works, because a large number of candidates with very high quality projects apply, but we are even more pleased that young scientists are interested not only in this competition, but in computer science in general," said Jaroslav Vojtěch, Head of HPC & Big Data at Atos in the Czech Republic.

Event

January

- 17. - 21. BISSIT: International Winter School of Information Technology 2022

March

- 1. 3. VGS-IT lecture: Augustin Žídek: Protein Structure Prediction with AlphaFold

May

- 6. 5., 9. 5. International cooperation in the forensic analysis of fingerprints and facial images for the Criminal Police Service
- 11. 5. VGS-IT lecture: Heikki Kälviäinen, Computer Vision Applications

July

- 11. - 26. 7. BISSIT: International Summer School of Information Technology

September

- 15. - 18. 9. Start@FIT: Welcome event for freshmen
- 30. 9. Czech European Researchers' Night at FIT: a pan-European popular science event

November

- 25. 11. We live IT: innovation technology conference

February

- 4. 2. Open day for study applicants
- 2. 2. Theatrical performance on the occasion of the opening of the celebrations for the 20th anniversary of FIT.

April

- 30. 4. FIT Festival: celebrations of the 20th anniversary of the faculty
- 30. 4. Excel@FIT: student projects conference

June

- 22. 6. Invited guest lectures from the Federal University of Santa Catarina, Brazil

August

- 22. - 26. 8. Summer school (F)IT for girls

October

- 21. 10. AI 4 Talents: introduction to the basics of AI for high school students

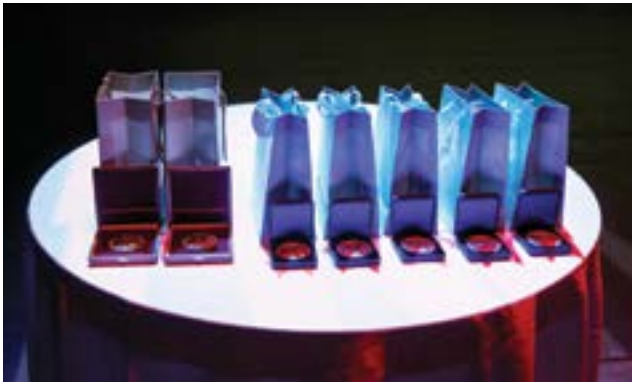
December

- 19. 12. Open day for study applicants

The Faculty of Information Technology of BUT celebrates 20 years. The Minister of Education and the Mayor of Brno congratulated it at the gala evening

The Faculty of Information Technology of the Brno University of Technology commemorated its 20th anniversary on 1 January at a gala evening held at the Brno Municipal Theatre. On this occasion, the Dean of the Faculty Pavel Zemčík presented gold and silver FIT medals. The Faculty was also congratulated on its anniversary by the Minister of Education Petr Gazdík, the Mayor of Brno Markéta Vaňková and the new Rector of the BUT Ladislav Janíček.

At the beginning of 2022, it will be 20 years since the establishment of the Faculty of Information Technology at BUT. The anniversary was commemorated at a gala evening attended by staff, students and invited guests. „In the beginning, there was an effort to give space to a dynamically developing field, which was then beginning to have a growing social impact. Over twenty years the faculty has become a solid part of education and research in the Czech Republic, and I am happy that we are known in Europe and the world. The Faculty has grown considerably in that time, but I am glad that we have managed to preserve the values with which we founded FIT," said Pavel Zemčík, Dean of the Faculty of Information Technology at the BUT.



Information technology has become one of the driving forces of the Brno region over 20 years. „And the Faculty of Information Technology at the BUT also has a great deal to do with this. It has cutting-edge research and knowledge at the edge of current knowledge he can pass on to students. This is extremely important for the entire society," said Czech Education, Youth and Sports Minister Petr Gazdík.

Markéta Vaňková, the Mayor of Brno, also congratulated the Faculty on its 20th anniversary at the gala evening. „The faculty has helped to change Brno during its existence. Thanks to it, South Moravia is turning into a knowledge region, and by cultivating a unique campus, it has significantly helped to change the face of Královo Pole and thus has one of the most beautiful campuses in Europe," said Markéta Vaňková.

The newly appointed Rector of the BUT Ladislav Janíček attended the ceremony as the first official event. „The faculty not only educates top engineers as its graduates, but it is also one of the best performing at the BUT in terms of obtaining international research grants as well as national subsidy projects. It is a significant performer in contract research and collaboration with work experience, including knowledge transfer and the establishment of spin-off and start-up companies. I wish the Faculty many excellent applicants, students, employees and graduates in the coming decades and at least equally successful and even better results in the field of research, including cooperation with work experience," said the Rector of Brno University of Technology Ladislav Janíček.

Photo: Majda Slámová

Excel@FIT 2022

The eighth year of the traditional conference of student ideas took place in the festive backdrop of the FIT Festival, organised in honour of the 20th anniversary of the Faculty of Information Technology. The joyful atmosphere certainly did not detract from the seriousness of the event Excel@FIT and the quality of the work submitted.

A total of 38 papers were submitted, of which 33 were accepted to the conference itself. Expert panels selected the 16 best papers, and 8 representatives of individual research directions had the opportunity to present their work at the beginning of the conference. All the other participants presented their projects in a poster show where their work was evaluated by a panel of experts. A total of 545 votes were cast.

Full results are available on the **Excel@FIT** website.

Photo: FILMONDO

Professional workshops, self-driving cars, concerts and a bouncy castle. Faculty celebrated anniversary at FIT Festival

The last Saturday in April was all about the celebration of the 20th anniversary of the Faculty of Information Technology. The faculty campus welcomed more than 1100 visitors. Beautiful sunny weather and a packed program created great conditions for meeting and enjoying the festival day.

The morning and early afternoon were devoted to science and research: 24 workshops on IT topics, the Excel@FIT student thesis conference, where 33 projects were evaluated this year, visitors had a look into the laboratories and were inspired by Leoš Dvořák's lecture on „Software Quo Vadis".

The courtyard at Hall L was besieged by children. They enjoyed the bouncy castle and competitions, and cheered on the parkour rabbits as they overcame the obstacles. In the FabLab truck, visitors could have a whistle made on a 3D printer and also see the technical gadgets on display.

The Student Union had many games and sports competitions under its direction, and the performances were impressive. For example, the roaring competition, where several participants broke the 120 decibel limit, which the average jackhammer would have had a hard time beating.

In the afternoon, student bands from FIT, followed by Michal Horák and Petr Čadek, took the main stage. And it was a great musical experience from the first to the last song.

Thank you to all visitors for finding their way to us, to our partners for their support and to everyone who gave their time to prepare this event and contributed to the smooth running of the festival day.

Photo: FILMONDO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2022

The best start-up projects received awards in the summer Booster-Challenge@FIT competition

On Wednesday, 21 September 2022, all the projects submitted to the Booster-Challenge@FIT 2022 competition were presented, after which the committee evaluated all the solutions and distributed the financial rewards among the researchers. In all cases, it was clear to see how passionate the researchers were about their task and how much energy and work they put into moving their projects forward, sometimes by a large margin. The committee evaluated the projects mainly in terms of the degree of development of the solution during the competition, i.e. the difference between the state before and after, what challenges the researchers had to cope with, and then generally in terms of the uniqueness of the solution, the topicality of the technologies used, the degree of elaboration, the vision of the commercial potential, the quality of the technical solution, the social benefits and the quality of the market potential research carried out.

The 16th annual (F)IT Summer School for Girls took place at the Faculty

The FIT is very lively in the summer. On Monday, 22 August, the 16th annual (F)IT Summer School for Girls started here. This year, more than twenty talented high school girls with an interest in IT peeked into our labs and classrooms. They had the opportunity to get acquainted with different areas of information technology and its latest trends. The programme of the summer school was inspiring, they were introduced to biometrics, programming, 3D printing and discovered the secrets of virtual reality and the Darkweb. They also had the opportunity to meet with IT experts and partner companies.

Photo: Jan Prokopius

I live, You live, We Live IT - this year for the sixth time at the FIT and again live and in style after the COVID break

The last Friday in November was all about those whose hearts beat to the rhythm of ones and zeros at the Faculty of Information Technology. It is true that a certain propensity for the world of information technology is to be expected at our university, but the sixth year of the interactive conference "We Live IT" brought together graduates, students and experts from the world of work and offered everyone an inspiring convergence of the academic and corporate worlds in a packed programme. Sixteen lectures, 2 panel discussions with participation by 15 IT experts, almost 150 students, 32 panellists from the ranks of IT experts, 45 company representatives and countless lively discussions and shared experiences.

"At the FIT, we are aware that academia and industry cannot function well without each other. We organise the We Live IT conference together with partners of the FIT with the aim of presenting practical professional topics in IT to our students. Cooperation with the IT industry is very important for our faculty, and that is why we have been building a portfolio of partners over the long term, to ensure that the offer of specialisations is broad and of a high professional level. We want to introduce students to our partners, discuss student projects and summer internships and participate in debates with representatives of IT companies and our graduates", says Vítězslav Beran, Vice Dean of the Faculty of Information Technology, explaining the motivation for organising this traditional event.

This year's programme offered visitors a varied selection of lectures on current IT topics. Thanks to them, students from the Faculty of Information Technology were able to get a clearer idea of possibilities for employment in the field. "I am pleased with the high participation by both company representatives and students at our faculty. It's great that even the lectures starting later in the day were packed. And the discussions were lively throughout the whole of the event", says the event organiser, who is responsible for cooperation with partner companies at the FIT.

Each of the speakers offered their specific point of view and outlined the perspective in "their" field of IT. The aim of the event is not only to get acquainted with the latest technologies and trends in the world of IT, but to create a friendly space where students, graduates and representatives of industrial companies can meet and share experiences, career paths, opportunities, dreams and ambitions and get motivated for their further development. "At the We Live IT conference, I liked the stands with experts from the world of work who were happy and very willing to talk about the work they do. Some talented students were even able to arrange an internship. I appreciate the fact that everyone was able to find something to suit them in the pro-

gramme - interesting lectures and panel discussions. And there were some great refreshments too. I am glad that I was also able to contribute a little towards the success of the event", says Lukáš Matuška, one of the first-year students at the Faculty of Information Technology who helped out at the event, sharing his impressions.

Our industrial partners evaluated both the activity of students at the Faculty of Information Technology and their professional knowledge in a positive light. "As far as I am concerned, it was definitely a successful event. As I recall, this year had the highest ever student turnout. My impression of the event as a whole is that it is on an upward trend, and that is important. Even our last lecture was well attended, which makes us happy", says Radek Štourač, a graduate of the FIT at the CTU and founder of Kinali.

Photo: Jan Prokopius

Open Days

Every year an Open Day is organised on two dates (in 2022 it was held on 4.2. and 19.12.) for those interested in studying at our faculty. Applicants have the opportunity to get acquainted with various aspects of studying at FIT, the admission procedure and to see the campus.

Photo: Jakub Vodrážka (SU FIT)

BUT Junior at FIT - young technical enthusiasts learned the basics of programming

On Saturday, 3 December, almost fifty pupils from primary schools and lower secondary schools sat down at the Faculty of Information Technology and learned about the basics of IT and topics such as artificial intelligence, robotics, cybersecurity, blockchain and others. They tried their hand at programming and created the game Snake. The students left enthusiastic and throughout the event showed interest in the topic discussed and the activity during the practical part.

Photo: Zuzana Balgová

Research, Development and Innovation

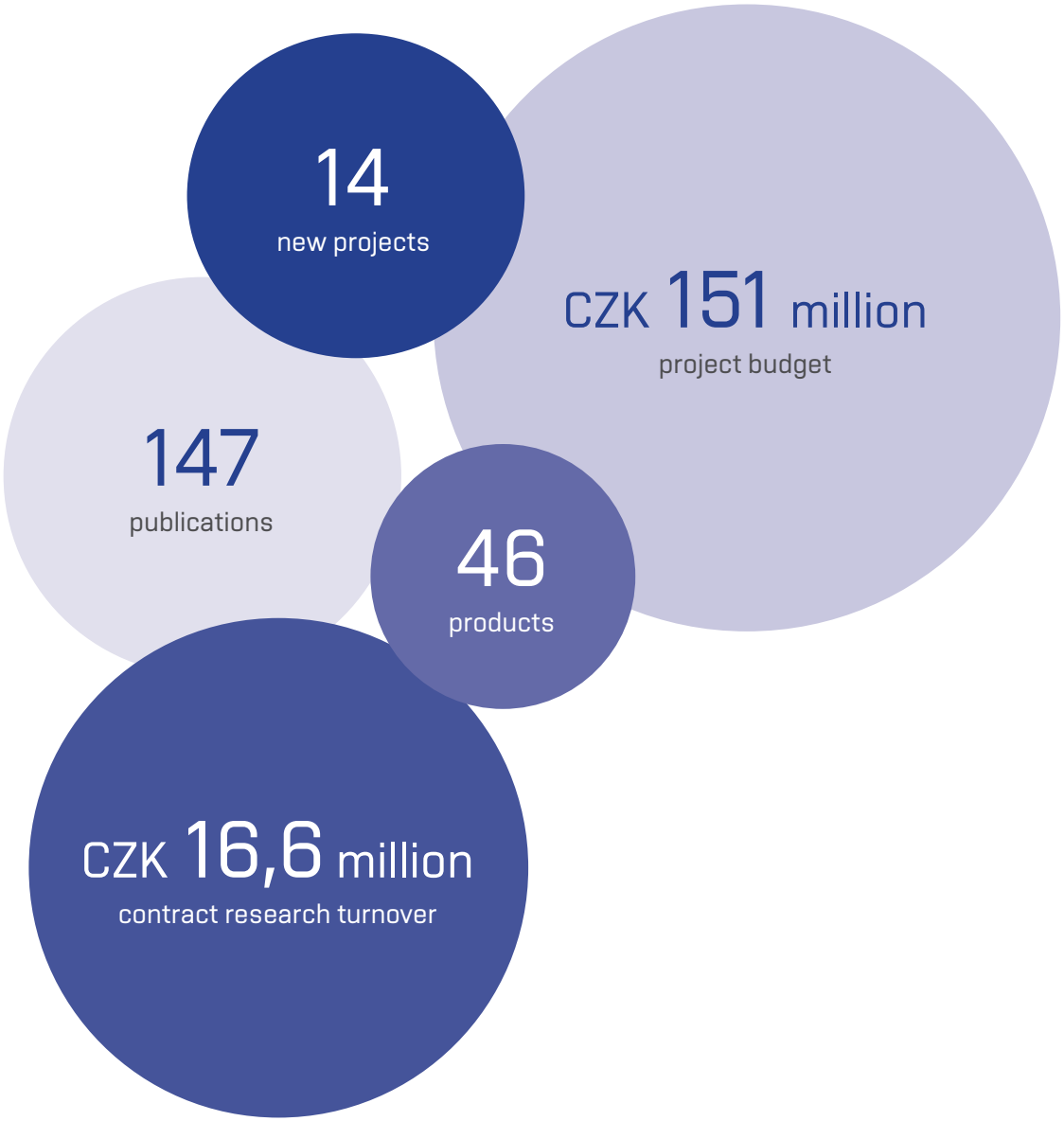
The Faculty has more than 20 research groups, many of which have achieved great success abroad. Many of the local start-ups and spin-offs are now world leaders. The school also promotes its quality in international scientific projects, either independently or in cooperation with other universities, research institutes and renowned companies and institutions. The key areas of science and research at the Faculty of Information Technology are cyber-security, artificial intelligence (AI) and machine learning (ML), automation of information linkage, hardware security, smart device collaboration including document digitization, network security and other areas.

Key areas of science and research at FIT

- Artificial intelligence and machine learning
- Network security
- Verification, synthesis and automata and logic
- Embedded computing and supercomputing technologies
- Evolutionary hardware
- Robotic and cyber-physical systems
- Knowledge acquisition, automation of information linking, smart device collaboration, document digitization
- Theoretical foundations of computer science

These areas are followed by other important activities in the field of infrastructure and applications, including their use in industry (Industry 4.0, Internet of Things), in transport (smart cities, autonomous vehicles), but also in healthcare (challenges of an ageing population, personalised healthcare), in the service of society (digitisation of cultural heritage). We are also interested in the sustainable development of humanity (carbon footprint, smart agriculture) and other human activities affected by information technology (eGovernment, GDPR).

Research at FIT in 2022 in numbers



Institutes, centres and research groups

Department of Information Systems FIT BUT in Brno

The Department of Information Systems provides teaching of courses of the Master's degree in Information Systems. The research activities of the Institute include security, computer networks and the Internet, database technologies, implementation of information systems, software project management, formal language theory and compilers.

Research groups:

- Computer Network Research Group (NES@FIT)
- Hardware-Software Codesign Research Group (LISSOM@FIT)
- Formal Model Research Group (FM@FIT)
- Information and Database Systems Research Group (IS@FIT)
- Management of Software Engineering Research Group (MSWI@FIT)

Year 2022 in numbers:

■ subjects taught in the academic year 21/22	68
■ publications	21
■ products	10

Overview on the FIT website:

Photo: Michal Fanta

Department of Intelligent Systems FIT BUT in Brno

The Department of Intelligent Systems provides teaching of three master's degree courses - Information Technology Security, Intelligent Systems and Mathematical Methods in Information Systems. The scientific research activities of the institute are mainly focused on intelligent systems, especially biometric systems and robotics, but attention is also paid to systems for specific applications, communication systems and sensor networks.

Research groups:

- Research group Brno University Security Laboratory (BUSLAB@FIT)
- Research group Security Technology Research and Development (STRaDe@FIT)
- Automated Analysis and Verification Research Group (VERIFIT@FIT)
- Intelligent Systems Research Group (INTSYS@FIT)
- Modelling and Optimisation Research Group (MODSIM@FIT)
- High Performance Computing Research Group (HPC@FIT)

Inter-institutional research group:

- Robotics Research Group (ROBO@FIT)

Year 2022 in numbers:

subjects taught in the academic year 21/22	59
publications	42
products	18

Overview on the FIT website:

Photo: Jitka Janů

Department of Computer Graphics and Multimedia FIT BUT Brno

Ústav počítačové grafiky a multimédií se věnuje výzkumu a výuce v oblastech interakce člověka s počítačem, dolování multimediálních a multimodálních dat, zpracování obrazu a videa, počítačové grafiky, získávání dolování informací z řeči, moderních přístupů automatického řízení systémů, znalostních technologií a zpracování velkých dat. Staví na pevných základech matematiky, fyziky, teoretické informatiky, zpracování signálů, automatizace a strojového učení.

Research groups:

- Speech Data Mining Research Group (SPEECH@FIT)
- Computer Graphics Research Group (GRAPH@FIT)
- Knowledge-based Technologies Research Group (KNOT@FIT)
- Computational Photography Research Group (CPHOTO@FIT)

Inter-institutional research group:

- Robotics Research Group (ROBO@FIT)

Year 2022 in numbers:

subjects taught in the academic year 21/22	45
publications	56
products	17

Overview on the FIT website:

Photo: Michal Fanta

Department of Computer Systems FIT BUT in Brno

The Department of Computer Systems provides teaching of mainly hardware-oriented courses in all study programmes accredited at FIT. In the newly accredited follow-up Master's degree programme Information Technology and Artificial Intelligence, it guarantees the specialisations Bioinformatics and Biocomputing, Embedded Systems and Supercomputing. The scientific research activities of the institute include HW/SW architecture of computing systems at the levels of digital circuits, single- and multi-processor systems (incl. GPUs), embedded systems, application-specific integrated circuits, reconfigurable field gate array (FPGA) systems, computer clusters and supercomputers.

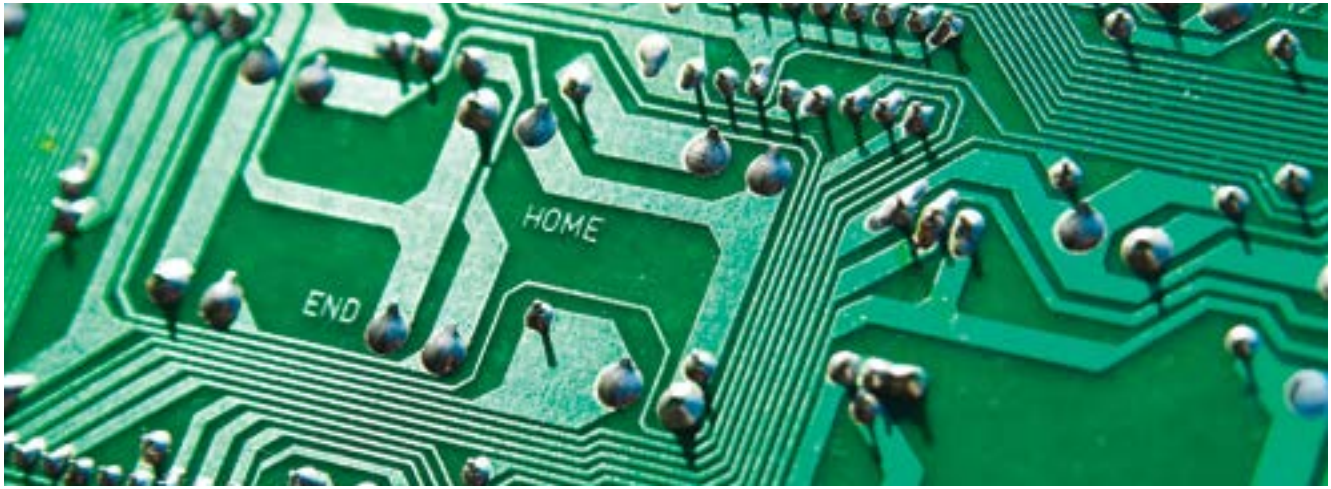
Research groups:

- Cognitive and Neural Engineering Research Group (CANE)
- Evolvable Hardware Research Group (EHW@FIT)
- Unconventional Digital Circuits Research Group (POLY@FIT)
- Dependable Systems Research Group (DIAG@FIT)
- Supercomputing Technology Research Group (SC@FIT)
- Accelerated Network Technology Research Group (ANT@FIT)

Year 2022 in numbers:

subjects taught in the academic year 21/22	48
publications	28
products	1

Overview on the FIT website:



Centres

Information Technology Research Centre

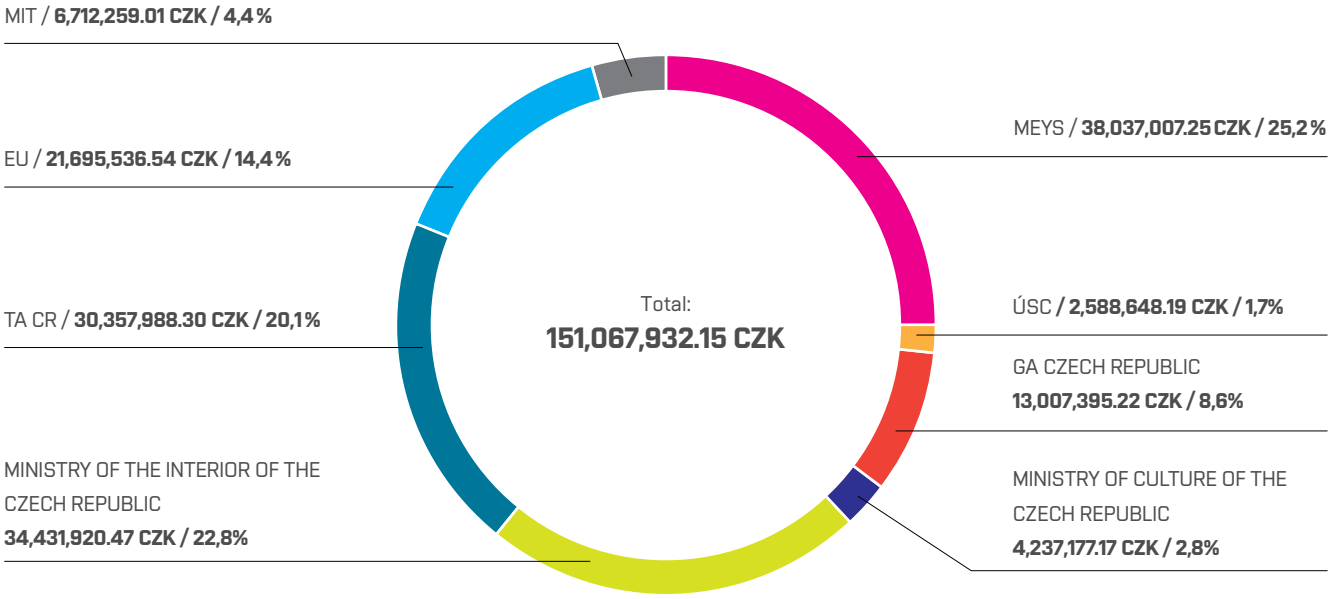
The IT4I Science Centre is a unique project that combines the function of a research centre for academic purposes with research for the needs of the application sphere and interaction with commercial entities in the form of contractual cooperation. The main research areas are information recognition and presentation from multimedia data and secure and reliable architectures, networks and protocols. There are very good opportunities for students - they can learn about cutting-edge projects and non-academic ways of working.

Computer Technology Centre

The Computer Technology Centre ensures the operation of computer laboratories, computer technology, faculty computer network, servers and information systems. Computer laboratories located in the centre are used for scheduled teaching as well as for projects, theses and research tasks. Outside of scheduled classes, the laboratories are freely accessible to all students of the Faculty of Information Technology.

Overview of projects and their funding

Project support by provider



Projects that started at FIT in 2022

Project name	Solver	Provider
AI enabled artistic solutions for sustainable food systems	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
Closed-loop Individualized image-guided Transcranial Ultrasonic Stimulation	doc. Ing. JIŘÍ JAROŠ Ph.D.	EC
Eyes for Information, Communication, and Understanding	prof. Dr. Ing. PAVEL ZEMČÍK	EC
TENACITy: Travelling intelligENce Against CrIme and Terrorism	Ing. VLADIMÍR VESELÝ Ph.D.	EC
AppNeCo: Approximative neural calculations	prof. Ing. LUKÁŠ SEKANINA Ph.D.	GACR
Intelligent sensors for traffic monitoring	prof. Dr. Ing. PAVEL ZEMČÍK	MIT
Development of an autonomous monitoring centre	prof. Ing. MARTIN DRAHANSKÝ Ph.D.	MIT
Activity A - Transformation of the form and content of education at Brno University of Technology	doc. Ing. RICHARD RŮŽIČKA Ph.D. MBA	MEYS
AISEE - AI Software Expert Search Engine for Videos and Photos	doc. RNDr. PAVEL SMRŽ Ph.D.	MoI
Encrypted traffic analysis using network flows	doc. Ing. ONDŘEJ RYŠAVÝ Ph.D.	MoI
Next generation safe transport systems	Ing. Vítězslav Beran Ph.D.	MoI
A suite of forensic analytical tools for image and video processing for the Criminal Investigation and Police Service	prof. Ing. MARTIN DRAHANSKÝ Ph.D.	MoI
Non-invasive and safe identification of objects and products	prof. Ing. ADAM HEROUT Ph.D.	TACR
Protecting aviation from low-energy lasers	prof. Ing. MARTIN DRAHANSKÝ Ph.D.	TACR

Other projects at FIT in 2022

Project name	Solver	Provider
Bio-inspired methods for resource aware computer system design	prof. Ing. LUKÁŠ SEKANINA Ph.D.	EC
Advanced Semantic Enrichment of Multi-Language Literary Text Collections	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
User Activity Analysis and Emotional Competence Assessment for Investigation of Problematic Usage of the Internet	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
Language Generation for Question Answering, Multi-Document Summarization, and Conversational Agents	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
Verification and Validation of Automated Systems' Safety and Security	Ing. ALEŠ SMRČKA Ph.D.	EC
AI-augmented automation for efficient DevOps, a model-based framework for continuous development At RunTime in cyber-physical systems	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
Distributed Artificial Intelligent Systems	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
Arrowhead Tools for Engineering of Digitalisation Solutions	prof. Ing. TOMÁŠ VOJNAR Ph.D.	EC

Project name	Solver	Provider
Framework of key enabling technologies for safe and autonomous drones´ applications	prof. Dr. Ing. PAVEL ZEMČÍK	EC
Next Perception	prof. Dr. Ing. PAVEL ZEMČÍK	EC
Automatic collection and processing of voice data from air-traffic communications	prof. Dr. Ing. JAN ČERNOCKÝ	EC
Real time network, text, and speaker analytics for combating organized crime	prof. Dr. Ing. JAN ČERNOCKÝ	EC
HumanE AI Network	prof. Dr. Ing. JAN ČERNOCKÝ	EC
Multiple Intelligent Conversation Agent Sevices for Reception, Management and Integration of Third Country Nationals	prof. Dr. Ing. JAN ČERNOCKÝ	EC
Exchanges for SPEech ReseArch aNd TechnOlogies	Ing. PAVEL MATĚJKA Ph.D.	EC
Assessing and Enhancing Emotional Competence for Well-Being (ECoWeB) in the Young: A principled, evidence-based, mobile-health approach to prevent mental disorders and promote mental well-being	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
HAAWAII - Highly Automated Air Traffic Controller Workstations with Artificial Intelligence Integration	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
5G-ERA - 5G-Enhanced Robot Autonomy	doc. RNDr. PAVEL SMRŽ Ph.D.	EC
Alliance for developing, teaching and training Digital Forensics and Incident Response students and practitioners	doc. Ing. ONDŘEJ RYŠAVÝ Ph.D.	EC
Neural Representations in multi-modal and multi-lingual modeling	doc. Ing. LUKÁŠ BURGET Ph.D.	GACR
Computer-Aided Quantitative Synthesis	doc. RNDr. MILAN ČEŠKA Ph.D.	GACR
Automated design of hardware accelerators for computational resource-aware machine learning	prof. Ing. LUKÁŠ SEKANINA Ph.D.	GACR
Scalable Techniques for Analysis of Complex Properties of Computer Systems	prof. Ing. TOMÁŠ VOJNAR Ph.D.	GACR
FIT BUT - Preparation of own project within the Horizon Europe programme	prof. RNDr. ALEXANDR MEDUNA CSc.	JMK
Advanced extraction and content recognition of printed and handwritten digital documents to increase their accessibility and usability	doc. RNDr. PAVEL SMRŽ Ph.D.	MK
Industrial research and experimental development at Platební instituce Roger a.s.	Ing. VLADIMÍR BARTÍK Ph.D.	MIT
Meta IT - Intelligent Irrigation System	Ing. JAKUB PODIVÍNSKÝ Ph.D.	MIT
Universal telemedicine software libraries	Ing. PETR SADOVSKÝ Ph.D.	MIT
Research and development of monitoring of the forming part of forging presses	doc. RNDr. PAVEL SMRŽ Ph.D.	MIT
WIM Latin America	prof. Dr. Ing. PAVEL ZEMČÍK	MIT
Topographic image analysis using deep learning methods	doc. Ing. MARTIN ČADÍK Ph.D.	MEYS
Multi-linguality in speech technologies	prof. Dr. Ing. JAN ČERNOCKÝ	MEYS
Identification, classification and numerical simulation of the fracture pattern in acrylic glass sheets	prof. Ing. MARTIN DRAHANSKÝ Ph.D.	MEYS

Project name	Solver	Provider
Efficient finite automata for automatic inference	doc. Mgr. LUKÁŠ HOLÍK Ph.D.	MEYS
Infrastructure for modern IT studies	doc. Ing. RICHARD RŮŽIČKA Ph.D. MBA	MEYS
Modern and Open Study of Technology (MOST)	doc. Ing. RICHARD RŮŽIČKA Ph.D. MBA	MEYS
International Mobility of Brno University of Technology Researchers II	prof. Dr. Ing. PAVEL ZEMČÍK	MEYS
Integrating artificial intelligence into emergency call reception	prof. Dr. Ing. JAN ČERNOCKÝ	MoI
International cooperation in the forensic analysis of fingerprints and facial images for the Criminal Police Service	prof. Ing. MARTIN DRAHANSKÝ Ph.D.	MoI
Robust recording processing for operations and security	Ing. MARTIN KARAFIÁT Ph.D.	MoI
Flexible lawful wiretapping probe	doc. Ing. JAN KOŘENEK Ph.D.	MoI
Security monitoring of ICS control communication in power networks (BONNET)	doc. Ing. ONDŘEJ RYŠAVÝ Ph.D.	MoI
BAZAR: Building a community on the issue of walletless dark markets	Ing. VLADIMÍR VESELÝ Ph.D.	MoI
Next generation integration of atomic force microscopy and electron microscopy	prof. Ing. ADAM HEROUT Ph.D.	TACR
Laser sensor for autonomous truck driving	doc. Ing. PETER CHUDÝ Ph.D., MBA	TACR
Nanoradar for autonomous truck driving and its industrialisation 4.0	doc. Ing. PETER CHUDÝ Ph.D., MBA	TACR
Tactical cognitive agent	doc. Ing. PETER CHUDÝ Ph.D., MBA	TACR
Deep learning v psychoterapii: Strojová analýza nahrávek terapeutických sezení	Ing. PAVEL MATĚJKA Ph.D.	TACR
Encrypted traffic analysis based on contextual analysis using flow data	doc. Ing. ONDŘEJ RYŠAVÝ Ph.D.	TACR
Security and monitoring of distributed production information systems	Ing. ALEŠ SMRČKA Ph.D.	TACR
EmIC - Embedded intelligence for smart cameras with computer vision applications in transport and industry	doc. RNDr. PAVEL SMRŽ Ph.D.	TACR
Embedded intelligence based on advanced machine learning and computer vision techniques for adaptive edge computing systems	doc. RNDr. PAVEL SMRŽ Ph.D.	TACR
Multilingual assistant for information search, analysis, processing and decision support	doc. RNDr. PAVEL SMRŽ Ph.D.	TACR
System for diagnosis and protection of bridge structures using WIM	prof. Dr. Ing. PAVEL ZEMČÍK	TACR
SECUSEN II: Secure Sensors and Data - Industrial Intelligence	prof. Dr. Ing. PAVEL ZEMČÍK	TACR
AI methods for cyberspace security and control systems	Ing. PETR MATOUŠEK Ph.D., M.A.	BUT
Design, optimization and evaluation of application-specific computer systems	prof. Ing. LUKÁŠ SEKANINA Ph.D.	BUT
Reliable, secure and efficient computer systems	prof. Ing. TOMÁŠ VOJNAR Ph.D.	BUT
Modern methods of multimedia and 3D data processing, analysis and display	prof. Dr. Ing. PAVEL ZEMČÍK	BUT

Selected projects

Scientists from FIT and MENDELU will solve how to feed the cities of the future

Scientists from the Faculty of Agronomy at MENDELU and the Faculty of Information Technology at BUT will participate in a European project to respond to major global changes in society. Most of the population is now moving to the big cities, and the question is how to feed these cities? The project, called Hungry EcoCities, will last almost 4 years and has a budget of €2.8 million. One of its goals is to increase people's trust in digital technologies, which are increasingly being applied to agriculture and food.

The research will see growers and agricultural experts working closely with artists, designers and scientists in the fields of IT and artificial intelligence, food science and biotechnology to come up with new ideas for the future food system. "Together with our colleagues, we will strive to increase people's trust in digital technologies and their acceptance in society through the art and development of digital technologies, while still preserving and recognising human values, thus enabling social inclusion and environmentally friendly innovation," said Dalibor Húska from the Institute of Chemistry and Biochemistry at Mendel University in Brno.

One way forward is to introduce digital technologies in the agricultural sector through artist-driven experiments to address social and business challenges beyond sustainability. The whole project is inspired by Carolyn Steel's 2008 book, which addresses a fundamental question of the contemporary civilized world, which includes socio-economic, cultural, and above all agronomic implications for sustainable agriculture.

The scientific consortium consists of eight scientific institutions from seven countries. The Czech Republic is represented by experts from BUT and MENDELU. Together, they are tasked with designing, consulting on and validating the virtual lab. They will consult with artists and link design with functionality. "We will design and build a digital environment that connects with existing platforms to provide a framework for the usability of artificial intelligence to manage the entire process and suggest possible solutions and improvements," added Húska.

Pavel Smrž from the Institute of Computer Graphics and Multimedia will be involved in the project on behalf of FIT, and states in the abstract for the four-year research: "Digital technologies and applications can lead to reduced food waste and more sustainable values, a greener approach and more ethical food consumption. In addition to universities, the project involves a number of Europe's leading agricultural companies with the aim of developing a healthier, more sustainable and affordable agricultural or food system for all."

(vut.cz)

Illustrative photo by: Pixabay

FIT researchers are developing an app for psychotherapists. They want to use deep learning to analyse therapy sessions

To offer psychotherapists systematic feedback on individual therapies and to improve the overall quality of psychotherapeutic care in the Czech Republic - this should be achieved by the new DeePsy application enabling automatic speech processing. Researchers from the BUT Speech@FIT group and their colleagues from Masaryk University are currently working on its development. The application should be completed in June next year.

Psychotherapists lack feedback in their practice that would allow them to continuously evaluate their work. „Psychotherapy is a demanding activity in which therapists process a considerable amount of information. They analyse a lot of information consciously, but much more they process unconsciously and intuitively. They can thus easily miss, for example, small signals of the client's discomfort or even deterioration. Clients usually deal their own problems rather than evaluate the professionalism of the therapist's performance. In addition, some research has revealed a declining level or stagnation of psychotherapeutic qualities over time," explains Pavel Matějka from the group BUT Speech@FIT.

Manual transcription of individual sessions and their subsequent analysis are too time consuming. That is why experts from Masaryk University turned to researchers from FIT BUT who specialize in automatic processing and mining of information from speech. The test version of the DeePsy deep learning application offers psychotherapists automatic transcription of sessions and analysis of their content.

Graphs comparing client and therapist speech show who spoke more during the session and what the average number of words per minute was. Keyword analysis can also reveal what emotions were prevalent in the speech or what proportion of verbs were phrased in the past, present or future tense. The app also evaluates the frequency of the most used words.

„Research studies show that when the language of the client and therapist differs significantly, both in content and form, it can indicate problems in the therapeutic relationship. DeePsy will alert the therapist to such a discrepancy. How this information is handled, however, is up to the therapist. We just provide him with information," Matějka adds.

To extract information from speech, FIT researchers use automatic speech recognition, natural language processing and machine learning technologies. They trained the neural network algorithm on thousands of hours of audio recordings - from interviews to phone calls to spoken monologues. Yet they ran into a problem right from the start: „We found that in therapy sessions, speech is very different from normal speech. Clients are usually emotionally distraught, so they repeat the words much more often - perhaps three to five times before moving on. It took us much longer to come up with a meaningful transcript of the interviews from the start," Matějka adds.

The DeePsy application also includes a client questionnaire system, which together with the audio reports enables systematic feedback for working with clients. „Next, we will work on evaluating the therapist's interventions. The algorithm should be able to recognise whether the therapist is frequently asking questions, interpreting, providing information or making recommendations," says Matějka.

The web application, which is being developed as part of a project of the Czech Technology Agency, is currently being tested by researchers together with therapists at the Psychosomatic Clinic and the Therapeutic Port. It should be ready in June next year. „We hope that it will provide psychotherapists with user-friendly and beneficial feedback that will enable them to improve the quality of psychotherapeutic care in the Czech Republic," Matějka concludes.

(mar)

Photo: Jan Prokopius

FIT scientists want to prevent laser dazzling of pilots. They're developing a security system that will find the attacker

The pilot of the plane is preparing to land on the runway when a blinding green beam illuminates the entire cabin. He has just been hit from the ground by an attacker equipped with a laser. The police register several dangerous incidents a year that can cause a tragic air accident. Václav Havel Airport, together with the Police of the Czech Republic, therefore approached scientists from the FIT BUT, CTU and the University of Defence. The aim is to design a system of aerial protection against low-energy lasers.

Attackers usually try to hit aircraft at the most vulnerable moments - during take-off or landing. Although the aircraft is partially controlled by automatic controls at that moment, manual intervention of the pilot is necessary for the correct direction to the runway. "This usually happens at night, when the beam can irradiate the entire cabin and momentarily blind the pilot. The low-energy lasers used by the attackers have a range of up to 10 kilometres. It is virtually impossible for the police to locate their position and find them in time," explains Martin Drahanský, project leader from the Institute of Intelligent Systems at FIT BUT.

In most cases, attackers target airports with higher traffic, where their chances of hitting an aircraft increase. "It's easier for them to hit a big transport plane because it can't stop or change direction. If they target a helicopter, for example, the situation can backfire on them. Someone decided to blind a military helicopter at a military airport. But it flew to the source, dropped lower and the soldiers descended directly to the attacker. In standard flight operations, however, it is virtually impossible to catch an attacker, as he may be several kilometres away from the airport's borders," Drahanský says.

The solution is to be offered by a 4-year project, which started this year under the auspices of TACR at FIT BUT in cooperation with other institutions mentioned above. Its goal is to design a camera system using smart algorithms that can detect and locate laser sources that threaten air traffic.

"Camera systems equipped with an optometric system with a radiation amplifier will be installed at the airport. They are necessary to be able to identify the laser beam even in good weather conditions, when its visibility is not emphasized by small particles scattered in the air - smoke, fog or clouds. By using computer vision and choosing the right algorithm, we will be able to identify the beam path and project the coordinates of where the person with the laser is on the map. This information is then immediately received by the patrol," says Drahanský, explaining the principle of the security system.

However, according to him, the actual design of a functional solution will not be easy: "We have to choose a suitable algorithm that can detect the beam even in an airport environment full of light pollution. So far, an edge detector based on image rotation is the most suitable. Unfortunately, this is a computationally intensive operation and we need to transmit the data to the patrol within seconds, not the next day. We will therefore have to optimise the computing power and hardware solution to make the system fast, functional and relatively storage-friendly," he points out.

The next challenge will be to identify the attacker in time. "The system will locate him accurately, but if he is several kilometres away, he will probably leave the scene before the police arrive. And if the patrol does catch him, it will not be easy to prove his criminal activity," Drahanský said.

Scientists are therefore considering the future use of so-called patrol drones that would not disrupt the security of the no-fly zone near the airport. "The moment we get the coordinates of the attacker, the drone could go to the site and see if anyone is there. The thermal imaging camera can detect a person even in the dark and can follow them to the car, where it recognises the registration plate of the vehicle. It then immediately sends the information to the police patrol, which is then able to find it in traffic," Drahanský suggests. In about a year, the researchers want to test the system in the military premises of the University of Defence and the Brno University of Technology. They will also approach the Brno airport for trial cooperation. After testing, the system will be installed at Václav Havel Airport. There is nothing like it in the Czech Republic or abroad.

(mar)

FIT researchers are involved in the preparation of the Milani spacecraft, which will map the composition of asteroids as part of a planetary defence test

On 27. 9. 2022, the U.S. Double Asteroid Redirection Test (DART) spacecraft conducted the first successful planetary defence test in history, crashing into the asteroid Dimorphos (Greek for „two forms"), which orbits the larger asteroid Didymos (Greek for „twin") as a moon. None of the asteroids posed a risk to planet Earth, so they could be used as a natural laboratory for testing. The first results of the experiment, i.e. the change in the orbit of the asteroid Dimorphos, will be known in a few weeks from ground-based observations. But it won't be until 2027, when ESA's HERA mission reaches the asteroid pair, that detailed mapping of both asteroids and the effects of the DART probe's targeted impact will be possible. HERA will also carry the smaller Milani spacecraft, which will be equipped with the Finnish-Czech ASPECT hyperspectral camera, mapping the mineralogical composition of both bodies.

Czech scientists and engineers from the Institute of Astronomy of the CAS, the Institute of Geology of the CAS and the Brno University of Technology are actively involved in the analysis of both DART and HERA data. At FIT BUT Tomáš Kašpárek and his colleagues from the AeroWorks group, under the guidance of prof. Pavel Zemčík and doc. Peter Chudý, are involved in the processing of data from the ASPECT camera on board the Milani spacecraft before it is sent back to Earth.

Illustrative photo: Pixabay

Sensors from BUT protect bee colonies from starvation and theft

Do you like honey? And do you know what it takes to get it to your table? The bees must survive the winter, start collecting nectar in the spring and not freeze. But even warm weather and a strong bee colony is no guarantee that the beekeeper will collect the honey. The bees can swarm and fly away, starve, or be stolen with the hive. But there is help. It is called ApiBeekeeper 4.0 and smart scales and sensors providing data to beekeepers remotely were invented by experts from the BUT.

"The hive is closed. It's a black box with something going on in it, and the beekeeper will only know what's going on when he opens it and looks inside. The aim was to make the hive transparent so that all the information the beekeeper needs for decision-making is available immediately from a mobile phone or computer," says the main motivation of researcher Petr Sadovský, who works at the Faculty of Electrical Engineering and Communication Technologies of the BUT.

The frequent opening and inspection of hives tends to be detrimental, the apiaries also usually have to be commuted to and the once a week inspection may not be sufficient in some cases, as the stories of some customers show. In fact, the research team managed to not only develop the system but also bring it to market together with a commercial company within a few months.

"During a big gust of wind, the hives on the apiary fell. The beekeeper would not have detected it practically, but the scales in the app suddenly showed zero. He got there, found the fallen hives and after a few hours put everything back in order. Without the application, he would have found out after a week, and by then it would have been too late," Sadovský adds as evidence the experience of one of the beekeepers.

Bees under scrutiny

The aforementioned scale is one of the accessories designed by the experts from Brno Technology. They also kept in mind that the Czechs are handymen and the hives are definitely not like the ones in the catalogue. "We have come up with a design that is universal for any type and size of hive. The scale monitors the weight of the colony and transmits the data online. Some older beekeepers, for example, use a decimal scale directly in the hive. But it still means going there. We

can see online what is happening in the hive," says Jakub Podivínský from the Faculty of Information Technology.

It was he who came to Petr Sadovský two years ago and told him that he would like to work on something that would be fun, have tangible results and help other people. And since they are both active beekeepers, the topic was decided. Creating a scale was the first step. From the weight of the hive, the beekeeper can see how fast the bees are carrying nectar and whether it is necessary to add another frame, if they have eaten all the winter stores and are not starving, but in combination with the humidity and temperature sensor in the hive, also if the bees have not swarmed.

Petr Sadovský confirms that even the sudden departure of a bee colony that has decided to swarm can be detected without being in the garden. All you need is a mobile phone that receives data every half hour from sensors installed in the hives. "When it's a warm day, around noon the temperature in the hive starts to rise as the bees look forward to flying out. Suddenly, the weight of the hive drops sharply by several kilograms, and the beekeeper knows that there's a problem, takes time off work and goes off to catch bees," laughs the researcher, who once also helped to revive Mendel's apiary in Brno. "About three weeks ago, a customer told us that an alert popped up while he was at work. He sent his wife home to the garden and she found the swarm in a tree. He immediately set out to catch bees," adds Jakub Podivínský.

Catch the thief

Unfortunately, beekeeping is interesting not only for those who have inherited hives or found an interesting hobby, but also for thieves. But even here the system developed at the BUT can help. A small box, which the authors named ApiTracker, is placed in the hive before the season. The bees cover it with wax so that it is hardly visible. If nothing happens to the hive, the tracker is asleep. But the moment the beehive is taken and loaded into the car, the box wakes up, sends an alert to the owner and starts projecting on the map the direction the thief is leaving with the valuable cargo.

"Beehives are sold after the winter for, say, four thousand crowns. This year the brood is excellent and one colony can produce fifty kilos of honey in one year, which is another loss. And, of course, the hive itself costs something," Podivínský calculates the damage, and the theft of one hive easily adds up to more than ten thousand crowns.

Researchers are of course registering the most interested in smart beekeeping among the younger generation. ApiBeekeeper will help to increase honey yields for experienced beekeepers, professionals and beginners. Thanks to artificial intelligence, the future system should be able to predict certain situations and evaluate them based on experience. And for newcomers who have no beekeeper grandfather in the family, it would allow them to sleep peacefully. "Older beekeepers generally don't trust technology that much. They have years of expert experience, they just need to come to the hive and observe nature, they don't even need to open the hive often. They don't need artificial intelligence, they have their own living one," concludes Petr Sadovský.

(tk)

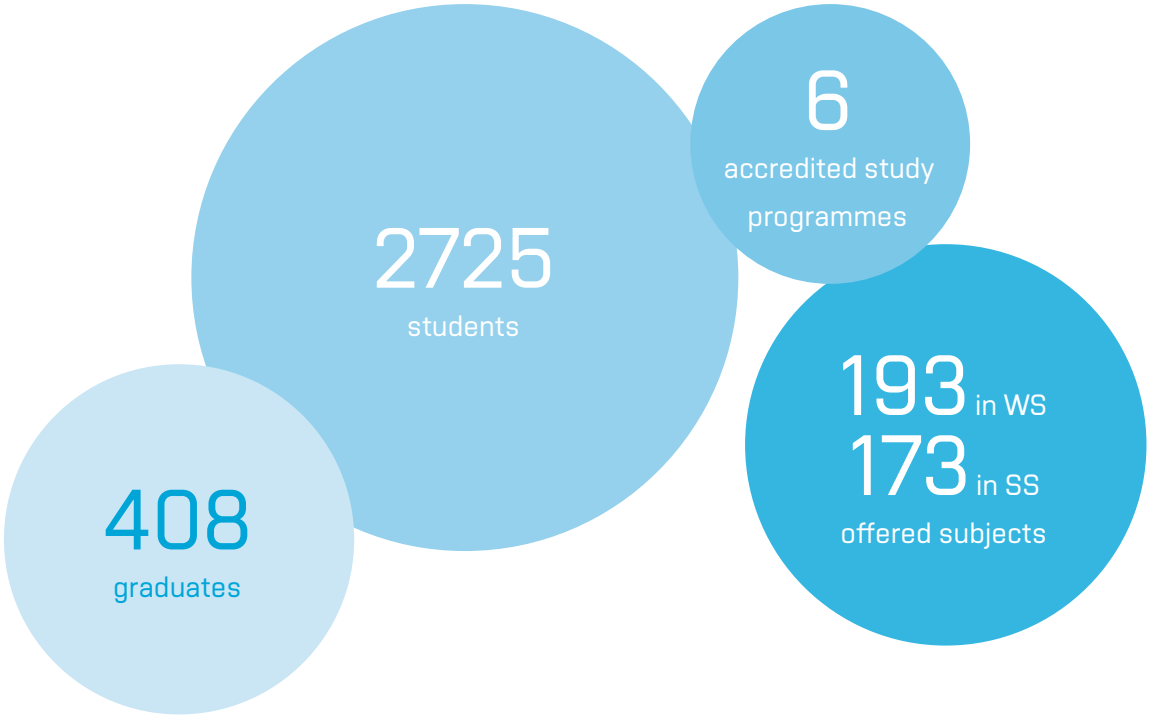
Photo: Jan Prokopius

Education and Study

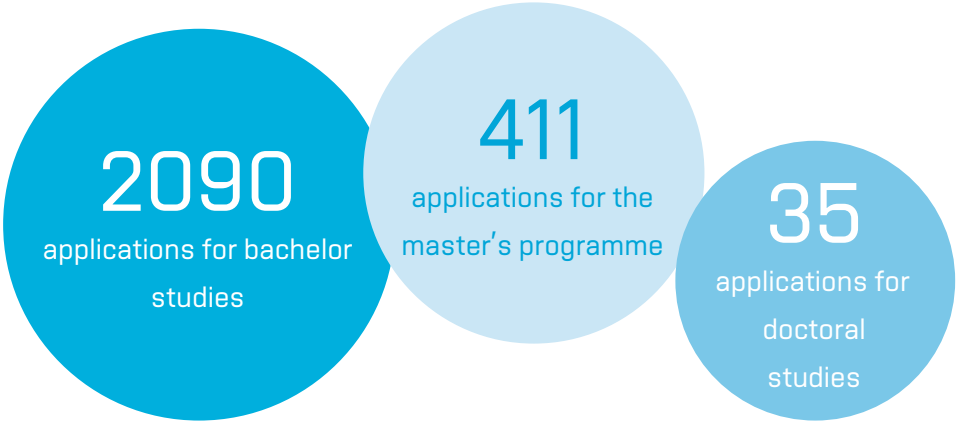
Currently, the Faculty of Information Technology provides education of professionals with the qualification of Bachelor (B.Sc.) in a three-year Bachelor's degree programme, Engineer (Eng.) in a two-year follow-up Master's degree programme and Doctor (Ph.D.) in a four-year doctoral programme.

Photo: Jiří Salik Sláma

Academic year 2021/2022 in numbers



Interest in studying at our faculty



Selected achievements of our students

FIT student interning at CERN develops software that controls particle accelerators

It started with an interest in nuclear physics, chemistry and energy, and continued with an internship at the European Organization for Nuclear Research (CERN) in Geneva. Since March, FIT student Silvie Němcová has been working as an intern in a team developing software that is part of CERN's critical infrastructure. „It's a great opportunity for me to combine IT with other disciplines I enjoy, while being part of a project where interesting experiments are being conducted," he says.

Silvia now works at CERN in the section responsible for power converters. These supply energy to various parts of the particle accelerator complex at CERN. „I am currently working on a project to ensure a quality energy supply for the Super Proton Synchotron particle accelerator. It studies many different particles - from the „normal" ones, such as the nuclei of sulphur or oxygen, to the study of individual protons. The W and Z bosons were also discovered on it, for which CERN researchers won the Nobel Prize," says Silvie Němcová.

It is the proximity to unique technologies and knowledge that Silvie considers the greatest benefit of her stay in Geneva. „There are countless opportunities for education. I can go on excursions with expert commentary from colleagues from different disciplines to places where only CERN members can go, there are educational seminars every two weeks, I can use the experimental facilities, the materials available in the library... For me, as an IT student, it is also inspiring to be in the environment where the world wide web was born, a technology without which we cannot imagine everyday life today," says Silvie.

She adds that in addition to „hard skills", the internship also pushes her in soft skills. „Living abroad is a very enriching experience in itself. Thanks to my previous experience, the supervisor has enabled me to have complete responsibility for my own project and thanks to this I am gaining valuable experience in project planning, people management, communication with people and decision-making," says Silvie Němcová.

At CERN, she is currently developing CI/CD infrastructure to help electrical engineers, particularly in the verification of software for programmable logic automata that provide and control the operation of particle accelerators. „The software our group develops is part of CERN's critical infrastructure. The goal is to have a stable CI/CD infrastructure for this software across the entire complex," she explains.

But Silvie very nearly did not send the application. „The decision to apply was probably the hardest part of the whole process for me. I didn't think I had a chance at all. Therefore, I would definitely advise anyone interested in any internship, conference or competition not to be afraid. It doesn't matter if you don't have all A's or a lot of friends, the most important thing is to be interested," she adds with a smile.

One of the winners of the Brno Ph.D. competition Talent is Tomas Dacik from FIT

Twenty-five young talents who will receive financial support from the City of Brno for their work were selected by the expert jury of the Brno Ph.D. Talent competition. Among the awardees is a PhD student Tomáš Dacík from FIT, who works at the Institute of Intelligent Systems under the supervision of prof. Tomáš Vojnar. The jury was impressed by his work Efficient Static Analysis of Advanced Pointer Programs. The aim of the project is to improve methods for static analysis of low-level programs working with dynamically allocated memory. Bugs in these programs can result in serious security vulnerabilities. The project focuses on the design of new algorithms for working with separation logic, which is one of the most successful methods for representing potentially infinite sets of memory configurations. These algorithms will then be used in tools based on highly scalable bi-abduction analysis.

Third place in the presentation competition 8 from BUT was won by Jan Klhůfek

8 from BUT is a competitive showcase of presentations of the best bachelor theses of students from all faculties of Brno University of Technology for the past academic year. The theses and their authors are nominated by the management of individual faculties. Selected students are first given the opportunity to attend a presentation skills course and then try to turn their experience into a presentation of their topic. Those who are able to present the topic of their bachelor's thesis in a clear and engaging manner to the jury will receive an extraordinary scholarship in addition to a diploma. For FIT, Jan Klhůfek, who is working on an arithmetic circuit generator, won the bronze podium.

Zdena Rábová Award

The annual Zdena Rábová Prize for the best FIT students for 2022 was awarded to Barbora Šmahlíková and Son Hai Nguyen by Dean Pavel Zemčík. In the academic year 2021/2022, Barbora Šmahlíková, a 1st year student of MITAI-NMAT, developed an excellent bachelor thesis on „A new generation of rank-based algorithms for omega automata", whose results were presented at the world's best conferences in the field of formal methods and verification. Throughout her studies, she showed excellent results and was also recognised by the expert panel of the Excel@FIT 2022 student conference.

In the academic year 2021/2022, Son Hai Nguyen, from the 1st year of DPS Information Technology, drafted an outstanding thesis on „Approximation of Ultrasound Propagation by Neural Networks", and was nominated to participate in the IT SPY competition. During his studies, he scored points in the 8zVUT bachelor thesis competition and the CESCG 2019 seminar, and in 2019 and 2022 he was presented with an award by the expert panel and the professional community at the Excel@FIT student conference. Their work was led by Ondřej Lengál in collaboration with Vojtěch Havlena and Adam Herout.

FIT student Son Hai Nguyen made it to the finals of the elite IT SPY thesis competition

Among the 8 best theses in the field of IT was the PhD student Son Hai Nguyen with his thesis "Approximation of sound propagation by neural networks", which he drafted under the supervision of Adam Herout. The finalists came from almost 1200 IT theses of university students defended in the last academic year at leading Czech and Slovak universities. In them talented young computer scientists dealt with theoretical and practical problems that plague today's society. These include, for example, the fight against the spread of misinformation, the falsification of personal documents, communication with customers using artificial intelligence, as well as energy and healthcare issues.

Photo: FILMONDO

Promoting student entrepreneurship in 2022

Star(t)up@FIT is a programme that helps students to break into the world of business. It brings together and educates interested students from the Faculty of Information Technology interested in developing their own IT projects, supports the development of these projects to the product stage, offers consultations from industry experts, and helps to establish business cooperation and start-ups. The programme is for all students who have an idea but don't know how to develop it, for those who have already started and want to take it commercially, and for those who still „don't know how to do it". In addition to regular consultations, a Refactoring workshop was held in 2022 with Y Soft.

Thanks to this workshop, they can learn how to think and act like entrepreneurs, learn important business and project skills, move their ideas forward, fine-tune their technological solutions, get acquainted with the inspiring experiences of successful companies, meet similarly minded and enthusiastic colleagues and gain basic know-how for their own commercial activities.

Booster-Challenge@FIT

In the second year of the creative challenge Booster-Challenge@FIT, 6 projects were awarded a total of CZK 140,000 based on the evaluation of an expert jury. The final presentations took place on Wednesday 21.9.2022 in the FIT Creative Showroom & Open Space. Among the presented projects were novel ideas from the field of robotics and IoT, interesting mobile applications, and also web applications and even desktop solutions. The solvers are both individuals and entire teams, some even quite large. Another interesting feature is the composition of the teams, which in many cases includes colleagues from the faculties of electrical engineering and even mechanical engineering.

The committee assessed the submitted projects in terms of progress in the solution within the project, uniqueness of the solution, topicality of the technologies used, level of elaboration, vision of commercial potential, quality of the technical solution, societal benefit and quality of the market research. In all cases, it was clear to see how passionate the researchers were about their task and how much energy and work they put into moving their projects forward, sometimes by a large margin.

Creative ideas from students in 2022

Matej Viskupič's award-winning algorithm will be used at the National Museum

To solve the optimal placement of exhibits in museums and galleries, the algorithm for tracking people developed by FIT student Matej Viskupič. His work was recognised with an award by the main partner of the competition, the company Sewio, which deals with similar issues, at the student competition conference Excel@FIT 2022.


Photo: Jan Prokopius

How did you get into such a specific area?

During my bachelor's studies, when I was checking out various IT industries, I was interested in the specialization of computer vision. Last year, I did an internship on this topic at a start-up where I observed a warehouse, and when I was considering the topic of my bachelor's thesis, I thought I could use the knowledge I gained there. Moreover, it seemed to be highly applicable in practice. So I contacted Professor Drahanský, who suggested Tracking the Movement of Visitors in Museum Exhibitions as the topic of my bachelor thesis. That made me even more excited and it was clear that I wanted to do it. Martin Drahanský became my supervisor and together with Tomáš Dyke they were very helpful and they recommended that I enter the Excel@FIT competition.

What had you studied about this issue beforehand?

The principle of research is similar to, for example, looking at websites: they also work with the placement and appearance of different elements to keep our attention for as long as possible, and in the same way museums and galleries think about the placement of their exhibits. That's why they keep track of where people move, how much time they spend there and which exhibits are most in demand. My supervisor provided me with literature, from which I learned that the most common current tracking technique is still pencil and paper: researchers in the study area record visitor movements in writing. Another method of tracking uses radio technology. The visitor carries a locator that determines his location. For example, it can be an RFID locator or a smartphone with a special app. Access points are placed in the monitored area and the location of the access point is calculated based on the received wifi signal strength from each point. This solution, however, requires more complex technology and the deployment of special beacons to receive these signals, so it is quite a demanding infrastructure.

What is your approach based on?

Our system works with camera technology: using neural networks, we find out where the visitor is and, by configuring the camera, we can pinpoint their location within the monitored object. Based on the position and image, we can identify the visitor and track him/her by counting his/her trajectories. I record the data in a histogram, which shows the distribution of clothing colour and location of a particular person. Thanks to these two parameters, visitors can be tracked quite accurately in a given facility. I then calculate statistics for each exhibit. The museum management identifies the exhibits, for which I then draw up statistics showing how many people stopped by and how long they spent there. This will actually evaluate the attractiveness of the exhibits and provide valuable feedback on their optimal placement and exhibition composition.

Have you tested the system in operation?

So far I've been testing on my own dataset to show how the output itself works, which tracks the trajectory of people and produces a heat map. Further testing was conducted on the wildtrack dataset, which was developed at a Swiss university and provides synchronised footage from up to seven cameras scanning the square in front of the university. A single record has about twenty people on it and provides 400 images, for a total of about 56,000 detections. I also performed comparisons with other methods on this dataset. As far as detection is concerned, my algorithm did very well, as far as tracking is concerned, there was some room for improvement, but compared to existing methods, my algorithm tracked the captured persons for longer.

What is the main advantage of your system?

First of all, I designed it to be modular. It is composed of several parts that are easily interchangeable. Although I tested and compared the performance of the systems that processed my own dataset and the wildtrack dataset, only one module needed to be replaced. This makes changing the neural networks for detecting people or the algorithm for tracking people really flexible and simple, while the rest of the system still works the same. Changes to the algorithm will be easy to implement, and this is where the high potential of my system lies for the future.

Your work will soon see its first application.

Yes, due to its modularity, the system is able to accommodate certain changes that a particular site will require. The first application site is the National Museum in Prague, which came up with the request to track visitors on its own. My bachelor's thesis was based on this - it was clear that they wanted to use the system and that I was programming something that had to work. Now I have a final exam at the end of my 3rd year, but it is agreed that we will do some more tests at the faculty right afterwards and start the installation. I would also like to continue working at the start-up I worked at last summer to further improve my computer vision skills. I'm already enrolled in a master's program in machine learning. While the latter is very closely related to computer vision, I am still considering switching to a computer vision specialty.

(Events BUT 4/2021-2022)

What am I having for lunch today? Healthy and tasty

Kilojoules and protein, chicken and rice instead of goulash and dumplings - do you think that only bodybuilders deal with similar worries? Everyone should be interested in nutrition, whether they want to lose weight, gain muscle, or just maintain the same weight they were (if possible) in their twenties. Creating an ideal diet should be easier thanks to the application of Jakub Pojsl, a student of computer science at Brno University of Technology, which he created under the guidance of his tutor Vítězslav Beran.

"I had a problem gaining weight for a few years and gradually found that I had to think a lot more about my eating and meal planning. I wanted to create a tool that would make it easier for people, generate a menu based on specific nutritional needs and inspire them what to cook or have for a snack," explains student and enthusiastic athlete Jakub Pojsl, showing me a test version of his app on his laptop screen.

After entering data such as age, weight, height or the amount of physical activity during the day, the program calculates how many calories a person should take in and how to distribute them between protein, carbohydrates and fat, based on formulas and goals. Where many of the internet calculators end, Jakub's is just beginning to show its benefits.

"The app generates a tailored diet according to the nutritional values you set. At the same time, you can have individual meals re-generated during the day if they don't suit you," he points to the breakfast box, where the system automatically puts a bagel, salami and a piece of vegetable. However, if you have a sweet tooth, the system offers an alternative in the form of porridge, which still fits into the recommended daily intake.

Sirloin stew is not breakfast

"One of the things I dealt with was the division of meals so that the system would not recommend goulash for breakfast. The app has fixed rules and the foods have clearly defined categories and it is determined which ones go together. When the algorithm creates a breakfast, it selects, for example, a combination of bread, fruit, and a dairy product," says Jakub Pojsl, who is in his fourth year at the Faculty of Information Technology at the BUT. The app served first as his u


Photo Jakub Pojsl

ndergraduate thesis and inspiration for a family limited by lockdown and then a lack of creativity in coming up with meaningful meals on a daily basis. In the future, it should help anyone interested in improving their eating habits and wanting to make meal planning easier.

Another modern trick should be system learning. For example, if a user repeatedly eliminates dishes with onions from the menu, the app would remember this and avoid dishes with onions in the future. Conversely, one could receive recommendations for foods that people with similar tastes like, as the system would learn across user accounts.

No food is forbidden

Thanks to meal planning ahead and the ability to manually add foods from a large database, it is possible to include foods that are often demonized and in lifestyle magazine articles you read that if you want to lose weight, you have to forget about them for the rest of your life.

"I eat everything, I like pizza or spaghetti Bolognese," says the young computer scientist. Even though his biggest favourite is chicken steak and rice, he created the app with the idea of generating a menu that includes what users really want. Only such a plan can be followed in the long term and will eventually become part of a healthy lifestyle.

A menu that buys itself

Although the app is still in the development and testing phase, Jakub Pojsl is already thinking about further additions: "We are offering to charge for the advanced version. We are also negotiating with the Rohlík food delivery service about the possibility of automatic ordering of food from the generated menu."

There is also a connection to a smartwatch, which would send data to the app if a person has moved more on a given day, for example, and thus needs to replenish more energy. "At the same time, the system would not recommend dumplings as a post-workout meal, but something lighter," adds Pojsl, concluding that no app can force a person to eat healthily.

(tk)

FIT student creates an app that shows how councillors vote in Brno

If you want to know how your councillors voted in the 2018-2022 electoral term, you can find everything in one place. FIT student Kristýna Zaklová has created an application called Visualization of the Brno City Council vote, in which you can find out who voted, who had the most absences, click through to the individual voting points, and compare individual policies.

Kristýna Zaklová has been working on the application under the guidance of Jiří Hynek from FIT since the summer semester 21/22 as part of her project practice in cooperation with the Brno City Council. She will further develop her work in the field of visualization of data from the Brno City Council vote and expand the application.

Cooperation with secondary schools

In 2022, the faculty organized and undertook the following activities for secondary schools:

- Open days for prospective students 4. 2. and 19. 12.
- Participation in Gaudeamus post-secondary education fairs in the Czech Republic and Slovakia (Nitra, Prague, Brno)
- Presentation of FIT studies by our students at selected vocational secondary schools and grammar schools for 4th year students and at mini-fairs of IT faculties at secondary schools in the Czech Republic and Slovakia (Brno, Blansko, Öpava, Židlochovice, Třebíč, Pardubice, Banská Bystrica)
- Specification and offer of SOT topics for interested students from secondary schools
- Presentation of the research groups of the Faculty of Information Technology at the ABD festival in Prague on 28. – 29 5. 2022
- Summer school (F)IT for girls, designed for female students of secondary schools, in cooperation with partner companies on 22. – 26 8. 2022 (workshops, seminars, demonstrations, excursions, meetings with successful IT graduates)
- Offer of participation to students of Brno secondary schools at the conference of student projects Excel@FIT 2022 (30. 4.) and at the conference of new IT technologies We Live IT 2022 (25. 11.)
- Lectures, panel discussions, workshops and presentations by faculty research groups at AI4Talents in VIDA science center 21. 10. - in cooperation with JIC, partner companies and FI MU
- Cooperation with selected vocational high schools and grammar schools in the working group (Brno, Pardubice, Zlín, Ostrava) - high school principals and IT teachers
- Excursion to FIT for students from Banská Bystrica

How we develop young talent - selected events

BUT Junior at FIT - young technical enthusiasts learned the basics of programming

BUT Junior is a project of Brno University of Technology for primary school pupils and students of lower years of multi-year grammar schools. Its aim is to introduce selected pupils and students to the environment of the Brno University of Technology and its study facilities, modern technologies and the latest knowledge resulting from scientific activities at the BUT. The programme at FIT attracted fifty young IT talents on the first Saturday in December and introduced them to the basics of the IT field. Participants also had the opportunity to try their hand at programming.

Two students from 25 high schools arrived at AI 4 Talents

Lectures, quiz, panel discussion, workshops, presentations by research groups and technology companies. All this was part of the AI 4 Talents event, held on Friday 21.10. 2022, as part of the interactive festival of artificial intelligence AI Days at the VIDA Science Centre.

The event for secondary schools was organized by the Faculty of Information Technology BUT together with the Brno AI platform and FI MU. AI 4 Talents was visited by two hundred students with pedagogical accompaniment from a total of 25 secondary schools.

With his novel and information-packed lecture „My and maybe your life with AI", prof. Jan Černocký from FIT kicked off a jam-packed programme on the theme of artificial intelligence. This was followed by a panel discussion with academics from both universities and specialists from the world of practical experience. The following presentations of research groups from the Faculty of Information Technology were very popular: PERO, KNOT and Security@FIT.

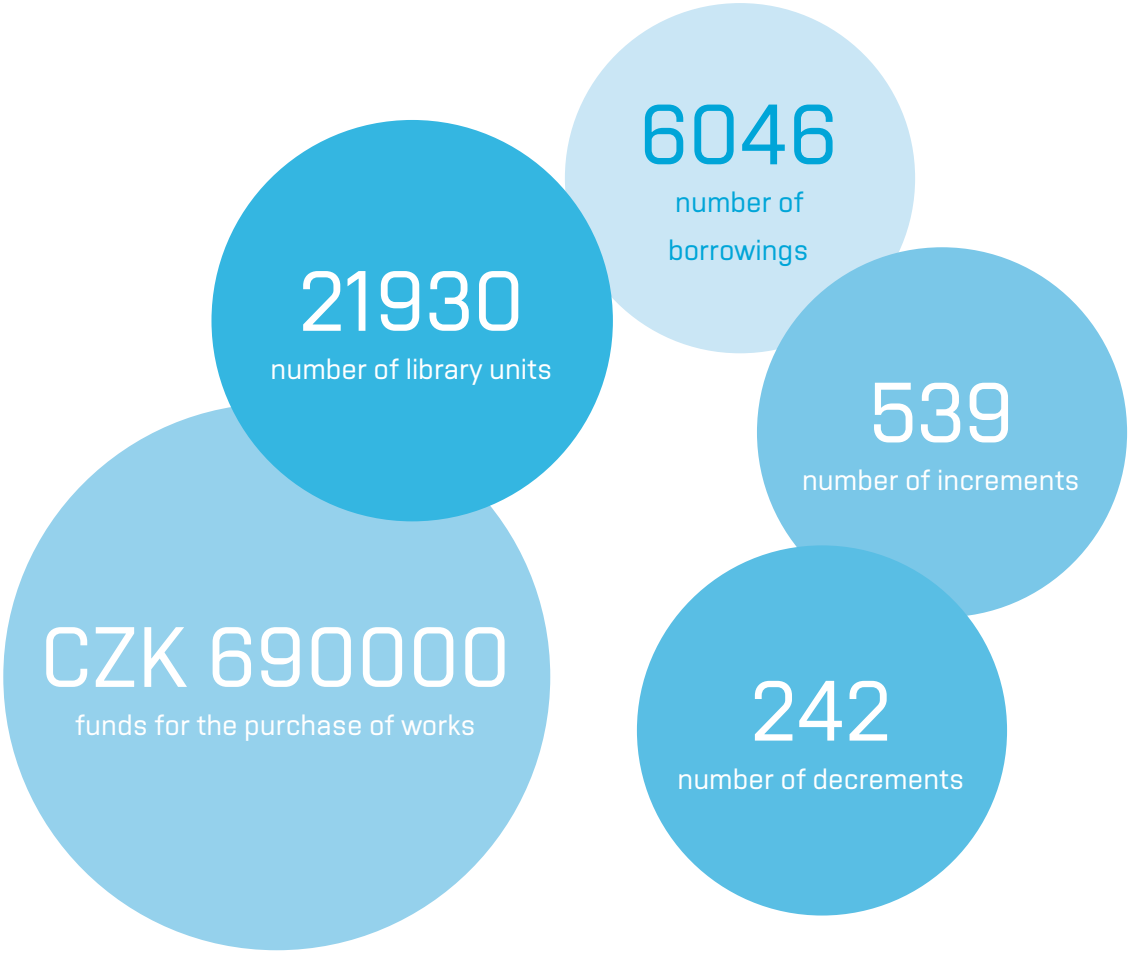
Thanks to an interactive demonstration by the PERO research group, the students learned about the principles of handwriting recognition by computers and how machines learn to read, see and understand. The KNOT Knowledge Technologies Research Group team presented a demo of their web application that searches for the best answers to factual questions in English. The Security@FIT research team introduced the phenomenon of Deepfakes.

Photo: Jan Prokopius

Photo: Jitka Janů

Library

Over 21 thousand library items, 100 study places and 20 places with computers and terminals are available 55 hours a week in the Faculty library. Its 688 m2 of space in the oldest and most historically valuable rooms of the monastery can be used by students as a study room for independent study and a place for group collaboration.



New Double Degree Programme

Internationalisation

The previous years, heavily affected by the global pandemic Covid-19, resulted in a significant decline in the number of international visits and arrivals from partner universities to FIT.
To our great joy, 2022 was a year of a slow return to normality in the field of foreign relations.

International Winter School of Information Technology

In the week of 17 -21 January, 2022, the BISSIT 2022International Winter School of Information Technology was held at FIT, following the summer school held in July 2021 online.

Lectures on Cyber Security and tours of Brno - Master's students from Strathmore University in Nairobi visited FIT

In the last week of June, our faculty welcomed 37 Master's students from Strathmore University based in Nairobi, Kenya. During their stay, they participated in a series of lectures in the field of Cyber Security, after which they received a certificate of participation, toured the centre of Brno, took a trip to Prague and visited the partner company NXP, which prepared a tour of individual workplaces for them. Most importantly, they had the opportunity to soak up the atmosphere of the faculty. And they were obviously very impressed by it. Several of the students have expressed interest in applying for doctoral studies here.

The BISSIT Summer School was again held at FIT this year

The third edition of the BISSIT International Summer School took place on 11. - 26 7. 2022. To our great joy, this summer was marked by a return to attendance mode. The faculty was attended by 28 students from Korean universities: partner Dankook University, Kyonggi University, Soongsil University, Sunmoon University and Wonkwang University. We also welcomed 17 students from Strathmore University and one student from the University of Crete. Participants of the summer school chose Machine Learning and Cyber Security and Forensics courses according to their preferences. In addition to classes, students also enjoyed leisure activities - an excursion to the partner company NXP, a tour of Brno and Prague and a trip to the Moravian Karst.

New Double Degree Programme

On Wednesday 9 November, the Rector, the Vice-Rector for Internationalisation and the Dean of the Faculty of Information Technology met with representatives of the Finnish Lappeenranta-Lahti University of Technology LUT. As part of the collaboration, the two universities signed an agreement for a new Double Degree programme. It is a joint study programme between FIT BUT and LUT. FIT students can take it as part of the Information Technology and Artificial Intelligence degree programme. The unique combination of courses from both institutions aims to deepen students' knowledge, particularly in the areas of computer vision and image processing. The Double Degree programme was created on the basis of many years of successful cooperation between FIT and LUT.

Foreign cooperation

In the academic year 2021/22, new partnerships with foreign institutions were established:

name of institution	state	type of ontract
Institute of Space Technology Islamabad	Pakistan	MINI
Lahore University of Management Sciences	Pakistan	MINI
National University of Science and Technology, School of Electrical Engineering and Computer Science	Pakistan	MINI
Kinneret Academic College	Israel	MINI
Ensimag, Grenoble Institute of Engineering and Management	France	Erasmus
University of Pisa, Department of Information Engineering	Italy	Erasmus
University of Porto, Faculty of Engineering	Portugal	Erasmus

*MoU = Memorandum of Understanding

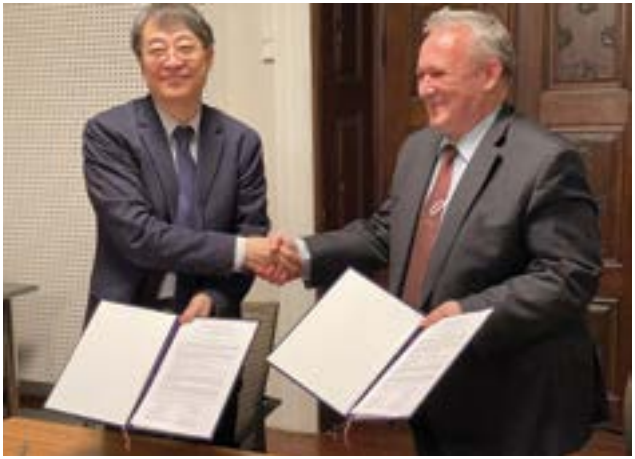
A complete list of partner universities is available on the website:

Foreign visits

In 2022, our faculty welcomed:

- Nah Yunmook, Dankook University, Korea - visit within the BISSIT courses, signing of MoU between FIT BUT and Software-Centric University Project Group, DKU
- Egger Bernhard, Friedrich-Alexander University, Germany - defence of the dissertation of Ing. Oldřich Kodym - opponent and member of the VGS-invited talk - lecture on „Inverse Graphics and Perception with Generative Face Models“
- Szalachovski Pawel, Singapore University of Technology and Design, Singapore - presentation in Blockchains and Decentralized Applications on Better Consensus Protocols
- Weinberg Kerstin, University Siegen, Germany - Collaboration in the project Identification, classification and numerical simulation of fracture pattern in acrylic glass sheets
- Kälviäinen Heikki, Lappeenranta University of Technology, Finland - VGS talk
- Umesh Srinivasana, Indian Institute of Technology Madras, India - visit within the framework of the project LTAIN 19087, funded by the Ministry of Education and Science on the Czech side in the INTER-EXCELLENCE, Inter-Action programme and by the Department of Science and Technology (DST) on the Indian side
- Garcia Otto Gustavo, Universidade Federal de Santa Catarina, Brazil - cooperation in the development of intelligent transportation systems, lecture on Weigh-in-Motion new approach to reduce vehicle dynamics uncertainties
- Badura Ján,Comenius University in Bratislava, Slovakia - Erasmus+ Staff Mobility for Training
- Wepner Saskia, Graz University of Technology, Austria - research fellowship in speech processing
- Mumtaz Wajid, National University of Science & Technology, Pakistan - conducting a series of seminars on EEG
- Erich Baker, Baylor University, USA - negotiations on cooperation
- Fritzsch Celemens, Faculty of Mathematics and Informatics, University of Leipzig, Germany - UPSY seminar lecture and discussion on collaborative research
- Lőrincz András, Faculty of Informatics at Eötvös University, Hungary - VGS-Invited Talks at FIT
- Casino Fran, University of Piraeus, Greece - lecture and joint research on central bank digital currency using blockchain and trusted computing
- Kälviäinen Heikki, Lappeenranta University of Technology, Finland - promotion of the joint double degree programme, Presentation of Lappeenranta University of Technology to those interested in studying abroad
- Faye Ibrahima, Universiti Teknologi PETRONAS, Malaysia - conducting a series of workshops related to machine learning and neuroimaging
- Liu Hao, Beihang University, China - establishing cooperation with International School Beihang University
- Nötzel Ralf, University Siegen, Germany - discussion on the ongoing project and future cooperation
- Villalba Lopez Jesus Antonio, Johns Hopkins University, USA - defence of Anna Silnová's dissertation, opponent and committee member

Signing of a Memorandum of Cooperation with a representative of the Korean Dankook University



Student mobility

FIT students' trips abroad in the academic year 2021/2022

Total 53

Programmes

- Erasmus+ 44
- intergovernmental agreements 0
- cooperation Agreements and Freemovers 9

Countries of departure

Denmark	4	Austria	3
Finland	4	Greece	3
Ireland	1	Singapore	1
Italy	2	United States of America	2
Korea	3	Germany	6
Lithuania	1	Spain	3
Latvia	1	Switzerland	4
Malta	1	Thailand	1
Netherlands	2	Great Britain	3
Norway	4		
Portugal	4		

Arrivals of foreign students for study stays in the academic year 2021/2022

Total 57

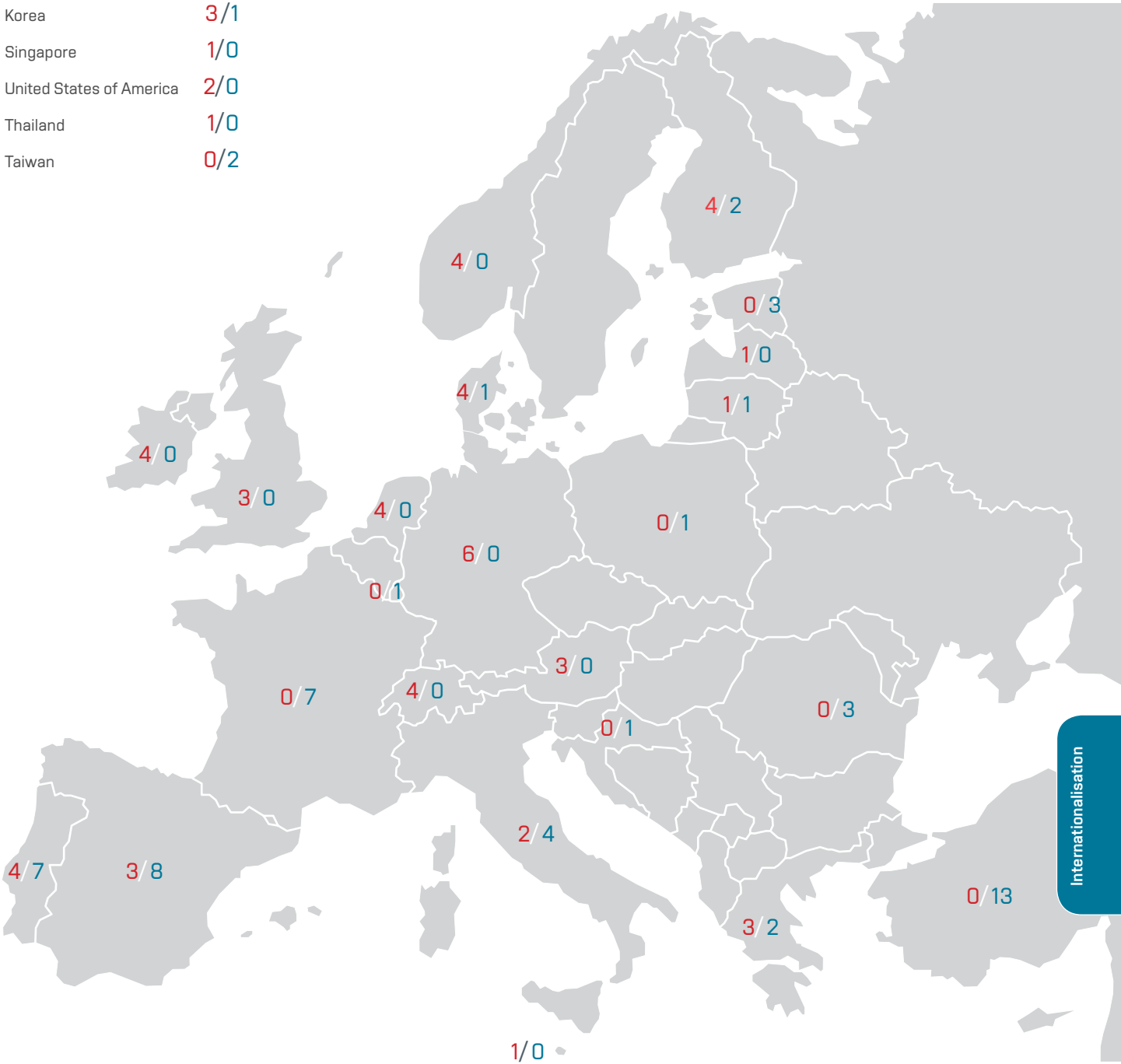
Programmes

- Erasmus+ 49
- intergovernmental agreements 1
- cooperation Agreements and Freemovers 7

From countries

Denmark	1	Poland	1
Estonia	3	Portugal	7
Spain	8	Romania	3
Finland	2	Turkey	13
France	7	Taiwan	2
Greece	2		
Croatia	1		
Italy	4		
Korea	1		
Lithuania	1		
Luxembourg	1		

Korea	3/1
Singapore	1/0
United States of America	2/0
Thailand	1/0
Taiwan	0/2



International staff mobility

In the academic year 2021/22, 19 faculty employees travelled to foreign institutions to gain new experience.

Foreign Workers at FIT

In 2022, there were 42 employees from abroad working at FIT in academic and support positions. We are pleased that the environment at our faculty is so welcoming and inspiring that some of them have decided to settle here permanently. As Mireia Diez Sánchez, a researcher with the BUT Speech@FIT research group, she has been teaching computers to understand human speech for over five years at FIT. She originally came to Brno for an internship and liked it so much that she came back and stayed here.

Photo: Michal Fanta

The brain is still a mystery to us

Can brain scans tell whether a person will develop depression or suffer a stroke? And can we diagnose ourselves at home on the couch with a cell phone? These and other questions have been asked for many years by Aamir Malik, who gradually made his way from Pakistan to Brno. The Faculty of Information Technology is creating algorithms to help process images of our most important organ, but one that scientists do not yet fully understand.

„We have the structure of the brain fairly well mapped because centuries ago people were fascinated by the brain and studied it. They simply opened the skulls of the dead, looked at the brain and guessed what part was used for what," Aamir Malik gives a brief excursion into the history of the scientific field to which he has devoted his life. But he doesn't focus on the visible folds of the cortex; he studies how the brain transmits signals and communicates across its centres. He obtains data from, for example, magnetic resonance imaging and processes it further.

What can he find in them? „I look for various abnormalities, signs that a person may be developing, for example, an anxiety disorder or depression," the researcher says. Depression is not just a state of mind on Monday morning when we don't feel like going to work. It's a disease that the algorithm could detect in time. „Doctors ask patients how they feel, what they eat, how their mood changes? But this is very subjective and it depends very much on the experience of the doctor and the patient's ability to talk about their condition."

Photo: Jan Prokopius

From Pakistan to Brno via Australia

Aamir Malik became interested in biomedical engineering and medical imaging when he went to South Korea to study at the Gwangju Institute of Science and Technology after study in his native Islamabad. From there, his journey led him to Malaysia, where he first worked in an imaging laboratory, then was instrumental in converting it into a research centre and a few years later became its director, leading 130 researchers. Then he headed to Australia, among other places.

"I was looking for another opportunity and I found a call from BUT. They wanted a person who would bring something new to the faculty, so I applied," Malik recalls. Representatives of the faculty asked him to come and give a lecture in Brno. But it was July 2020 and there were strict travel restrictions in Australia because of covid. Everything was finally done online, the BUT expressed interest and in October 2021 the Pakistani scientist arrived in Brno.

Depression medication, experiment number three

In his research, he compares brain scans of healthy patients and those diagnosed with depression, for example. He is creating an algorithm that would do this work for him and alert him to the disease, even in its

early stages. In addition to costly MRI scans, the programme could be based, for example, on the results of an electroencephalograph scan, which is also used by GPs.

The next step would be to compare images of depressed patients undergoing treatment: "If your doctor diagnoses you with depression, what does he do next? He will prescribe you one of a number of antidepressants. He'll tell you to take them for maybe four to six weeks and then come in for a check-up." If the symptoms disappear or lessen, the choice of medication was correct. If not, the doctor prescribes another kind and everything starts all over again. "By comparing brain scans, we can tell with some probability whether a particular type of antidepressant will work for a given person. We want to reduce this 'try and see' approach and bring more measurable indicators to the issue," hopes Aamir Malik.

According to the researcher from FIT BUT, the possibilities of use are almost unlimited. He is researching dementia, but also early detection of stroke. It often happens that when a person has a stroke, they are monitored in hospital, sent home, and the next day a second stroke occurs, which can be fatal. Modern technology could predict whether such a scenario is imminent for a given patient.

Nobody goes to the doctor with stress

A sensible lifestyle, a balanced diet, relaxation, adequate exercise - all this should be part of an equation that also includes work, family and a healthy person after the equal sign. Often this is not the case and stress creeps into our lives, sometimes even taking over. But who among us takes stress as life-threatening?

And yet we shouldn't underestimate stress, warns Aamir Malik: "It can lead to the development of depression, anxiety, but also cardiovascular problems." But how do you tell when you've had too much stress? Self-diagnosis, i.e. examination at home by the user himself, could help with this. Isn't that utopia? Today people monitor their heart rate on their watches, and during the covid pandemic almost everyone had a blood oxygen meter that was put on their finger.

For starters, Malik said a mobile phone would be enough. "They take photos of the face, record audio and record handwriting. We can read a wide range of emotions from the face, as well as from the voice, from the writing we can detect pressure and tension, and all this gives us a picture of whether a person is under stress." If the app detected severe stress, it would of course recommend a visit to the doctor.

In a roundabout way, the researcher from Pakistan is taking a stressful trip back to his beginnings at the BUT, but in reality we are not straying too far from the topic. "When I came to Brno, I was really surprised at how hard-working students in the Czech Republic are. They study into the night: you don't really see that much in southern Europe, and I have the experience to draw a comparison. I also meet faculty colleagues who sit in on Saturdays and some on Sundays. I think a little bit of that southern or Australian approach would do no harm," he concludes with a smile.

(Tereza Cinka)

In research, one has to keep learning. It's a great job for inquisitive people, says graduate working in Singapore

Jakub Pružinec, a graduate of FIT, has been working in distant Singapore for over two years. At Nanyang Technological University (NTU), he is a research assistant in the HP-NTU Corporate Lab, a new lab created by a collaboration between the university and HP. "You get a taste of both the academic world and industry," says Jakub Pružinec.

He got to the University of Singapore in a rather unconventional way. "After completing my bachelor's thesis, I was looking for research opportunities where I could gain experience and, more importantly, references for future doctoral studies. I came across the university website of Professor Liu Yang, who runs several security labs at NTU, where he was offering research positions for a new lab. They were intended for post-graduates and I, as an undergraduate student just before my state exams, wrote to him with only a little soul," Jakub Pružinec laughs today.

As he adds, the study results, the support of Professor Černocký, who recommended Jakub through mutual friends, and of course luck helped. "During my studies at FIT, I met many exceptionally intelligent and capable students. I was surprised, however, that they often did not realize this and considered foreign programs out of their reach. FIT is a demanding school, but it gives you everything you need to fully realize yourself. You just have to try," says Jakub Pružinec.

Today, he works in the security team, which is mainly engaged in malware analysis and evaluation of the effectiveness of security measures. "In research, you have to keep learning. De facto, I am partly paid for education and training. I have a free hand at work and I can do what interests me. It's a perfect job for young and especially curious people," says Jakub.

But as he says, it was not easy to get used to it. "The biggest challenge is clearly the separation from family. It's the price for discovering the world. In addition, you constantly perceive that you have a different dialect, customs and especially a sense of humour. Many times I had to save the situation with the magic words just kidding," Jakub laughs and adds that he eventually fell in love with Singapore. "It's a very vibrant place with five million people, you make friends and build a support structure quickly," he says.

He has no plans to return to Europe anytime soon. "Here you have a great opportunity to publish and patent your results. Such references are very valuable when applying for further studies, academic positions or jobs in industry. And I would like to start my PhD studies after finishing my projects. Preferably in America," he says.

Photo: archive of J. Pružinec


20
YEARS

Cooperation with Industry

Brno is often referred to as Europe's Silicon Valley. The Faculty of Information Technology, located in its centre, is as close to global companies, promising start-ups and top research teams as it can get. We work with partners with whom we find a common professional interest in a number of areas:

- joint preparation of national and international research projects
- contracts, services and licences in the field of information technology
- hosting of laboratories and research facilities
- research topics with possible student participation
- cooperation in student teaching
- support for faculty events, conferences and competitions
- promotion of a partner on the faculty premises

At FIT, we believe that in addition to a solid theoretical foundation, contact with the private sphere is an essential prerequisite for a successful career in IT. We are therefore happy to let our corporate partners teach selected subjects in the form of seminars or lectures, upon agreement with the teacher or subject guarantor.

In 2022, our cooperation with companies took this concrete form:

- 15 companies participated in the Excel@FIT 2022 student project conference
- 11 companies presented product demonstrations, lectures and workshops at the FIT Festival, organized on the occasion of the 20th anniversary of the Faculty
- 18 companies presented their technologies at the Live IT 2022 conference
- involvement in the implementation of the Summer School (F)IT for Girls in the form of workshops and excursions in companies
- participation in the implementation of summer professional schools for foreign students in the form of excursions in the company (International Summer School in IT and Cyber Security lecture series)
- assignment of topics Bc. and Ing. theses - 42 defended last year, 11 of them received awards

FIT partners

Golden Partners

- Honeywell, spol. s r.o.
- Avast Software s.r.o.

Silver partners

- T&T Global Network Services Czech Republic s.r.o.
- CAMEA, spol. s r.o.
- SAP ČR, spol. s r.o.
- ŠKODA AUTO a.s.
- Thermo Fisher Scientific Brno s.r.o.
- Red Hat Czech s.r.o.
- Espressif Systems (Czech) s.r.o.

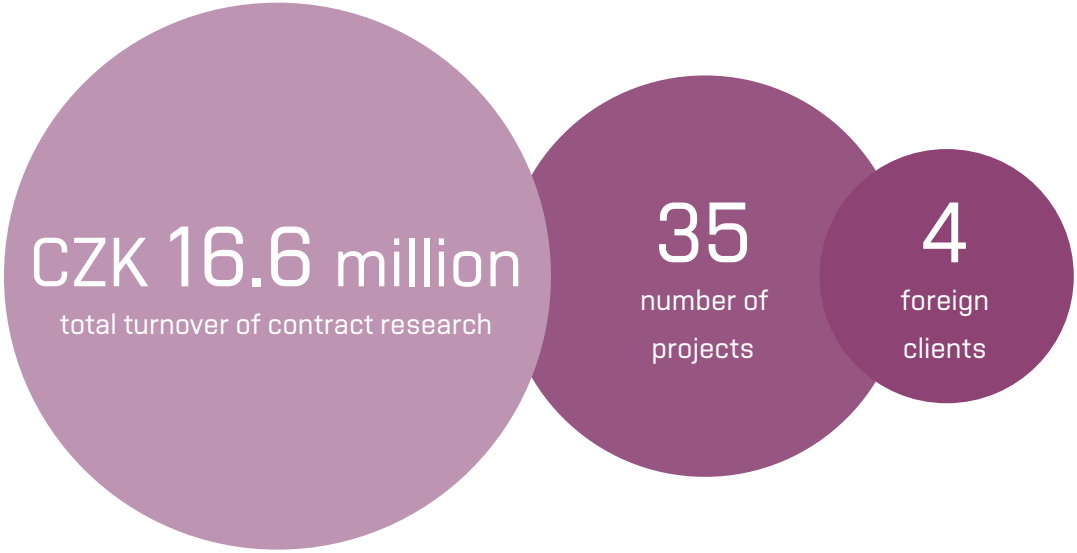
Bronze partners

- Phonexia s.r.o.
- TESCAN 3DIM, s.r.o.
- NXP Semiconductors Czech Republic s.r.o.
- Allium, s.r.o.
- FNZ (UK) Ltd - Czech Branch, odštěpný závod
- Intel Czech Tradings, Inc
- SolarWinds Czech s.r.o
- 24i Media CZ s.r.o.
- ARTIN, spol. s r.o.
- Edhouse s.r.o.
- GINA Software s.r.o.
- ChyronHego Czech s.r.o.
- Kyndryl Client Center, s.r.o.
- Innovatrics, s.r.o.
- IN2CORE s.r.o.
- IS4U, s.r.o.
- Kinalisoft s.r.o.
- Mavenir s.r.o.
- Oracle Corporation
- Smartlook.com, s.r.o.
- TESCAN Brno, s.r.o.
- Y Soft Corporation, a.s.
- CROSS Zlín, a.s.
- SEACOMP s.r.o.
- Sewio Networks s.r.o.

Start partners

- ReplayWell, s.r.o.
- COGNITECHNA s.r.o.
- BringAuto s.r.o.
- World from Space s.r.o.

Contract research at FIT in 2022 in numbers



Cooperation with other institutions

Five European Centres for Digital Innovation will be established in the Czech Republic. It will also include FIT

Five candidates nominated by the Czech Republic succeeded in the European call for proposals of the Digital Europe Programme. Among them is the Cybersecurity Innovation Hub, of which FIT is also a part. In addition to the Faculty of Information Technology, which coordinates the project on behalf of the BUT, Masaryk University, CTU, the Technology Centre of the Academy of Sciences, the Regional Chamber of Commerce Brno, Industry cluster 4.0 and the CzechInno association will also participate in the project. The new European Centres for Digital Innovation are designed to help small and medium-sized companies in particular go digital. The centre will provide services such as technology, testing or prototyping solutions, especially in the field of cybersecurity, and will also participate in professional training and access to innovation ecosystems. In addition, FIT will be part of one more centre as a co-investigator, the DIH DIGIMAT digital innovation hub led by CEITEC BUT. For more information, see the press release of the Ministry of Trade and Industry, which is the main coordinator.

Kinalisoft is receives an award in the Visionaries 2022 competition for its future product quality controller technology

On 6 December, the CzechInno association announced the winners of the twelfth year of the Visionaries project. Among the six entities awarded the title of Visionary 2022 are the following companies Kinalisoft, a partner company of the Faculty of Information Technology. It scored points with the Test-it-off system - the product quality controller technology of the future and its technological and economic benefits in the field of industrial production. Kinalisoft was founded when its founders were still students at FIT, and most of their employees come from our faculty. They see the collaboration with the Faculty of Information Technology on research grants as an integral part of the success of the Test-it-off system. The test-it-off project was carried out at FIT by a team of the ROBO@FIT research group.

The Visionaries project searches for, recognises and highlights exceptional innovative achievements in Czech business and cooperation between applied research and practice with significant technological, economic or social benefits or a combination of both. The expert jury, consisting of thirteen renowned state organizations and project partners, highly evaluated the breadth of the societal benefits of the awarded innovations and the usefulness of their implementation in practice with an emphasis on sustainability, ecological and economic solutions, benefits for health protection and also the penetration of innovations into fields such as forestry, agriculture or food processing.

AI Days : Discover artificial intelligence as a smart assistant for everyday life. The Brno.AI Interactive Festival took place in Brno

An autonomous car, a receptionist, an app for the blind, but also voice recognition, a virtual power plant or the development of a cure for coronavirus - artificial intelligence has its place everywhere. The Brno.AI community organised an event to introduce the use of artificial intelligence in practice to various target groups. The Brno.AI community includes Brno universities, startups, AI fans and representatives of corporations. „We perceive the Brno AI Days as an exceptional connection between research and industry in the South Moravian region. The term AI covers a wide range of information technology applications - from industrial applications to the arts. We are glad to be part of this event and to see in one place not only the results of our research, but also the application of our graduates in top companies, products and creative solutions," says Vítězslav Beran, Vice Dean of the Faculty of Information Technology at Brno University of Technology.

Right at the beginning of this interactive week-long artificial intelligence seminar, the Faculty of Information Technology organized a seminar that dealt with ethical and legal issues related to artificial intelligence. It was also the main organizer of the AI 4 Talents event for high school students, which took place on Friday 21 October 2022 at the VIDA Centre. The event was organized by the Faculty of Information Technology of BUT together with the Brno AI platform and FI MU. AI 4 Talents was visited by two hundred students with pedagogical accompaniment from a total of 25 secondary schools. With his novel and information-packed lecture „My and maybe your life with AI", prof. Jan Černocký from FIT kicked off a jam-packed programme on the theme of artificial intelligence. This was followed by a panel discussion with academics from both universities and specialists from the world of practical experience. The following presentations of research groups from the Faculty of Information Technology were very popular: PERO, KNOT and Security@FIT.

Photo: Jan Prokopius

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