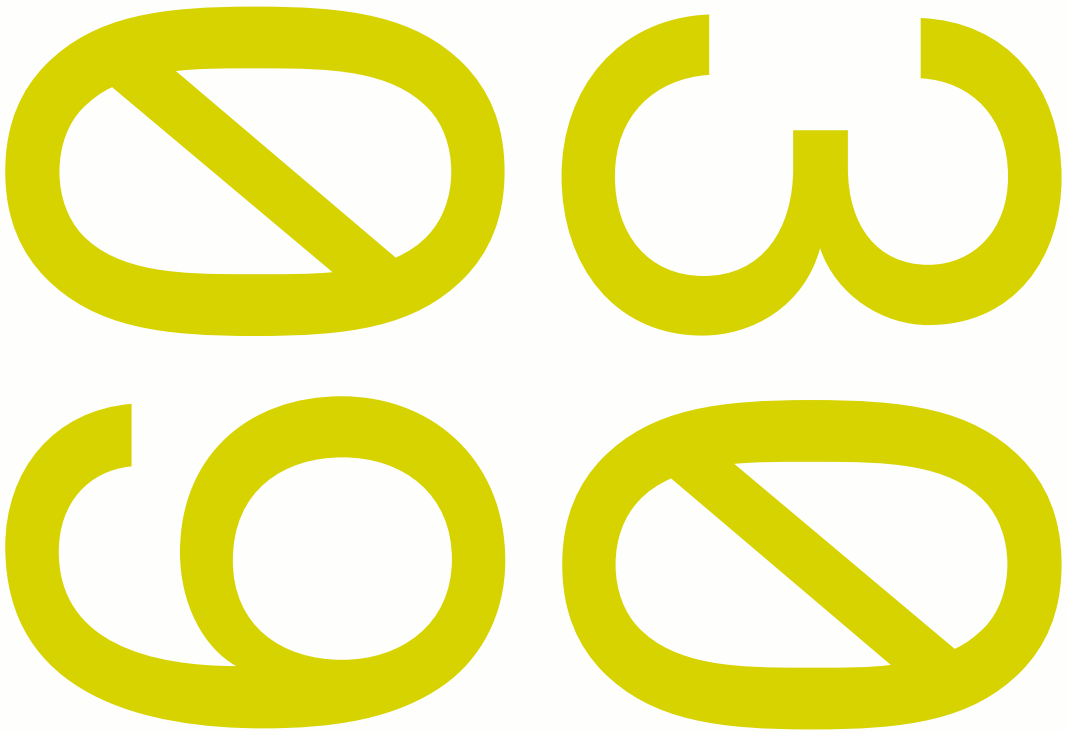
60 Years of Experience, 30 Years of Youth

School of Computer Science MFF UK

Collective of Authors



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MatfyzPress 2023

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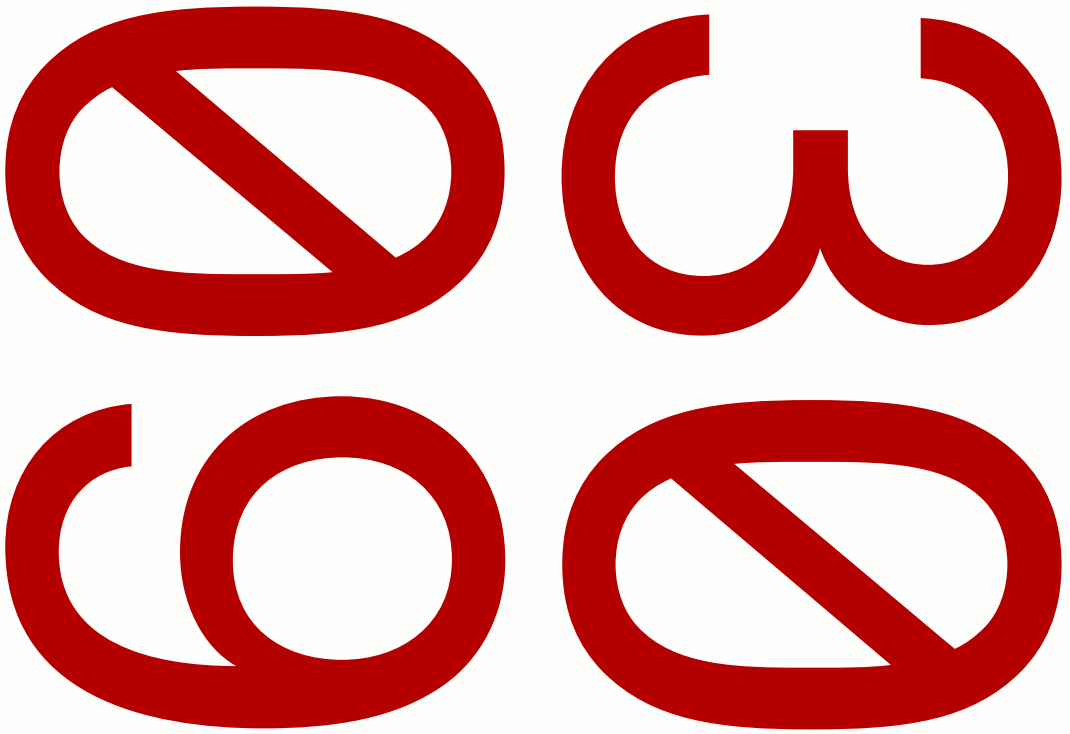

Contents

1952 + MFF UK

1993 + School of Computer Science
+ School of Mathematics
+ School of Physics

2023

1.0

Foreword

We are the School of Computer Science within the Faculty of Mathematics and Physics at Charles University, and we are celebrating a special milestone this year – our 30th anniversary. This significant moment was set in motion by the Dean's measure on May 10, 1993 establishing three distinct schools at the Faculty: the School of Mathematics, the School of Computer Science, and the School of Physics. It is crucial to emphasize the term "organizational", as the fields of mathematics, computer science, and physics have been cultivated for a much longer period. Notably, computer science for 60 years, which allows us to combine three decades of youth with six decades of experience.

As we commemorate the 30 years since the establishment of the School of Computer Science, we would like to remind the evolution of computer science at the Faculty to students, colleagues, alumni, and the broader public. To remember this occasion, we have planned various festive activities: this publication for reading, a festive gathering for meeting, a concert and podcast featuring interviews for listening, and an exhibition for exploring.

The School of Computer Science, much like the entire Faculty, is composed of personalities. This includes not only those mentioned in this publication but also extends to the broader community. During this anniversary reflection, I find myself recalling my teachers, classmates, colleagues, and students. Each of these groups comprises outstanding individuals, and there is often a significant overlap between them. After all, my learning journey was not solely shaped by my teachers; classmates and students have also imparted valuable lessons. I believe my colleagues share this feeling as well.

For the celebration, we have chosen a timeline as our visual motif, even though our journey is far more complex than a linear representation can capture. The timeline serves as a reminder of how certain individuals have played essential roles in the School, as well as how crucial specific events have been. It is my hope that the timeline prompts readers to recall important figures and moments in their own personal timelines – even though many of these might not be covered in this text, they are undoubtedly worth cherishing.

Jiří Sgall
Vice-Dean for Computer Science

2.0

Introduction after Foreword

We are diving into the narrative of the 30th anniversary of the School of Computer Science (the School here after), a story that started back in the 1960s at the Faculty of Mathematics and Physics (the Faculty or MFF here after), driven by a handful of passionate individuals. The timeline spanning these sixty years is packed with events, leading us to ponder which ones should be revisited and spotlighted on the timeline for maximum impact. Our focus rests on the events that have been instrumental in making this year's celebration possible. These pivotal instances naturally encompass moments of appearance, disappearance, merging, splitting, renaming – alongside individuals entering, departing, and achieving awards. To display them on the timeline, we are using the addition (+) and subtraction (-) symbols, and we are providing detailed insights in the text. In particular, we are recounting the moments that predate 1993 through snippets from Jiří Demner's song lyrics, playfully capturing the origins of computer science at the Faculty. Jiří Demner's close connection stems from his membership in the generation that, during the 1970s and 1980s, transformed com-

puter science into a distinct domain at the Faculty. He sang about himself *žádný jazyk, žádný systém, vlastní drivery, to je fér, holý vstupy, uznávám jen assembler (no language, no system, own drivers, that's fair, low-level inputs, I only recognize assembly language).* This description relies on the recollections of Jaroslav Pokorný (Pokorný, 2002).

Whenever possible, we mention the moments with precise time references, readily available in public sources. However, in a few instances precise dating is missing, prompting us to rely on participant memories expressed through reflections, personal records, or letters and mails – allowing for a broader specification. It is worth noting that these sources inherently bring a subjective dimension to the narratives, an aspect that historical retrospectives must take into account.

3.0

60 Years of Experience

In 1952, the Faculty of Mathematics and Physics was separated from the Faculty of Science at Charles University in Prague. Therefore we celebrated the seventieth anniversary of our Faculty the previous year (Doležalová, Hrabáková, 2022). Initially, the plan was to split the Faculty of Science into the Faculty of Physics and the Faculty of Science. An examination of the anticipated departmental division from 1951 reveals that mathematics was also intended to find a home within the Faculty of Physics, with no consideration given to computer science. Consequently, a faculty devoted exclusively to "only" mathematics and physics was established alongside the natural sciences faculty. Taking a global perspective, the first computer science teams began emerging at universities during the early 1960s, gradually developing into independent faculties. Over the initial three decades, computer science at our Faculty followed a similar path, albeit at a considerably slower pace due to the political climate. We document its history prior to the establishment of the School in decades.

3.1

1960s

'Hello world' is as an iconic message that opens the door into the field of programming. It often serves as the output of the very first program students write while acquainting themselves with a new programming language. When this message appears on the screen, it signifies that the student has successfully configured the development environment and grasped the fundamental skills of programming. Indeed, programming represents the origins of computer science at the Faculty, dating them back to the 1960s. It was during this period when the first computers appeared at the Faculty: LGP 30 (with an 8 thousand word drum memory and approx. 50 operations/s) and the MINSK 22. Alongside these technological advancements the pioneering figures of programming, including Evžen Kindler, Ladislav Koubek, and Jiří Raichl, emerged. Demner's song from 1976 vividly captures the essence of the programming ethos during that era *Sám já ladívám rád (I tune by myself):*

> I create a problem myself, I fight the data myself.
> Only I can see the programme.

```
I punch it myself, I check it myself,
I label my program myself.
I like to tune by myself, only by myself.
```

The Faculty undertook the task of educating programmers or their various iterations, initially doing so in a somewhat concealed manner under the umbrella of Non-numerical computer applications and Programming languages courses. These courses provided both theoretical and practical foundations at a remarkably high level. A glance at the student records from that era, the predecessors of today's electronic systems, reveals that the entire computer science education was concentrated around Jiří Raichel from the Department of Numerical Mathematics (Boček 1991, Kindler 1987). In the Introduction to Automatic Programming course and the programming seminar, he introduced the emerging innovations of the field. It is fair to say that as well as the Faculty of Electrical Engineering (FEL ČVUT) had its Mr. Koníček, the Faculty had its leading figure of Mr. Reichel. He had an almost paternal air about him, although he maintained strict standards during examination sessions. There were students who did not quite get through. Both Reichel and Koníček belong to the legends, who shaped the development of computer science as a discipline in our country, and Jiří Demner paid tribute to them in the song *V druhé generaci (In the second generation)* about the famous FEL system and how the Horse (Koníček) took it far, about the implementation of Algol, and illustrated how Raichl used it as an example.

Additional figures entered the scene, including individuals like Marek Malík, Michal Chytil, and Jiří Demner, collectively shaping computer science into a domain warranting its own autonomous study programme. The computer science enthusiasts at the Faculty switched from solitary debugging to collaborative teamwork, extending their proficiency beyond algorithmic theory. They delved into programming methodologies, operating systems, and other subjects. They were still deeply rooted in mathematics, which set them apart from computer science students within other disciplines like engineering or economics.

1973

+ Linguistics at MFF

1974

+ Department of Mathematical Computer Science
+ SOFSEM

1975

- Department of Mathematical Computer Science
+ Department of Cybernetics and Operational Analysis
+ Department of Mathematical Computer Science

1977

- Center for Numerical Mathematics
+ Charles University Computing Center at MFF
+ Study specialization Mathematical Computer Science and Theoretical Cybernetics

3.2

1970s

The integration of computer science into universities became an irreversible trend. The subsequent passages, though intricate, hold substantial importance in understanding the framework of computer science departments and educational activities at the Faculty during the 1970s. On May 19, 1972, the Advisory board for computing systems in the Czech Socialist Republic and the Slovak Socialist Republic discussed the Ministry of Education's proposal for the advancement of computing systems at universities and recommended its execution. This proposal tasked the Faculty with a rapid establishment of a new field of study – computer science. In less than two months (July 3, 1972), the MFF Scientific Council agreed on a three-year plan: to (1) submit a proposition to the Rector's Board to establish the Department of Computer Science by October 1, 1972, anticipating a faculty comprising 3 professors, 3 associate professors, 6 research assistants, and 4 assistants; (2) introduce a pilot study programme for computer science under the Department of Numerical Mathematics from 1972/73; (3) implement dual studies in numerical mathematics and computer science

from 1973/74; (4) launch a teacher's study programme combining mathematics and computer science from 1974/75, and initiate a recruitment process for two professor positions in computer science; (5) set up a committee for defending professors' theses in the field of computer science and seek approval from the state committee for scientific degrees. The given proposal (No. 5152/72) was submitted to the Rector's Board at the beginning of 1972/73 (October 29, 1972). The notion of a computer science study field was being cultivated for a year and was formally presented on November 29, 1973, when Dean of the Faculty František Fabian submitted an additional proposal to the Rector's Board for the inclusion of computer science into the curriculum. This response was triggered by the Ministry of Education's concept ensuring the resolution of the Government of the Czech Socialist Republic No. 26 issued on January 31, 1973. The renewed proposal advocated for the establishment of the Department of Computer Science, this time planned for January 1, 1974. The proposal also contained a specific detailed staffing arrangement of 11 faculty members and called for the expansion of this staff by 9 positions within a two-year timeframe at the latest.

On June 1, 1974, the first department containing computer science in its title came into being. It was called the Department of Mathematical Computer Science, and was led by Milan Vlach, who directed a team consisting of 4 lecturers, 4 researchers, 3 technical staff members, and an office manager. However, a shift took place on December 1, 1975, leading to the dissolution of this department, facilitating the emergence of two new departments: the Department of Cybernetics and Operational Analysis, led by Milan Vlach, and the Department of Mathematical Computer Science, led by Karel Najzar. Two years later, the Center for Numerical Mathematics was dissolved, paving the way for the establishment of the Charles University Computing Center at the Faculty on October 1, 1977, with Bohumil Miniberger at the helm.

The era of normalization (the period following the Warsaw Pact invasion of Czechoslovakia in August 1968) did not bypass the Faculty either. Numerous individuals faced obstacles in teaching,

Room with EC 1040 computer on the fourth floor of the Professed House's west wing (1980s)

pursuing scientific and pedagogical qualifications, or embarking on international travels. Hiring new personnel often depended on their political affiliations. Nevertheless, the Faculty managed to uphold a creditable standard of scientific and educational endeavors while preserving a certain degree of freedom. Those ineligible for admission to other institutions due to personnel-related factors found a haven at the Faculty, and experts from various faculties discovered support within the Faculty's walls. Even before the establishment of the Department of Mathematical Computer Science, linguistics found its way to the Faculty: in the years following the invasion, the Laboratory of Algebraic Linguistics, led by Petr Sgall, encountered obstacles at the Faculty of Arts and subsequently found support at the Faculty in January 1973. Its journey began in the Center of Numerical Mathematics, gradually splitting into other departments. During the late 1980s, the Group of Algebraic Linguistics was established within the Department of Applied Mathematics. At first glance, lin-

guistics might appear out of place in the Faculty's context. In fact, the reverse is true. The team from the Laboratory of Algebraic Linguistics pioneered experiments with machine translation from English to Czech using the initial Czech SAPO computer as far back as 1959 – the computer accurately translated the English sentence *The consonants have not by far been investigated to the same extent as the vowels* to Czech *Souhlásky zdaleka nebyly do stejné míry prozkoumány jako samohlásky.* In the second half of the 1970s, the EC 1040 computer, with a bit of manual assistance grounded in hand-crafted grammar rules and a small dictionary, "randomly" generated a few grammatically correct, yet occasionally semantically peculiar or even absurd Czech sentences, for example *Nutíme hrad pánovi. (We force the castle to the master.) Musíme seznámit s kvalitou paměť. (We must introduce the quality to the memory.) Fuj! (Yuck!)*

Jaroslav Pokorný and Jiří Demner (from left)

During 1973/74, the first study programme related to computer science emerged: the Numerical mathematics study programme with the specializations Use of computing systems and Mathematical security of computing systems is separated from the Mathematics programme (Bečvář, Bečvářová, 2012). Subsequently, in 1977/78, a brand-new study specialization Mathematical computer science and theoretical cybernetics emerged. Over the initial two years of this five-year curriculum, students establish concepts common to all mathematical study programmes (introduction to mathematical analysis, algebra, probability theory, and mathematical statistics). In addition, they acquire proficiency in Algol programming, delve into assembly language programming, and acquire essential knowledge concerning prevalent programming techniques. The curriculum further acquaints students with algorithmic theory, recursive functions, and mathematical logic. In the next three years, the programme diverged into the specializations of Automatic computers and programming, alongside Theoretical cybernetics (Najzar, Reichl, 1978).

Distinct courses come into existence thanks to the efforts of individuals who are actively contributing to the growth and evolution of the field. This fundamental aspect remains unchanged. However, during the 1970s, access to foreign textbooks was rare, leaving information acquisition reliant on correspondence and a handful of specialized journals available through subscriptions. Undoubtedly, external influences were imperative. A significant role in this endeavor was assumed by the SOFSEM seminar, established in 1974 by Jozef Gruska. While today's perspective might perceive the 14-day seminar as ambitious, it rather resembled a winter school. The comprehensive six-hour sessions, thoroughly prepared by specialists in their respective domains, were among the most enriching resources available to computer scientists within the limitations of Czechoslovakia's resources. With some effort, a term course could be created from a single tutorial. Participation at SOFSEM had both professional and cultural significance for the Faculty's staff. Jaroslav Pokorný, the first head of the Department of Software Engineering, along with Mr. and Mrs. Demner, contributed to the cultural

facet of SOFSEM by offering performances in the band Příležitostná skupina měkkého jazzu, known as soft jazz. SOFSEM has already turned 30, as recounted in (Wiedermann, 2004). Actually, this year marks its 48th iteration. Therefore we can sing *Ódu na radost z programování (Ode to the joy of programming):*

```
Long live SOFSEM!
The world changes with each of its anniversaries.
To participate is nothing,
to establish it – a creative act.
```

1981

- Department of Cybernetics and Operational Analysis
- Department of Mathematical Computer Science
+ Department of Cybernetics, Computer Science and Operational Research
+ Department of Applied Mathematics

1983

+ Group of Didactic Technology

1985

+ Category P in the national Mathematical Olympiad

1986

- Department of Cybernetics, Computer Science and Operational Research
+ Department of Cybernetics and Computer Science
+ Correspondence seminar on programming

3.3

1980s

In September 1981, the Department of Cybernetics and Operational Analysis and the Department of Mathematical Computer Science disappeared and the Department of Cybernetics, Computer Science, and Operational Research emerged under the leadership of Milan Vlach, with a staff of 17. Simultaneously, in the same year, the Department of Applied Mathematics (KAM) emerged and was chaired by Václav Horák from the Czech Technical University. In 1986, Jaroslav Nešetřil took over KAM's leadership and the Group of Operational Research moved over to KAM from the Department of Cybernetics, Computer Science, and Operational Research, the latter department undergoing a name simplification and becoming the Department of Cybernetics and Computer Science.

The gradually increasing emergence of personal computers (PCs) naturally had an impact on computer science at the Faculty. Changes were needed. Everyone was keen on not to be left behind and was saying to himself *já tu jenom zírám, zájem nepředstírám, dál svou čtyřicítku podpírám (I'm just staring here, not pretending interest, still propping up my forty.)* The EC 1040 was indeed a computer

in the Malá Strana computing center. It was evident that the time when each individual would possess their own personal computer was coming. However, this transition still took a while. The microprocessor was regarded with respect, even when it was "just" from Tesla Rožnov:

> Faster than a functional prototype,
> smarter than a vice rector,
> stronger than a compressor
> is the microprocessor.

It might seem that there were no problems with the theory. Nevertheless, practical implementation was always a few steps behind the global norm (referred to as the "capitalist" world), as sung in a song from 1985:

> Punch cards, it sorts punch cards,
> poking claws into holes,
> pouring them into compartments,

Historical snapshot from the Spring School of the Combinatorial Seminar in the 1980s led by Jaroslav Nešetřil. From left Igor Kříž, Jaroslav Nešetřil, Tobiáš Rataj, Jiří Matoušek, Iva Rulić (roz. Dvořáková), Martin Loebl, Jiří Witzany, Svatopluk Poljak, Petr Lopéz Kučera, Jan Kratochvíl

because punch cards, holey cards,
even though they’re not large,
they’re the foundation of technology.

The typical hardware malfunction also deserved a song lyric, for example:

The monitor emitted its
flickering light,
then promptly paled before
extinguishing outright.
Once I glimpsed “Basic ready,”
but sadly, that day was the last.

Since the first half of the 1980s, it was possible to enroll for a five-year study programme bearing a long title Theoretical Cybernetics, Mathematical Computer Science, and Theory of Computing Systems (TKMITS), along with teacher’s study programmes Mathematics – Computing Systems and Physics – Computing Systems.

East Germany cars left in front of the Faculty building at Malostranské square (late summer 1989)

During the 1980s, the Faculty began to take an interest in educating gifted secondary school students, i.e. to educate potential students of the Faculty. Specifically, in 1985, Pavel Töpfer (currently the head of the Department of Software and Computer Science Education) played a crucial role in establishing category P within the national Mathematical Olympiad. This category was designed to focus on algorithmization and programming:

```
I know no greater pleasure
than when a person has mastery over something,
taking over a program is nothing,
debugging it – that's a creative act.
```

Pavel Töpfer was in charge of this category for an astonishing span of 35 years, until 2020. His name is also closely associated with the start of the Correspondence seminar on programming at the Faculty, which came into being a year later in 1986. At the time of its establishment, this seminar was one of unique projects in the country and served not only as a competition platform, but also as a means for consistently educating all the gifted individuals who displayed an interest in computer science. After two decades, the responsibility was handed over to Martin Mareš from the Department of Applied Mathematics.

The Velvet Revolution in 1989 extended the Faculty's ability to breathe freely, as documented in (Stehlíková, Vlach, and Veverka, 2019). With borders widely open *We're heading to Europe*:

```
We'll stuff the best we can find
into our backpacks,
Tesla will add a new model,
a black-and-white monitor.
```

1990

+ Department of Philosophy of Mathematics and Natural Sciences
+ Institute of Formal and Applied Linguistics
+ Group of Software and Computer Science Teaching

1991

+ Laboratory of Computing Systems

1992

- Group of Software and Computer Science Teaching
+ Group of Software and Computer Science Education

1993

+ School of Computer Science
+ School of Mathematics
+ School of Physics
- Department of Cybernetics and Computer Science
+ Department of Software Engineering
+ Department of Theoretical Computer Science
- Department of Philosophy of Mathematics and Natural Sciences
+ Department of Mathematical Logic and Philosophy of Mathematics

1994

- Laboratory of Computing Systems
- Charles University Computing Center at MFF
+ Network and Labs Management Center

3.4

1990s

In the early 1990s, while there was a literal struggle for computer science at the Faculty, various significant events occurred: the British physicist Tim Berners-Lee introduced the markup language HTML, the Finnish student Linus Torvalds released the kernel of his open operating system, the first text message was sent etc. The presence of two computer science departments and a change in the Faculty leadership marked the starting point of the complicated three-year period preceding the establishment of the School. At that time, the Department of Cybernetics and Computer Science (KKI) was led by Michal Chytil after Milan Vlach and comprised the Group of Theoretical Computer Science (headed by Václav Koubek) and the Group of Software Engineering (headed by Jan Pavelka). Additionally, the Department of Applied Mathematics (KAM) continued under the guidance of Jaroslav Nešetril. In the spring of 1990, the process to elect a new dean commenced, resulting in an appointment of the mathematician Karel Drbohlav as the Dean.

The first organizational change initiated by Dean's measure No. 4/1990 involved the separation of the Group of Algebraic Linguistics from KAM and the subsequent establishment of the Institute of Formal and Applied Linguistics on August 1, 1990. Eva Hajičová was appointed as the head of the Institute. In addition to this fact, Dean's measure No. 9/1990 dated November 1, 1990 set up an independent Group of Software and Computer Science Teaching (KSVI) within KKI. This step aimed to address the neglected situation at the Faculty in training secondary school teachers of computer science. Rudolf Kryl, formerly in charge of the Group of Didactic Technology, was assigned to lead KSVI. Moreover, the creation of the Department of Philosophy of Mathematics and Natural Sciences was supervised by Petr Vopěnka (who served as Minister of Education in 1990–1992). Then, in the autumn of 1990, changes occurred in KKI's leadership: on November 5, 1990, Michal Chytil was relieved of his position as the head, and on the same day, Antonín Kučera was appointed as KKI's head.

The admissions process in 1990 witnessed a substantial influx of students. Both KKI and KAM correctly anticipated the continuation of this trend. However, their available personnel capacity and computer resources proved insufficient to accommodate a surge of such significance. Consequently, the departments initiated an internal discussion at the Faculty to establish computer science on a par with mathematics and physics. The goal was to ensure a sustained high-quality development in both pedagogical and scientific areas. During the MFF Scientific Council meeting on March 21, 1991, Antonín Kučera reported on the highly critical situation regarding the provision of education in computer science. Furthermore, on July 4, 1991, he reached out to the Dean with a proposal to open positions of research assistants at KKI in the fields of Database Systems, Neural Networks, Software Engineering, Distributed Systems, and Operating Systems. Due to capacity reasons, there was only room in the study programme Computer Science for the Data Engineering and System Programming tracks, despite the favorable conditions for the development of the aforementioned fields. During the MFF Scientific Council meeting on November 6, 1991,

Antonín Kučera and Jaroslav Nešetřil repeatedly emphasized the need of a solution of the unsatisfactory state of computer science education.

During the subsequent MFF Scientific Council meeting on December 11, 1991, a document titled *Analysis of the State of Computer Science and Proposals for Measures* prepared by KKI, was presented to address this issue. Additionally, the conclusions of a discussion among several members of the MFF Scientific Council who met on December 2, 1991 (Jiří Bičák, Václav Dupač, Antonín Kučera, Jaroslav Nešetřil, Ivan Netuka, Bedřich Sedlák) were available. Both documents contained recommendations *to establish certain "boards" for addressing issues within the fields of mathematics, physics, and computer science,* thereby initiating the origin of the Schools. Unfortunately, due to time constraints, the discussion regarding these documents was postponed to the meeting on January 8, 1992. During this meeting, Antonín Kučera urged *to reflect not only on computer science itself, but to consider it in the context of other disciplines at the Faculty, keeping in mind the overall future concept of the Faculty.* Among the conclusions from the meeting, there was an explicit statement: *Retain the personnel ensuring computer science education (a clearer Dean's Board gesture is needed).*

Viewed in the context of the ongoing discussion about computer science at the Faculty, an essential moment was embodied in Dean's measure No. 4/1992, which was issued on June 30, 1992. This measure relieved Antonín Kučera from his position as KKI's head, as he had requested on the basis of his disagreement with the Dean's Board approach to addressing current issues. Concurrently, the measure halted KKI's operations and transferred the responsibilities held by KKI to two of its groups (KSVI already possessed such authority). The suspension of KKI's activities at a point, when a substantial number of students was being admitted to study programmes that were solely managed by KKI and when it is apparent that the importance of computer science is rising, is indeed puzzling.

Since the beginning of 1993, there has been an accelerating sequence of events. On February 11, 1993, the first meeting of the Council of computer science departments convened. The Council

served as the representation of the emerging School of Computer Science. The Council put forth recommendations to the Dean regarding the restructuring of computer science departments. Built upon these recommendations and the subsequent discussion within the MFF Academic Senate on March 24, 1993, Dean's measure No. 3/1993 was issued. This measure established the Department of Theoretical Computer Science, led by Antonín Kučera, and the Department of Software Engineering, led by Jaroslav Pokorný, effective from April 15, 1993. Coinciding with this, the existence of KKI was terminated. Starting April 15, 1993, the Faculty was home to seven computer science departments: the Department of Software Engineering (Jaroslav Pokorný), the Department of Theoretical Computer Science (Antonín Kučera), the Department of Software and Computer Science Education (Rudolf Kryl; the name was changed by Dean's measure No. 4/1992), the Department of Applied Mathematics (Jaroslav Nešetril), the Department of Mathematical Logic and Philosophy of Mathematics (Petr Vopěnka), the Institute of Formal and Applied Linguistics (Eva Hajičová), and the Laboratory of Computing Systems (Antonín Říha).

Through Dean's measure No. 5/1993, effective from May 10, 1993, the School of Mathematics, the School of Computer Science and the School of Physics were established as integral parts of the Faculty. This organizational shift gained approval from the MFF Academic Senate during the session held on May 5, 1993. During this meeting, the strained atmosphere between the Senate and the Dean's Board eased as a majority of the Senate members endorsed a compromise proposition suggested by the Dean's Board. This compromise led to the resignation of both the Dean's Board and the staff chamber of the Senate. Then, a new staff chamber of the Senate was elected. On July 7, 1993, the election for the position of Dean took place, resulting in the nomination of physicist Bedřich Sedlák. Following his appointment, he promptly introduced new Vice-Deans for the Schools during the Senate gathering on September 15, 1993. Antonín Kučera assumed the role of the first Vice-Dean for Computer Science.

2000

- Department of Theoretical Computer Science
- Department of Mathematical Logic and Philosophy of Mathematics
+ Department of Theoretical Computer Science and Mathematical Logic

2010

+ Department of Distributed and Dependable Systems

2012

+ Computer Science Institute of Charles University

2015

- Group of Software and Computer Science Education
+ Department of Software and Computer Science Education

4.0

30 Years of Youth

Reflecting upon the School's journey of three decades comes with relative ease, primarily due to the materials about the School's and Faculty's activities available online. These materials include minutes from various meetings such as the School's Board from February 27, 1997, the Dean's Board from September 6, 2012, Academic Senate MFF from June 17, 1993, and Dean's measures from No. 3/1995 and annual reports of the Faculty from 1998. Therefore, this chapter takes on a more concise tone.

The structure of the School's department has remained stable for a span of thirty years, undergoing the following changes: (1) by Dean's measure No. 10/1994, the Laboratory of Computing Systems was disbanded and replaced by the establishment of the Network and Labs Management Center; (2) by Dean's measure No. 4/2000, the Department of Mathematical Logic and Philosophy of Mathematics merged with the Department of Theoretical Informatics, resulting in the Department of Theoretical Computer Science and Mathematical Logic; (3) by Dean's measure No. 2/2010, the group focused on distributed systems was detached from the Department of Software Engineering, culminating in the inception of the Department of Distributed and Dependable Systems; (4) Dean's measure No. 7/2011 announced the establishment of the Computer Science Institute of Charles University as a department separated from the Department of Applied Mathematics; (5) by Dean's measure No. 9/2014, the Group of Software and Computer Science Education underwent a name change, becoming the Department of Software and Computer Science Education.

Department of Applied Mathematics

kam.mff.cuni.cz

1987–1998	Jaroslav Nešetřil
1999–2002	Aleš Pultr
2003–2011	Jan Kratochvíl
2012–2015	Pavel Valtr
2016–2023	Martin Loebl
2023–	Milan Hladík

Department of Software and Computer Science Education

ksvi.mff.cuni.cz

1990–2006	Rudolf Kryl
2006–2014	Pavel Töpfer
2014–2022	Tomáš Dvořák
2022–	Pavel Töpfer

Department of Software Engineering

ksi.mff.cuni.cz

1993–2006	Jaroslav Pokorný
2006–2009	František Plášil
2009–2012	Peter Vojtáš
2012–2021	Tomáš Skopal
2021–	Martin Nečaský

Department of Theoretical Computer Science and Mathematical Logic

ktiml.mff.cuni.cz

1993	Petr Štěpánek
1993	Antonín Kučera
1994–2000	Václav Koubek
2000–2006	Petr Štěpánek
2006–2014	Roman Barták
2014–2022	Iveta Mrázová
2022–	Roman Barták

Institute of Formal and Applied Linguistics

ufal.mff.cuni.cz

1990–2001	Eva Hajičová
2001–2011	Jan Hajič
2012–2021	Markéta Lopatková
2021–	Barbora Vidová Hladká

Department of Distributed and Dependable Systems

d3s.mff.cuni.cz

2010	František Plášil
2010–2014	Petr Tůma
2014–2018	Tomáš Bureš
2018–	Petr Tůma

Network and Labs Management Center

sisal.mff.cuni.cz

1994–	Libor Forst

Computer Science Institute of Charles University

iuuk.mff.cuni.cz

2012–2013	Jaroslav Nešetřil
2014–2017	Jiří Sgall
2018–	Michal Koucký

The members of the School were/are in the management of the Faculty and University:

1990–1991	Michal Chytil, Vice-Dean without specification
1991–1996	Zdeněk Renc, Vice-Dean for Academic Affairs
1993–2011	Antonín Kučera, Vice-Dean for Computer Science
2008–2012	Jaroslav Pokorný, Vice-Dean for Research and International Affairs
2012–2018	Ondřej Čepek, Vice-Dean for Computer Science
2012–2020	Jan Kratochvíl, Dean
2012–2017	Petr Kolman, Vice-Dean for Student Affairs
2018–2021	Markéta Lopatková, member of the Rector's Board
2017–	Vladislav Kuboň, Vice-Dean for Education
2018–	Jiří Sgall, Vice-Dean for Computer Science
2022–	Tomáš Skopal, Vice-Rector for Information Technologies

In tandem with the list of departments, we underscore the principal milestones in the study agenda and we serve a selection of grapes being publications and projects to taste, alongside their respective labels. Behind each of these achievements lies an extensive amount of labor, not all of which has been illuminated by unbroken sunshine. Matters such as the evaluation of scientific endeavors and the funding of education, research, and science traverse the entire three-decade period. The discussion and resolution of these topics remains ongoing (Kučera, 2008). This dynamic propels us forward, as we continually develop and promptly react to events both nationally and internationally, all within a friendly and respectful environment. We deeply appreciate the contributions of our students, alumni, and colleagues, recognizing opportunities to express gratitude whenever possible. Among them, we recognize the recipients of honorary doctorates of Charles University (nominated by the School), whose generosity facilitated our exploration of the realm of research even before the Velvet Revolution and allowed us to fully immerse ourselves in it afterward. Noteworthy in-

dividuals include Pál Erdős, Hungary, 1992, recognized for exceptional contributions in potential theory and various areas of mathematical analysis and probability theory; Barbara H. Partee, USA, 1992, lauded for remarkable achievements in semantic theory and other aspects of mathematical language description; Frederick Jelinek, USA, 2001, celebrated for a lifetime of accomplishments in computer science and computational linguistics; Endre Szemerédi, Hungary, 2010, acknowledged for exceptional and lasting achievements in mathematics and computer science, notably in number theory and combinatorics; Aravind Joshi, USA, 2013, acclaimed for a lifetime of contributions to computational and formal linguistics, and for significantly advancing research at Charles University; László Lovász, Hungary, 2020, honored for extraordinary lifelong scientific feats in graph theory and combinatorics, and for his significant role in research development in collaboration with Charles University.

Barbara H. Partee (University of Massachusetts, Amherst, USA, honorary doctor of Charles University) while working on a joint publication together with Eva Hajičová (on the right) and Petr Sgall (1993)

1992	+ Pál Erdős, Hungary + Barbara H. Partee, USA
2001	+ Frederick Jelinek, USA
2010	+ Endre Szemerédi, Hungary
2013	+ Aravind Joshi, USA
2020	+ László Lovász, Hungary

1991	–	Theoretical Cybernetics, Mathematical Computer Science, and Theory of Computing Systems
	+	Computer Science
2002	–	Five-year master’s degree
	+	Three-year bachelor’s degree, two-year follow-up master’s degree
2007	+	European Masters Program in Language and Communication Technologies
2013	+	Three-year bachelor’s degree in English
2018	–	teaching Pascal
	+	teaching Python
2020 (10. 3.)	–	Face-to-face study
	+	Distance study
2021 (29. 9.)	–	Distance study
	+	Face-to-face study

4.1

Study

The study programme Theoretical Cybernetics, Mathematical Computer Science, and Theory of Computing Systems (TKMITS) ended in 1990/91. Starting from 1991/92, new degree plans were introduced. TKMITS was renamed as Computer science, while the teacher's programme Mathematics – Computing Systems was changed to Mathematics – Computer science. There was a gradual transition from the traditional five-year study format to the 3+2 model. This new model consisted of three years dedicated to a bachelor's degree followed by additional two years for a master's degree. The shift began as early as in 1992/93 when students could acquire a B.Sc. after passing the comprehensive exam in the third year of the former five-year programme. By 1993/94, a three-year bachelor's degree programme in Computer science was introduced alongside the existing five-year master's programme. Graduates with a B.Sc. had the option to proceed to the master's programme after successfully completing differential exams. A successful passing of these exams enabled students to have the first three years of their master's study approved. Conversely, mas-

ter's study students had the opportunity to obtain a B.Sc. by opting for an extended comprehensive exam instead of the regular one in the third year of their studies. This educational structure persisted until 2002/03. From 2003/04 onward, the five-year master's study was replaced with a three-year bachelor's study and a two-year follow-up master's study

The bachelor's studies within the Computer science study programme underwent a transformation initiated by the institutional accreditation by the Internal Evaluation Board of Charles University and commenced in 2019/20. This accreditation triggered alterations in the structure of fundamental programming courses. As an example, the algorithmization was moved to a single course. A crucial moment in the historical development of degree plans was reached when the decision was made to discontinue the teaching of the Pascal programming language during the first year of study. This noteworthy adjustment, which ignited emotional discussions, transpired in 2018/19. Subsequently, starting from 2019/20, Python was introduced as a replacement for Pascal. Right now sending the message *Hello world* to the output by running the codes written in both languages is entirely appropriate.

helloworld.pas

```
program HelloWorld;
begin
 writeln('Hello world');
end.
```

helloworld.py

```
print("Hello world")
```

Rudolf Kryl, the first head of KSVI and a prominent figure in the realm of teaching programming at the Faculty, expressed a strong affinity for Pascal. He liked Pascal: *Pascal, that's like a mommy – all rounded corners, low-voltage sockets, and when you fall, it's into something soft. You really have to try hard to hurt yourself.* Of course, he also had a clear opinion on how teaching should be conduct-

ed: *We will teach you programming at the edge of your capabilities.* Regarding didactics itself, he used to recount this anecdote: *I remember how, in a didactic seminar during the era of socialism, there was a lecturer, who asserted that one should completely bypass single-variable functions in mathematical analysis and directly move on to functions with an infinite number of variables. He claimed that they had already attempted this with quite satisfactory outcomes. In that moment, an elderly professor stood up and exclaimed in alarm, "Have you tested this on people?"*

In addition to bachelor's and master's study programmes, the School provides a comprehensive doctoral study programme as well. As per the provisions of the Higher Education Act No. 172/1990 Coll., the academic year 1991/92 saw the initiation of doctoral studies in three computer science programmes at the Faculty – Theoretical Computer Science, Software Systems, and Computational Linguistics. These studies culminated in a doctoral examination and the defense of a dissertation, leading to the conferment of the doctoral title (Dr.). With the Higher Education Act No. 111/1998 Coll., this academic title changed from Dr. to Ph.D. The composition of computer science programmes offered at the Faculty has evolved over time, and there are currently five programmes: Theoretical Computer Science and Artificial Intelligence, Computer Science – Software Systems, Computational Linguistics, Computer Science – Theory of Computing, Discrete Models and Optimization, and Computer Science – Visual Computing and Computer Games.

The School actively participates in all the three study levels of the Bioinformatics study programme. This programme is collaboratively organized with the Faculty of Science at Charles University, combining the disciplines of biology, statistics, and computer science.

A noteworthy detail to highlight is that starting from 2023/24, the teacher's study Physics – Computer Science will once again become available.

In 2018/19, Vice-Dean Jiří Sgall introduced the School's doctoral candidates employment programme. This programme was designed to enhance the conditions for doctoral candidates at the

Faculty and elevate the allure of pursuing doctoral studies. This action was prompted by a longstanding challenge faced by computer science since the early 1990s – a pronounced discrepancy in compensation between Faculty employees and their counterparts in the private IT sector. This dilemma also affects graduates, who consider research work. Particularly when considering the choice between continuing their doctoral studies or embarking on a career in the commercial sphere. This dilemma was intensified by the realization that top-tier doctoral programmes in computer science encompass not only teaching, but also active involvement in research activities, similar to comprehensive scientific undertakings. This programme ensures that doctoral candidates receive a fixed salary, aligned with their years of study and their involvement in the School's research projects, in addition to their scholarship.

The impulse to attract international students does not require elaborate justification; it necessitates proactive efforts. Similar to the Czech Bachelor's programme in Computer Science, Dean Jan Kratochvíl, in collaboration with Petr Kolman, Vice-Dean for Student Affairs, formulated the foundation of the English Computer Science programme. The inaugural students enrolled for this program, accredited by the Ministry of Education and Culture of the Czech Republic's Accreditation Commission in 2013/14. As we mark this year, we are also celebrating the unforgettable milestones achieved in the study agenda. The enrollment count for the English programme has been on a consistent rise: 3, 7, 6, 14, 15, 15, 21, 34, 47, 68. Notably, it is worth mentioning that the number of students, who joined the programme in 2022/23 (68) exceeded the combined count of the first six years (60). Moreover, if we divide the past ten years into two-year intervals, the progression is quite impressive: 10, 20, 30, 55, 115. Remarkably, the last two-year sum (115) is precisely the cumulative sum of the preceding four!

Foreign master's students began coming to the Faculty prior to the arrival of bachelor's students, specifically since 2007 through the European Master Language and Communication Technologies programme (LCT). Commencing from 2007, a consortium of seven European universities has been offering a comprehensive two-year

Pavel Töpfer, Pavel Machek, Jiří Hájek, Martin Mareš (from left) with the cup for 1st place in the prestigious ACM International Collegiate Programming Contest 1998

master's curriculum in computer science and language technology, wherein students spend a year at one of the member universities within the consortium. From its introduction, the LCT programme in Prague has seen the graduation of 51 students. This noteworthy achievement signifies that the School has been progressively delivering courses in English since 2007, even before the official accreditation of English programmes. In 2019, the Internal Evaluation Board of Charles University accredited seven Master's Computer Science programmes, available in both Czech and English, with a validity period of ten years.

All the aforementioned aspects of our study agenda have predominantly unfolded in line with our (usually) long-term strategies. The summer term of 2019/20 commenced as scheduled. However, an unforeseen development emerged in March 2020 that completely disrupted our plans — the emergence of an illness and the subsequent onset of the COVID-19 pandemic, which continued to significantly impact

our educational activities for a period of more than two years. In accordance with the resolution of the Ministry of Health and the decision made by the Rector, the Dean of the Faculty promptly took action on March 10, 2020, at 18:00, by immediately suspending in-person instruction and prohibiting the physical presence of students and participants across all instructional formats. Over a span of just 14 days, both lecturers and students had to swiftly adapt, both mentally and technologically, to the transition to a remote study mode. This mode remained in effect, with minor relaxations during the summer breaks, until the summer of 2021, when the official announcement was made regarding the resumption of face-to-face teaching. Phew.

The need for digitizing the study agenda became evident in the early 1990s. This transformation was particularly notable at Charles University, where computer scientists from the Faculty played a pivotal role. In 1996, Erudio, a company that emerged from the transformation of the Charles University Computing Center at MFF, undertook the task of refactoring their existing study agenda system to operate under MS Windows system and store data in a client-server database. In March 1996, Erudio made an agreement with Tomáš Holan (KSVI), who was teaching Borland Delphi programming as Erudio's lecturer, that this system would be created with the assistance of two employees from Erudio. By November 1997, the initial version of this new system was implemented at the Faculty of Law. Simultaneously, the Faculty was exploring a potential acquisition of KOS (BLACKBIRD), a system used at institutions like the Czech Technical University. During an AS MFF meeting, prototypes of this system were showcased, although they only presented screenshots. However, Rudolf Kryl expressed reservations, believing that the planned system would not deliver the anticipated benefits for the Faculty. Consequently, he developed a new specification named PĚNKAVA (FINCH), inspired by bird terminology. This specification aimed to define terms enabling the system to articulate study plans, course dependencies, and more. The Faculty's management embraced this new specification and subsequently collaborated with Erudio to develop a system based on it. Charles

University decided to procure the Erudio system, now known as SIS (albeit unpoetically), for all its faculties. As a gesture of support, Tomáš Holan contributed to the Faculty his share of the award that Erudio received for implementing the system. Following the conclusion of his contract with Erudio, David Bednárek and Filip Zavoral from KSI assumed responsibility for the collaboration with Erudio on SIS. Presently, SIS is operating at its full capacity. Its modernization is currently a priority on the agenda of Tomáš Skopal, who serves as a professor of computer science at Charles University and Vice-Rector for Information Technologies at Charles University.

4.2

Science and Research

The School's core activities are centered around science, research, and education. To showcase the diverse spectrum of our research areas, we present a collection of selected publications and projects that serve as a showcase of our accomplishments. This display also underscores the depth of our national and international partnerships and collaborations, linking us to esteemed institutions and influential figures worldwide. To avoid any sign of self-promotion in the spirit of *If I don't praise myself, no one will do it for me* (Jára Cimrman, Posel z Liptákova), we have included the number of citations for the publications up to April 2023.

Publications

Number of citations: 22 (Google Scholar)

BARTÁK, Roman; MAILLARD, Adrien; CARDOSO, Rafael Cauê: Validation of Hierarchical Plans via Parsing of Attribute Grammars. Proceedings of ICAPS, 28(1); pp. 11–19; 2018.

The sequence of actions, the plan, when executed, should correspond to the given specification. This can be described by a set of rules determining how common tasks are solved by decomposition into subtasks until directly executable actions are obtained. For example, the task of transporting some goods means arriving at the place where the goods are located, loading them, driving to the destination and unloading them there. In addition, the execution of multiple tasks can overlap, for example, when transporting goods, lunch can be scheduled. The article describes a method for determining whether a given sequence of actions conforms to a specification expressed by a set of formal grammar rules. Thanks to its generality, this method provides a basic framework for solving related problems, such as recognizing what task is being performed based on only the observed part of the plan, or correcting the plan to meet the specification.

Number of citations: 39 (Google Scholar)

BARTÁK, Roman; MORRIS, Robert; VENABLE, Kristen Brent: An Introduction to Constraint-Based Temporal Reasoning. Morgan & Claypool Publishers; 2014.

Working with time is the basis of many automated systems. It is used in planning and scheduling activities or in determining the consistency of statements based on time data (for example, in investigations). In a compact and accessible way, the booklet provides an overview of formal models for describing events over time, techniques for determining consistency or answering questions about when a given event might have happened, as well as existing applications. In 2014, the book was awarded the Dean's Award of MFF UK for the best textbook.

BIENVENU, Laurent; GREENBERG, Noam; KUČERA, Antonín; NIES, Andre; TURETSKY, Dan: Coherent Randomness Tests and Computing the K-trivial Sets. Journal of the European Mathematical Society No. 18; pp. 773–812; 2016.

Number of citations: 32 (Google Scholar)

Algorithmically random sets can be characterized as chaotic sets in the algorithmic (effective) sense. The article introduces a new term "Oberwolfach randomness" and shows the meaning and importance of this term. Oberwolfach random sets satisfy, among other things, the effective version of Lebesgue's density theorem and further provide another characterization of the so-called "K-trivial sets", which are sets with minimal prefix-free Kolmogorov complexity. The article received the "Kalman prize for Best paper 2018". This award is given to the most significant mathematical paper where one of the authors is from New Zealand for the period 2014–2018.

BROM, Cyril; STÁRKOVÁ, Tereza; D'MELLO, Sidney K.: How Effective is Emotional Design? A Meta-Analysis on Facial Anthropomorphisms and Pleasant Colors During Multimedia Learning. Educational Research Review No. 25; pp. 100–119; 2018.

Number of citations: 55 (Web of Science)

The article is an internationally recognized analysis of the so-called emotional design in multimedia learning. This is a pioneering work from the CR published in the TOP 5% of journals indexed in the Web of Science citation database in the Education & Educational Research category.

BUREŠ, Tomáš; GEROSTATHOPOULOS, Ilias; HNĚTYNKA, Petr; KEZNIKL, Jaroslav; KIT, Michal; PLÁŠIL, František: DEECo – an Ensemble-Based Component System. Proceedings of the 16th International ACM SIGSOFT Symposium on Component-Based Software Engineering; pp. 81–90; 2013.

Number of citations: 158 (Google Scholar)

The more computers cooperate with each other and with the world around them, the more difficult it is to write software that not only works well on its own, but also interacts well with its surroundings in all situations. Our DEECo component system offers a solution in the form of programs that can work together in dynamically created groups when needed. The article won the "10 Year Most Influential Paper Award" at the ICSA 2023 world conference.

Award: Best paper award at PODS 2021, 2022 ACM SIGMOD Research Highlight Award

CORMODE, Graham; KARNIN, Zohar S.; LIBERTY, Edo; THALER, Justin; VESELÝ, Pavel: Relative Error Streaming Quantiles. Proceedings of the Symposium on Principles of Database Systems (PODS 2021); pp. 96–108; 2021.

Quantiles are one of the basic statistical tools for measuring data. Therefore, quantile determination algorithms are an important tool for processing large data streams. In this article, we proposed a new algorithm for their measurement, the implementation of which was included in standard libraries for processing data streams.

Number of citations: 50 (Google Scholar), 17 (Web of Science)

ČADEK, Martin; KRČÁL, Marek; MATOUŠEK, Jiří; SERGERAERT, Francis; VOKŘÍNEK, Lukáš; WAGNER, Uli: Computing All Maps Into a Sphere. Journal of the ACM, Volume 61, Issue 3, Article No. 17; pp 1–44; 2014.

A basic article in algorithmic geometry.

Number of citations: 185 (Google Scholar), 94 (Web of Science)

DVOŘÁK, Zdeněk; POSTLE, Luke: Correspondence Coloring and its Application to List-coloring Planar Graphs without Cycles of Lengths 4 to 8. Journal of Combinatorial Theory, Series B 129; pp. 38–54; 2018.

Graph coloring is an important concept that models a number of practical problems. In this article, we define a new variant of graph coloring that generalizes well the previous variants and has advantageous algorithmic properties. Using it, we solved some long-open problems.

Number of citations: 77 (Scopus)

GEMROT, Jakub; KADLEC, Rudolf; BÍDA, Michal; et al.: Pogamut 3 Can Assist Developers in Building AI (not only) for their Videogame Agents. Lecture Notes in Computer Science vol. 5920; Springer, Berlin, Heidelberg; 2009.

Pogamut is a tool for rapid prototyping of artificial intelligence in computer games. The platform has been successfully used in various environments provided by game engines such as Unreal Engine, in the international BotPrize competition, and also as a learning tool for coding the behavior of intelligent virtual agents.

GEORGIEV, Iliyan; KŘIVÁNEK, Jaroslav; DAVIDOVIČ, Tomáš: Light Transport Simulation with Vertex Connection and Merging. ACM TOG 31, No. 6; 2012.

Number of citations: 110 (Web of Science)

Probably the first article to bring together previously separate approaches to simulating light transport. The resulting VCM algorithm has been integrated into standard graphics tools and is currently considered the most robust solution for rendering scenes with complex specular materials. The article was published in a journal with the highest impact factor in the Web of Science citation database category "Computer Science, Software Engineering" in 2012.

GREGOR, Petr; MÜTZE, Torsten; NUMMENPALO, Jeri: A Short Proof of the Middle Levels Theorem. Discrete Analysis 8; pp. 1–12; 2018.

Number of citations: 27 (Google Scholar)

The article presents a new, short and elegant proof of the intermediate layers hypothesis, which has been open for more than 30 years. The article was published as a response to the invitation of the Fields Medalist Timothy Gowers, who wrote an editorial introduction to it. This article develops methods used in several other articles.

HELL, Pavol; NEŠETŘIL, Jaroslav: Graphs and Homomorphisms. Oxford University Press, Oxford; 2004.

Number of citations: 1,275 (Google Scholar)

An important monograph in the field of graph coloring that combines mathematics with, for example, algorithms and statistical physics.

HOLAN, Tomáš: Delphi v příkladech. BEN – technická literatura; 2002

HOLAN, Tomáš; NERUDA, Roman: C++ Builder v příkladech; BEN – technická literatura; 2002.

HOLAN, Tomáš; FORST, Libor: Kylix v příkladech; BEN – technická literatura; 2003.

HOLAN, Tomáš; TAHALOVÁ, Lenka: Visual Basic v příkladech; BEN – technická literatura; 2004.

HOLAN, Tomáš: Unity: První seznámení s tvorbou počítačových her; CZ.NIC; 2020

A series of Czech textbooks of programming in various languages and environments, used in high school computer science education.

Number of citations: 78 (Web of Science)

HOŠEK, Lukáš; WILKIE, Alexander: An Analytic Model for Full Spectral Sky-Dome Radiance. ACM TOG 31, No. 4; 2012.

Together with two follow-up publications by the same authors, this work describes the model used by most major rendering programs today and which has become the de facto industry standard.

Award: Best paper award at Symposium on Foundations of Computer Science FOCS 2018

CHAKRABORTY, Diptarka; DAS, Debarati; GOLDENBERG, Elazar; KOUCKÝ, Michal; SAKS, Michael E.: Approximating Edit Distance Within Constant Factor in Truly Sub-quadratic Time. ACM 67(6): pp. 1–22; 2020.

Editing distance measures the similarity of texts and chains in general, for example DNA sequences. It is therefore widely used in text processing and bioinformatics. However, its calculation for specific chains is computationally relatively expensive. In this article, we proposed the first algorithm that can approximately calculate the edit distance with constant precision and runs in better than quadratic time.

KANTOR, Ida; MATOUŠEK, Jiří; ŠÁMAL, Robert: Mathematics++. American Mathematical Society, AMS 2015. 343 pp.; 2015.

A textbook providing a basic introduction to several areas of modern mathematics that are important in modern computer science, engineering, and other technical fields.

Number of citations: 6,873 (Google Scholar)

KOEHN, Philipp; HOANG, Hieu; BIRCH, Alexandra; CALLISON-BURCH, Chris; FEDERICO, Marcello; BERTOLDI, Nicola; COWAN, Brooke; SHEN, Wade; MORAN, Christine; ZENS, Richard; DYER, Chris; BOJAR, Ondřej; CONSTANTIN, Alexandra; HERBST, Evan: Moses: Open Source Toolkit for Statistical Machine Translation. Proceedings of the 45th Annual Meeting of the Association for Computational Linguistics Companion, volume Proceedings of the Demo and Poster Sessions; Prague, Czech Republic; Association for Computational Linguistics; pp. 177–180; 2007.

During a six-week workshop at John Hopkins University in Baltimore, USA, in 2006, the Moses machine translation system was created. It was not just the core of the system itself, but a whole complex of freely distributable tools, thanks to which, for the very first time in history, any

computer scientist could create a translation system. All that was needed was a larger collection of texts translated into the target language by humans. Based on Moses, several foreign companies were established that created customized translation systems for their customers.

KRIVÁK, Radoslav; HOKSZA, David: P2Rank: Machine Learning Based Tool for Rapid and Accurate Prediction of Ligand Binding Sites from Protein Structure. Journal of Cheminformatics 10; pp. 1–12; 2018.

Number of citations: 208 (Google Scholar)

The vast majority of current drugs are small molecules that bind to proteins and thereby modulate their function. The first step in rational drug research is therefore the detection of these binding sites, typically followed by the identification of small molecules that can bind to the predicted binding sites. We have developed a machine learning method that is able to detect these binding sites based on the 3D structure of the protein. Not only does the method outperform existing methods in terms of the ability to detect these locations, but it is also very fast. This enables the application of this method, for example, on the entire human proteome, i.e. the set of all known human proteins.

LOEBL, Martin; NEŠETŘIL, Jaroslav; THOMAS, Robin (eds.). A Journey Through Discrete Mathematics. A Tribute to Jiří Matoušek. Springer; 2017.

Number of citations: 80 (Google Scholar)

The book dedicated to the memory of Jirka Matoušek contains texts by outstanding experts in discrete mathematics.

LU, Jiaheng; HOLUBOVÁ, Irena: Multi-Model Databases: A New Journey to Handle the Variety of Data. ACM Computing Surveys, volume 52, issue 3, article no. 55. ACM Press; 2019.

Number of citations: 114 (Google Scholar)

Until recently, traditional relational databases were the first choice for efficient data storage. But at the beginning of the new millennium, new technologies and applications, such as mobile phones or social networks, brought a completely new challenge, so-called Big Data. Newly created data sets are not only extremely large, but also their volume often grows rapidly, we do not know their exact structure in advance, and moreover, the data can be very diverse, from structured to semi-struc-

tured to unstructured and any combination thereof. In this article, we focus on modern database systems designed for Big Data and examine their possibilities, especially from the point of view of supporting data diversity.

Number of citations: 1,004 (Google Scholar), 351 (Web of Science)

MORAVČÍK, Matej; SCHMID, Martin; BURCH, Neil; LISÝ, Viliam; MORRILL, Dustin; BARD, Nolan; DAVIS, Trevor; WAUGH, Kevin; JOHANSON, Michael; BOWLING, Michael: DeepStack: Expert-level Artificial Intelligence in Heads-up No-limit Poker. Science 356; No. 6337, pp. 508–513; 2017.

A lead article in the journal Science describes a result that broke a long-resisting frontier in artificial intelligence.

Number of citations: 324 (Google Scholar)

NEŠETŘIL, Jaroslav; MATOUŠEK, Jiří: Invitation to Discrete Mathematics. Oxford University Press; 443 pp.; 2008.

A basic college textbook of discrete mathematics that has found an audience around the world and is used in teaching at many universities at home and abroad. It has seen several editions and has been translated into four languages.

Number of citations: 484 (Google Scholar)

NEŠETŘIL, Jaroslav; OSSONA DE MENDEZ, Patrice: Sparsity – Graphs, Structures, and Algorithms. Algorithms and combinatorics 28, Springer; 2012.

A comprehensive monograph that captures and to a certain extent defines one large area of research on graphs and their structure. It deals with the so-called sparsity of graphs, which are used to capture various phenomena and structures.

Number of citations: 1,411 (Google Scholar)

NIVRE, Joakim; de MARNEFFE, Marie-Catherine; GINTER, Filip; GOLDBERG, Yoav; HAJIČ, Jan; MANNING, Christopher D.; McDONALD, Ryan; PETROV, Slav; PYYSALO, Sampo; SILVEIRA, Natalia; TSARFATY, Reut; ZEMAN, Daniel: Universal Dependencies v1: A Multilingual Treebank Collection. Proceedings of the Tenth International Conference on Language Resources and Evaluation (LREC'16), Portorož, Slovenia; European Language Resources Association (ELRA); pp. 1659–1666; 2016.

The article describes Universal Dependencies – a collection of language data, i.e. texts in many world languages, supplemented with grammatical information such as parts of speech or sentence structure. Such data, together with specialized software tools, are suitable both for linguistic research (comparison of languages, analysis of texts in already dead languages, documentation of endangered indigenous languages...) and for learning artificial intelligence algorithms, which can then analyze other texts in natural language. The Universal Dependencies project is groundbreaking in that it unifies the language description so that it is applicable to all known languages. The article was published in the spring of 2016 and describes the first version of Universal Dependencies, but the project continued to develop and influenced many other scientific works. And while at the time the article was published, the collection covered 33 languages, this year it is already 141 languages and the data size has exceeded 30 million words.

PANEVOVÁ, Jarmila; HAJIČOVÁ, Eva; KETTNEROVÁ, Vendula; LOPATKOVÁ, Markéta; MIKULOVÁ, Marie; ŠEVČÍKOVÁ, Magda: Mluvnice současné češtiny 2, Syntax na základě anotovaného korpusu. Praha: Karolinum; 2014.

Number of citations: 92 (Google Scholar)

This volume presents a view of Czech syntax based on material provided by grammatically annotated material from Czech computer corpora. Using this rich material, the authors analyze the basic questions of the meaning structure of the Czech sentence (types of dependency relations, the interplay of morphology and syntax in the Czech sentence, the essence of infinitive constructions, word order in relation to information structure, etc.) and supplement them with examples from real texts.

PAPADOPOULOS, Alessandro Vittorio; VERSLUIS, Laurens; BAUER, André; HERBST, Nikolas; von KISTOWSKI, Jóakim; ALI-ELDIN, Ahmed; ABAD, Cristina L.; AMARAL, José Nelson; TŮMA, Petr; IOSUP, Alexandru: Methodological Principles for Reproducible Performance Evaluation in Cloud Computing. IEEE Transactions on Software Engineering, pp. 16; 2019.

Number of citations: 74 (Google Scholar)

One of the principles of any experiment is reproducibility. If we discover something through an experiment, we would like such discovery to be

more than just an unrepeatable combination of coincidences. Our article on the methodological principles of experiments focuses on how to promote reproducibility in cloud computing environments, which are generally difficult to control.

Number of citations: 180 (Google Scholar)

PICADO, Jorge; PULTR, Aleš: Frames and Locales. Topology without points. Birkhäuser/Springer Basel AG, Basel; 2012.

An important monograph on topology.

Number of citations: 441

PLÁŠIL, František; BÁLEK, Dušan; JANEČEK, Radovan: SOFA/DCUP: Architecture for Component Trading and Dynamic Updating. Proceedings of 4th IEEE International Conference on Configurable Distributed Systems; pp. 43–51; 1998.

Nowadays we are used to the fact that the programs we use – whether on our phones or, e.g., on the web – update themselves. The SOFA/DCUP system, presented in our article, was able to run and safely and transparently update applications assembled from components already a quarter of a century ago.

PLÁŠIL, František; VIŠŇOVSKÝ, Stanislav: Behavior Protocols for Software Components. IEEE Trans. Software Eng. 28(11), pp. 1056–1076; 2002.

A number of errors in large programs surprisingly arise from the fact that their components cannot communicate with each other properly. The article shows how programs can be supplemented with rules for the communication of their components and then check whether all components follow these rules. In the January 2003 issue of IEEE SPECTRUM, this article was selected as one of four publications worthy of attention in the regular summaries of world research "Summaries of Research and Inventions from Science and Technology Journals".

Number of

POKORNÝ, Jaroslav: NoSQL Databases: A Step to Database Scalability in Web Environment. Proceedings of the 13th International Conference on Information Integration and Web-based Applications and Services (iiWAS '11). Association for Computing Machinery, New York, NY, USA; pp. 278–283; 2011.

The article is focused on the so-called NoSQL databases. In the context of cloud computing, the architectures and basic properties of these databases are studied, especially their horizontal scalability and the concurrent processing model, which is usually weaker than ACID transactions in relational database systems, especially SQL databases. Some characteristics, such as the data model and query capabilities, are discussed in more detail. The article also contains an overview of some representatives of NoSQL databases.

POPEL, Martin; TOMKOVÁ, Markéta; TOMEK, Jakub; KAISER, Łukasz; USZKOREIT, Łukasz; BOJAR, Ondřej; ŽABOKRTSKÝ, Zdeněk: Transforming Machine Translation: A Deep Learning System Reaches News Translation Quality Comparable to Human Professionals. Nature communications, 11, 438; 2020.

Number of citations: 183 (Google Scholar)

Automatic translation from one language to another belongs to the most popular uses of artificial intelligence methods in the field of natural language processing. Until recently, it was assumed that for a quality translation it is necessary to thoroughly understand the content of the translated text and that automatic translation will not reach a quality comparable to the results of human translators for a long time. This idea was broken by the CUBBITT translator, which was evaluated as more accurate than a translation performed by a professional agency in a blind test of the translation of English-Czech newspaper articles.

PROKOPEC, Aleksandar; ROSÀ, Andrea; LEOPOLDSEDER, David; DUBOSCQ, Gilles; TŮMA, Petr; STUDENER, Martin; BULEJ, Lubomír; ZHENG, Yudi; VILLAZÓN, Alex; SIMON, Doug; WÜRTHINGER, Thomas; BINDER, Walter: Renaissance: Benchmarking Suite for Parallel Applications on the JVM. 40th ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI); pp. 11–12; 2019.

Number of citations: 103 (Google Scholar)

Do you know the quote “You can only make as well as you can measure”? Even computers and programs need to be measured. Our Renaissance benchmark suite provides workloads for measuring the Java environment.

Number of citations: 76 (Google Scholar)

ROSSETTO, Luca; GASSER, Ralph; LOKOČ, Jakub; BAILER, Werner; SCHOEFFMANN, Klaus; MÜNZER, Bernd; SOUČEK, Tomáš; NGUYEN, Phuong Anh; BOLETTIERI, Paolo; LEIBETSEDER, Andreas; VROCHIDIS, Stefanos: Interactive Video Retrieval in the Age of Deep Learning – Detailed Evaluation of VBS; Transactions on Multimedia 23; pp. 243–256; 2021.

When searching in video, it is still very difficult to find all instances of a class of objects or one specific scene in a large collection. Modern tools therefore integrate text-based search approaches and interactive techniques for traversing candidate result sets. The article presents a comparative study of tools that already use deep learning techniques combined with interactive search methods. Further, an analysis of logs is presented, which points to the used search techniques.

Number of citations: 1 459 (Google Scholar)

SGALL, Petr; HAJIČOVÁ, Eva; PANEVOVÁ, Jarmila: The Meaning of the Sentence in its Semantic and Pragmatic Aspects. Dordrecht: Reidel; pp. xi + 353; 1986.

This monograph can be understood as a certain milestone in the history of Prague's approach to computer linguistics and to the formal description of language called "Functional generative description". Modern language resources (corpora) and their processing were based to a significant extent on the scientific knowledge published in this monograph both for the syntactic-semantic analysis of the real language usage and for building the Prague "family" of annotated corpora and valence lexicons since the second half of the 90s of the last century.

Number of citations: 101 (Google Scholar)

SKOPAL, Tomáš; BUSTOS, Benjamin: On Nonmetric Similarity Search Problems in Complex Domains. ACM Computing Surveys. 43; pp. 1–50; 2011.

The article is devoted to the then exotic way of searching in large databases in many domains, based on the similarity of individual data objects. Today, thanks to the growth of artificial intelligence methods, this method of searching is common, but it is significantly more complex than searching in traditional structured data (e.g. in relational databases). The article is devoted to fast search mechanisms even in the wildest (non-metric) similarity spaces.

VILÍM, Petr; BARTÁK, Roman; ČEPEK, Ondřej: Unary Resource Constraint with Optional Activities. Principles and Practice of Constraint Programming vol 3258; Springer, Berlin, Heidelberg; 2004.

Number of citations: 39 (Google Scholar)

When scheduling activities, so-called unary resources are often used, which are machines or humans who can perform a maximum of one activity at any given time. The article describes how to effectively determine when the activities allocated to a resource can be performed in such a way that the capacity of the resource is not exceeded. In addition, for optional activities, the resource can refuse to process the activity if it does not have the capacity for it. This article was the first to show how such techniques could be implemented effectively, for which it won the Distinguished Paper Award at the Principles and Practice of Constraint Programming 2004 conference.

Projects

DiGeo: Fundamental questions of discrete geometry

Pavel Valtr, GA ČR EXPRO, 2023–2027

The Digeo project investigates the fundamental questions of computational geometry.

kam.mff.cuni.cz/~digeo

Experimentation Driven and User-Experience-Oriented Analytics for Extremely Precise Outcomes and Decisions (ExtremeXP)

Tomáš Bureš, EU Horizon Europe, 2023–2025

Decisions, especially important ones, should be backed by data. These days, we usually have a lot of data, but not always in the necessary quality and not always exactly suitable for our needs. The ExtremeXP project develops tools that will improve our ability to make decisions through systematic experimental steps that augment low-quality data as needed. The project tools are applied in a wide range of scenarios, from forecasting flash floods through detecting attacks on computer networks to preventing industrial machine failures in automated factories.

extremexp.eu

Next-Generation Natural Language Generation (NG-NLG)

Ondřej Dušek, ERC Starting grant, 2022–2027

The goal of the project is to overcome the main problems of neural language models for text generation, which prevent their deployment in practice. It is mainly about transparency and reliability, because today's models work like a "black box", so the generated text cannot be controlled well, the behavior of the models is difficult to explain, and the outputs often contain unsubstantiated claims – we are literally talking about hallucinations. The project therefore develops explicit and controllable semantic representations for use during generation and focuses on the alignment of words and phrases at input and output. The project should make possible, for example, putting into oper-

ation a new system for reporting on data in a given area based on just a few dozen examples of inputs and outputs.
ufal.mff.cuni.cz/grants/ng-nlg

High Performance Language Technologies (HPLT)

Jan Hajič, EU Horizon Europe, 2022–2025

Large language models are very fast computer programs that are trained on huge amounts of text using artificial intelligence methods. Through extremely time-consuming and hardware-intensive training, they acquire the ability to generate texts and thereby answer questions, translate texts, write articles, program, etc. However, it must be noted that the models produce errors because they do not train the ability to understand. The aim of the European HPLT project is to process a huge amount of texts and create language and translation models ideally for all European languages. The project also focuses on ethical issues related to research in the field of language models, e.g. privacy protection and bias.
hplt-project.org

Predictive Rendering In Manufacture and Engineering (PRIME)

Alexander Wilkie, EU Horizon 2020, 2020–2024

The PRIME international project deals with computer graphics, specifically predictive rendering. Researchers collaborate on projects focused on accurate physical simulation of light and a whole range of materials, which has applications in various manufacturing sectors including precision optical components, color 3D printing, furniture production, etc.
prime-itn.eu

European Network for Integrated Training on Innovation Therapies for Vision RestoratIon (enTRAIN Vision)

Ján Antolík, EU Horizon 2020, 2020–2024

In the enTRAIN Vision project, young researchers from many European countries work together on innovative technologies designed to restore vision in blind patients. This research network brings together

experts from a variety of fields including neuroscience, vision research, psychophysics, genetics, electronics, bioengineering, machine learning and computational modeling.
entrain-vision.eu

STIRData

Jakub Klímek, EU CEF Telecom, 2020–2023

The STIRData project was addressed by an international consortium of academic institutions, companies and public administration institutions. It dealt with connecting data from different data sources, which is generally a very difficult task with a very expensive solution. The project showed the possibility of using technology for working with so-called knowledge graphs (data structures for representing a network of real-world objects and their mutual links) for connecting related data about companies in the countries of the European Union. The project also showed how it is possible to create software applications on top of linked data at significantly lower costs.
stirdata.eu

Algorithms and Complexity within and beyond Bounded Expansion

Zdeněk Dvořák, MŠMT ERC-CZ, 2020–2022

Any network of nodes and edges can be divided into roughly equal parts by removing a small number of nodes. More precisely, mathematically, it is claimed that every network with √n nodes drawn in a plane without crossing edges can be divided into roughly equal parts by removing approximately √n nodes. Networks with this property are found in many theoretical and practical applications (for example, in transportation). The goal of the project was to describe such networks by structural and geometric means and to use these findings to design effective algorithms for processing such networks.

SOMHunter Open source

Jakub Lokoč and his students, 2020–2021

Today, everyone can easily create large collections of images and videos using a smartphone. Once the volume of these data reaches a certain size (tens of thousands of objects), searching and browsing these data becomes a time-consuming problem. The SOMHunter project aims to enable fast searching of multimedia data using text queries, feedback and various search techniques.

github.com/siret/somhunter

Datová Lhota

Cyril Brom and Pavel Ježek, project MFF UK, ČT :D and CZ.NIC, released in 2020

Datová Lhota is a children's animated series about computers and the Internet. The main characters of the series are Kuba and his friend, the computer enthusiast Marwin. In the series, both are transported to Datová Lhota, where they experience adventure stories during which they solve Kuba's problems with computers.

ceskatelevize.cz/porady/11933175266-datova-lhota

Combinatorial Structures and Processes (CoSP)

Martin Loebl, EU Horizon 2020, 2019–2024

The CoSP project investigates questions of structure, algorithmic complexity and probabilistic connections in graph theory.

kam.mff.cuni.cz/rise/about

Dynamics and Structure of Networks (DYNASNET)

Jaroslav Nešetřil, ERC Synergy grant, 2019–2025

The topic of the international DYNASNET project is dynamic networks, i.e. constantly changing networks all around us, e.g. in communications, cell biology, the socio-economic system. The project represents a unique combination of mathematics together with applied research that seeks methods to more accurately understand and model dynamic networks.

iuuk.mff.cuni.cz/~hartman/dynasnet

Efficient Approximation Algorithms and Circuit Complexity (EPAC)

Michal Koucký, GA ČR EXPRO, 2019–2023

We want to compare two texts to see how similar they are. We want to find an integer solution to a system of linear equations. We want to find a schedule satisfying the specified constraints. What are the optimal algorithms for these problems and what makes these problems difficult to solve? The EPAC project aims to answer these and similar questions.

iuuk.mff.cuni.cz/~koucky/EPAC

European Live Translator (ELITR)

Ondřej Bojar, EU Horizon 2020, 2019–2021

The ELITR project developed a system for automatic simultaneous translation of spoken speech into many languages at the same time. The ELITR system can be set to monitor the speaker and interpreters simultaneously, creating a real-time transcription and translation from the currently selected source. Depending on the chosen configuration, the system achieves a delay comparable to human interpreters. In an experimental deployment at the EUROSAI congress and other events, ELITR translated from five languages to 42 languages. The second domain of the ELITR project was the automatic minuting. ELITR defined this task and made it a topic for shared tasks.

ufal.mff.cuni.cz/grants/elitr

Graal Compiler Performance Evaluation Techniques (UNiCORN)

Petr Tůma, Industrial (Oracle), 2016–2023

We want our phones and computers to work quickly and efficiently. This means that not only the hardware, but also the software that runs on this hardware, must be fast and efficient. A fundamental role in the speed of programs is played by compilers, i.e. tools that transform programs written by humans into a form comprehensible to computers. The UNiCORN project helps to identify situations in which Java compilers do not work efficiently, thereby contributing to speeding up a significant portion of existing software today.

graal.d3s.mff.cuni.cz

Distributed 3D Object Design (DISTRO)

Jaroslav Křivánek, EU Horizon 2020, 2015–2018

Nowadays, obtaining, digitally enhancing, publishing, and printing photographs are common activites. However, the challenge lies in effortlessly capturing the precise form and visual attributes of real-world objects, effectively storing and modifying them, facilitating online sharing, and even physically reproducing them elsewhere through printing. The international DISTRO project emerged with the aim of addressing precisely these challenges and providing viable solutions.

distro-itn.eu

Lower Bounds for Combinatorial Algorithms and Dynamic Problems (LBCAD)

Michal Koucký, ERC Consolidator grant, 2014–2018

Consider a map of road connections that change over time, e.g. existing roads are repaired or new ones are built. The LBCAD project addressed questions related to the best connection between two cities: What is the optimal way to store map information so that both map queries and map updates are as fast as possible? What is the best possible ratio of time spent on queries to time spent on updates? What are the best data structures and algorithms for such questions?

iuuk.mff.cuni.cz/~koucky/LBCAD

Graph Drawing and Geometric Intersection Graphs (GraDR EUROGIGA)

Jan Kratochvíl, EUROCORES, 2013–2015

Graph drawing is an area on the border between discrete mathematics and theoretical computer science that deals with the visualization of graphs and networks. Questions studied in this area often have names motivated by practical applications, e.g., the gallery guarding problem or the subway scheme design problem. Despite their funny names, however, these are difficult problems that often cannot be solved efficiently algorithmically.

Components Supporting the Open Data Exploitation (COMSODE)

Martin Nečaský, EU FP7, 2013–2015

The result of the international project was the software tool Open Data Node, which offers an instant and easy-to-use environment for managing and publishing open data. The project demonstrated to public administration institutions from different countries how it is possible to manage and publish their own data in the form of open data using the tool and with as little effort as possible.

comsode.eu

Center of Excellence – Institute for Theoretical Computer Science(CE-ITI)

Jaroslav Nešetřil, GA ČR, 2012–2018

The center has contributed to world and Czech science with a large amount of scientific knowledge, it has significantly contributed to the development of top science in the field of discrete mathematics and theoretical computer science in the Czech Republic, it has trained a whole new generation of experts who have found successful carrier both in the Czech Republic and abroad, and it has organized countless conferences and seminars.

iti.mff.cuni.cz

Complex Structures: Regularities in Combinatorics and Discrete Mathematics (CORES)

Jaroslav Nešetřil, MŠMT ERC-CZ, 2012–2017

An extensive project in the field of combinatorics and discrete mathematics. The project team included leading scholars in several areas: Ramsey theory, graph sparsity, homomorphisms, models, and categories.

Discrete and convex geometry: challenges, methods, applications (DISCONV)

Jiří Matoušek, ERC Advanced grant, 2011–2017

The DISCONV project dealt with fundamental questions in the field of combinatorics, discrete geometry, computational complexity and alge-

braic topology. As such, it has substantially contributed to the deepening of current knowledge in these areas. For example, it focused on the following question: consider finitely many points in three-dimensional space. How many pairs of points can have a distance of 1 meter between them? Although this question sounds simple, it is still not solved and is related to deep mathematical knowledge. The project succeeded in improving 25-year-old estimates.
cordis.europa.eu/project/id/267165/reporting

Autonomic Service-Component Ensembles (ASCENS)
František Plášil, EU FP7, 2011–2014

Today's computer systems are good at solving self-contained problems, e.g. computing on cloud servers, controlling individual robots or finding a route to an electric car charger. The ASCENS project brought formal tools that allow these systems to better cooperate and solve open-world tasks – coordinate computing cloud resources, control groups of cooperating robots, or recommend a charging space so that it is not occupied by someone else just as we arrive.
www.ascens-ist.eu

LINDAT/CLARIAH-CZ: Digital Research Infrastructure for the Language Technologies, Arts and Humanities
Jan Hajič, MŠMT, 2010–2026

LINDAT/CLARIAH-CZ is a large research infrastructure for language technologies, arts and social sciences and humanities, in which 15 Czech institutions participate. It enables the archiving, processing, management and making available of data, resources and tools from all named research areas. The infrastructure is characterized by the adjective digital: it significantly supports modern methods with data, software and web services in fields that previously carried out research in a traditional way. LINDAT/CLARIAH-CZ also serves the public (machine translation, Internet language guide, etc.) and emphasizes open access to data and tools so that they are available with as few restrictions as possible to all potential users.
lindat.cz

An Extended Value Chain Model for Performance Prediction and Optimisation of Product and Process Lifecycles for SMEs (ValuePOLE)

Roman Barták, EU FP7-SME, 2008–2011

A European project focused on techniques for predicting future production performance and thus enabling the selection of a production line modification (for example, the purchase of equipment) that best suits the expected production volume.

cordis.europa.eu/project/id/222218

Quality Impact Prediction for Evolving Service-Oriented Software (Q-ImPrESS)

František Plášil, EU FP7, 2008–2010

As the capabilities of computer hardware grow, so does the volume of software. A typical mobile phone today runs tens of millions of lines of code. Similarly large software can be found, for example, in corporate information systems or on the web. At the same time, extensive software is expensive to maintain and further develop. The Q-ImPrESS project therefore came up with procedures to estimate the impact of changes in software using simulation, thus giving programmers an opportunity to better plan software development and maintenance.

cordis.europa.eu/project/id/215013

Enterprise Modelling and Performance Optimisation (EMPOSME)

Roman Barták, EU FP6-SME, 2005–2008

A European project in which a software tool was created for modeling and optimizing production in small and medium-sized manufacturing companies. All in a user-friendly interface that allows ordinary users to use the tool even without expertise in optimization.

cordis.europa.eu/project/id/18071

Platform for Enhanced Provisioning of Terminal-independent Applications (PEPiTA)

František Plášil, EU ITEA, 1999–2001

Similar to other domains, “divide and rule” also applies in software development. Complex software systems are commonly composed of

many simpler components that together form the final application. The PEPiTA project created tools for defining and composing applications by deploying separately developed and potentially partially incompatible components.
itea4.org/project/pepita.html

Laboratory of Language Data Processing (LPZJD)

Eva Hajičová, MŠMT, 1996–2000

The Prague Dependency Treebank is a unique collection (corpus) of richly linguistically annotated Czech texts. Its first version was published in 2001, and at that time it was the largest annotated corpus in the world, after the American PennTreebank corpus. Annotation of the corpus on the morphological, syntactic and semantic layers was initiated in the LPZJD project according to the theoretical framework of the Functional Generative Description of Language. From the point of view of the development of the field of computational linguistics at MFF UK, this is a very crucial moment. In 2020, a consolidated version of the corpus with a total volume of 4.5 million words was published. Nothing has changed about its uniqueness.
starfos.tacr.cz/cs/projekty/VS96151

NetBeans

Adam Dingle, student project MFF UK, 1996

NetBeans is a software environment that greatly simplifies the development of all types of applications. At the very beginning, it was a student project at MFF UK, the goal of which was to create a user-friendly development environment for the Java programming language. After graduation, the students founded a company and continued the project commercially. In 1999, the company was bought by Sun Microsystems, which has been part of Oracle since 2010.

Application Specific Depository of Object ORiented Environment (ADOORE)

Jaroslav Pokorný, COPERNICUS, 1995–1998

The project was handled by an international consortium of the Czech institutions MFF UK and DCIT and the foreign institutions IQSOFT (Hun-

gary) and Objectif Technologie (France). MFF UK participated in the design and development of the GEN.LIB/C++ software library. The goal was to implement the OMT methodologies of object-oriented analysis and design into the environment of building enterprise applications. The library enables object persistence in C++ and also offers non-procedural querying capabilities.

A Network of Research Excellent Centres, developing the scientific foundations for Trustworthy AI through the integration of learning, optimisation and reasoning (TAILOR)

Roman Barták, EU Horizon 2020, 2020–2024

TAILOR is a network of excellent European research facilities focused on developing artificial intelligence techniques that allow automated systems to provide trustworthy and verifiable outputs.
tailor-network.eu

4.3

Personalities of the School

The School of Computer Science awarded these academics with a commemorative certificate or medal of the Faculty of Mathematics and Physics of Charles University on the occasion of the 30th anniversary of the establishment of the School.

prof. RNDr. Jan Kratochvíl, CSc., *commemorative certificate* for his significant contribution to the scientific, pedagogical, and structural development of the School of Computer Science.

Jan Kratochvíl's scientific work is focused on discrete mathematics and theoretical informatics, graph theory, and algorithms and their complexity. He has published important works in the theory of geometric representations of graphs. He is one of the pillars of the world-famous Prague School of Discrete Mathematics, concentrated in the Department of Applied Mathematics, which he chaired for 8 years. Later, he also served for 8 years as the Dean of the Faculty of Mathematics and Physics of Charles University, the first coming from the School of Computer Science. Since 2023, he has been a member of the Scientific Council of the Neuron Foundation, which supports excellent scientists in the Czech Republic. Jan Kratochvíl is a member of the Learned Society of the Czech Republic.

doc. RNDr. Antonín Kučera, CSc., *commemorative certificate* for his significant contribution to the scientific, pedagogical, and structural development of the School of Computer Science.

Antonín Kučera graduated from the Faculty of Mathematics and Physics in Mathematical Analysis. However, since his studies, he has devoted himself to constructive mathematics, mathematical logic, and later to recursion theory and the theory of algorithmic randomness. Several results in the algorithmic randomness that he authored or co-authored constitute the foundations of this theory. Antonín Kučera was one of the main initiators of the formation of the School of Computer Science at the Faculty of Mathematics and Physics. He served as the head of the Department of Cybernetics and Computer Science, and after the formation of the School of Computer Science in 1993, he became its first vice-dean. During his tenure, he was largely responsible for the renovation of the School's building at Lesser Town Square (Malostranské náměstí). He held the position of Vice-Dean until 2011.

prof. RNDr. Jaroslav Nešetřil, DrSc., dr. h. c. mult., *commemorative certificate* for his significant contribution to the scientific, pedagogical, and structural development of the School of Computer Science.

Jaroslav Nešetřil was instrumental in the development of discrete mathematics and theoretical computer science, with his impact reaching beyond the Faculty of Mathematics and Physics. At the beginning of the 1970s, he founded a combinatorial seminar, which he over time expanded to the world-famous Prague School of Discrete Mathematics. For many years, he was the head of the Department of Applied Mathematics, and in 2012 he was responsible for the creation of the Computer Science Institute of Charles University, which he initially also led. Besides, he is a co-founder of the national research center of the Institute of Theoretical Computer Science, which became the Centre of Excellence – Institute of Theoretical Computer Science. Jaroslav Nešetřil is a member of the Learned Society of the Czech Republic.

prof. RNDr. Ondřej Čepek, Ph.D., *Gold Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the scientific, pedagogical, and structural development of Computer Science at the Faculty of Mathematics and Physics at Charles University.

Ondřej Čepek is historically the second Vice-Dean of the School of Computer Science. He held this post 2011–2018. Among other things, he was responsible for building new spaces for graduate students in the School's building at Lesser Town Square (Malostranské náměstí). He initially specialized in scheduling theory. More recently, he has focused on knowledge compilation and representation of Boolean functions. He utilizes his teaching and organizational skills as a coordinator of the Bachelor Computer Science programme.

prof. PhDr. Eva Hajičová, DrSc., *Gold Medal of the Faculty of Mathematics and Physics, Charles University* for her significant contribution to the development of computational linguistics as a respected scientific and study branch of computer science at the Faculty of Mathematics and Physics of Charles University.

Eva Hajičová was one of the pioneers of computational and formal linguistics who, after an ideologically conditioned departure from the Faculty of Arts in the early 1970s, found a supportive environment at the Faculty of Mathematics and Physics. After the Velvet Revolution, she was a key person in the founding of the Institute of Formal and Applied Linguistics in 1990 and became its first director. Her leadership attracted talented students and scientists from all over the world, which made IFAL one of the pillars of computer science at the School of Computer Science. Eva Hajičová is a member of the Learned Society of the Czech Republic.

RNDr. Rudolf Kryl, *Gold Medal of the Faculty of Mathematics and Physics, Charles University* for a significant contribution to teaching programming and for his dedication to the development of computer science education studies at the Faculty of Mathematics and Physics at Charles University.

Rudolf Kryl played a vital role in shaping the modern concept of computer science education studies in the 1980s and 1990s. He founded the Department of Software and Computer Science Education within the School of Computer Science and served as its head from 1990 to 2006. He established the department to provide comprehensive support for computer science education studies and to offer basic programming courses for the entire Faculty. He also established the Carolina Center, which provided computer assistance and support to visually impaired students, later expanding its scope to become a university-wide department.

prof. Ing. František Plášil, DrSc., *Gold Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the scientific, pedagogical, and structural development of the School of Computer Science, particularly within the Department of Distributed and Dependable Systems.

František Plášil established one of the first software-oriented research groups within the School of Computer Science, focusing on software architectures and distributed systems. Under his leadership and leveraging his experience from foreign universities, the group gradually evolved into the Department of Distributed and Dependable Systems. Thanks to his efforts, the School of Computer Science became involved in the first international research projects in the field of software systems, as well as in the first applied research projects with international industrial partners.

prof. RNDr. Aleš Pultr, DrSc., *Gold Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the scientific, pedagogical, and structural development of the School of Computer Science.

Aleš Pultr's scientific work spans across various mathematical disciplines, including algebra, topology, mathematical analysis, category theory, and combinatorics. He is one of the founders of the Prague School of Category Theory, which has garnered considerable interna-

tional recognition. Additionally, Aleš Pultr has made notable contributions to point-free topology, having published two monographs in this area. Aleš Pultr is a member of the Learned Society of the Czech Republic.

RNDr. Libor Forst, *Silver Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the structural development of computer science and the thriving of computer networks at the School of Computer Science, the student dormitories, and the Faculty of Mathematics and Physics as a whole.

He has been involved in computer technology and computer networks at the Faculty of Mathematics and Physics since 1990. He played a crucial role in building up essential services and computer networks, particularly in the School's building at Lesser Town Square (Malostranské náměstí). On the organizational front, he established the Networks and Labs Management Center (SISAL) and has served as its head for several decades. Under his leadership, SISAL has been responsible for building and managing computer networks in the student dormitories and the IMPAKT pavilion in Troja.

RNDr. Michal Chytil, DrSc., *Silver Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the scientific, pedagogical, and structural development of computer science at the Faculty of Mathematics and Physics of Charles University.

Michal Chytil represents the generation that shaped computer science as a distinct field of study at the Faculty of Mathematics and Physics in the 1970s and 1980s. His scientific work primarily focuses on the theory of formal languages. In 1990, he served as the vice-dean and head of the Department of Cybernetics and Computer Science. He subsequently pursued a career in the commercial sector, and, from 2012 to 2017, he held the position of director of the Institute of Computer Science of the Czech Academy of Sciences.

prof. RNDr. Jaroslav Pokorný, CSc., *Silver Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the scientific and pedagogical development of the field of software and data engineering at the Faculty of Mathematics and Physics of Charles University.

Jaroslav Pokorný played a pivotal role in establishing software and data engineering as a distinct field of study at the Faculty of Mathematics and Physics of Charles University in the 1980s and 1990s. His scientific work primarily focuses on the theory of database systems, database models, and query languages. In the realm of pedagogy, he founded, oversaw, and taught core subjects related to software and data engineering. He served as the head of the Department of Software Engineering from 1993 to 2006, and as the vice-dean for research and foreign cooperation from 2008 to 2012.

doc. RNDr. Pavel Töpfer, CSc., *Silver Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the pedagogical and organizational development of the School of Computer Science, particularly in the areas of programming and computer science didactics.

Pavel Töpfer is dedicated to computer science didactics and the support of talented students interested in the field. He served as a long-time coordinator of the Computer Science curriculum at the School of Computer Science and as the head of the Department of Software and Computer Science Education. Under his leadership, working groups emerged that have been focusing on innovative didactic research at the intersection of computer science, pedagogy, and psychology, as well as on educational computer games and the synthesis of realistic images in computer graphics

prof. RNDr. Milan Vlach, DrSc., *Silver Medal of the Faculty of Mathematics and Physics, Charles University* for his significant contribution to the scientific, pedagogical, and organizational development of computer science at the Faculty of Mathematics and Physics of Charles University.

Milan Vlach is one of the nestors not only at the Faculty of Mathematics and Physics of Charles University but also within the broader academic community. In the 1970s, he played a crucial role in establishing university and secondary study curricula as well as dedicated academic workplaces for teaching and research of computer science. His early work primarily dealt with specific tasks of linear programming and production scheduling. Later, his research interests shifted to optimization under conditions of uncertainty. With the support of the Japanese Ministry of Education, he co-founded the Czech-Japanese seminar on decision-making under uncertainty.

1691 + Professed House in Prague’s Lesser Town

1960 + MFF in Professed House

2000 + Complex reconstruction of Professed House

2004 + The unveiling of the rotunda of St. Václav in Professed House

2005 – Complex reconstruction of Professed House

2015 + Roof for Computer Science

2020 + IMPAKT in Troja

5.0

At Good Addresses

When the Faculty was established in 1952, it was located in two buildings on Ke Karlovu Street 3 and 5. Over time, its research and teaching activities gradually expanded, leading to space constraints within the Karlov buildings. Consequently, the Faculty began to acquire additional premises: in 1960, the space in the Professed House on Malostranské square 25 was acquired, housing mostly computer scientists, and in 1961, a building on Sokolovská Street in Karlín was obtained for mathematicians. In 1968, construction commenced on a complex of buildings on the site of the former Pelc-Tyrolka estate on the right bank of the Vltava River, near the Barikadník bridge. This complex was gradually developed and ten years later, some physics departments from Karlov moved to these new premises. Presently, this cluster of Faculty buildings is commonly referred to as the Troja Campus.

The origins of the Professed House can be traced back to the period following the Battle of White Mountain in 1620. During this time, the Jesuit Order rose to prominence in Bohemia. Adjacent to their central establishment in Old Town, called Klementi-

num, they built the Professed House on the opposite bank of the Vltava River. This structure functioned as a dwelling for members of the order who had achieved the highest ranks within its hierarchy.[1] Considering the role of the Professed House in the 21st century as a university workspace, a comprehensive renovation was imperative. The building was in a severely decayed state, both externally and internally. Prior to the restoration, the first floor housed a court archive with antiquated and ugly shelves. The corridors were partitioned into cramped offices, humorously referred to as "chicken coops." The building was equipped with only a freight elevator, which was not always operational, and many rooms still had functional stoves for heating. The process of refurbishment commenced in 2000, with little anticipation that it would eventually uncover an archaeological marvel. The initiative began with clearance work beneath the first-floor surface in December 2003, aimed at creating purpose-designed spaces. As fragments of masonry were uncovered in January 2004, a significant discovery emerged on February 3 of the same year: the revelation of the St. Wenceslas rotunda. Historical records indicated its 11th-century construction on Malostranské square, yet no tangible remains had persisted, and the exact location had remained elusive for historians (Čiháková, Müller, 2020).

The comprehensive renovation of the Professed House reached its successful conclusion in 2005. Among the notable changes, the former check-in hall of the State Bank, built in the court yard by the Ministry of Finance during the First Republic, which held ownership of the Professed House after 1918, was transformed into a computer lab. Additionally, a catering facility was established within the building's basement, and the two floors above it saw the restoration of the refectory, now known as the Hall, along with the revival of its painted decorations. Since September 2008, the Hall has been the venue for bachelor graduation ceremonies of all the faculties of Charles University.

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1 ms.mff.cuni.cz/tourist/ProfDum.html.en

Romanesque tiles discovered in the rotunda of St. Wenceslas

The pivotal figure behind the build-up of the Professed House and the Church of St. Nicholas was Václav, Count Liebsteinský of Kolowrat. Without his remarkable generosity, the construction of these buildings might not have even commenced. The profound contributions of contemporary benefactors facilitated the acquisition of a grand piano for the refectory in 2013. Notably, half of the instrument's cost was covered through the Adopt Your Hertz fundraising initiative, where contributors symbolically adopted single piano strings. With the same generosity, the message of the fundraising to save the St. Wenceslas rotunda found a positive response. The mission was successfully accomplished. The inaugural piano recital took place on October 22, 2013, performed by Ivan Klánský, and on August 28, 2016, the rotunda was officially unveiled to the donors in a ceremonial event.

As the buildings in Malá Strana and Karlín started bursting at the seams, the Faculty's management proposed the construction of a new pavilion with-

in the Troja Campus in 2011. That year, Dean Zdeněk Němeček and his team advanced the plan to a full-fledged architectural study. However, it was not until a span of nine years had passed that the IMPAKT pavilion was officially inaugurated on June 9, 2020. In the opening ceremony Dean Jan Kratochvíl, Charles University Rector Tomáš Zima, and Vice-Dean for Development Ladislav Skrbek cut the ribbon in unison. Dean's speech during the event acknowledged: *"The preparation of the pavilion took a very long time and was affected by a number of administrative complications. I assumed that we would open the IMPAKT pavilion at the end of my term. But I originally had the first term in mind. I am glad that we were able to successfully complete the construction at the end of my second term."* A quote by English philosopher and scientist Roger Bacon (1214–1294) graces the main entrance of the building: *Mathematics is the gate and key to the sciences.* This statement does not require any further augmentation.

During the preparation for the construction of the IMPAKT pavilion, a significant development occurred between the period of November 1, 2014, to October 31, 2015, with the reconstruction of the Roof for Computer Science project. This initiative involved insulating the attic spaces of the Professed House and erecting a new attic structure equipped for use by doctoral candidates. This expansion in facilities contributed to a greater capacity for workspace. Interestingly, the attic, alongside the computer server rooms, is the only air-conditioned area in the building. One might speculate whether this signifies a particular emphasis on valuing students and computers. To address such ponderings, it is worth noting that the IMPAKT pavilion is fully air-conditioned.

6.0

Messages in a Bottle

The Vltava River is visible from every building of the Faculty. It gives us the opportunity to throw a bottle into Vltava's currents, carrying messages that reflect our vision of the future. We categorize the fortunate fishermen into distinct groups, which explains the presence of multiple messages in the bottle.

A message for present students of the Faculty
You are likely to be aware that computer science is an expanding field. This means you have the freedom to select your own ventures within our domain and pursue them with enthusiasm. Our doors remain wide open to you. We are committed to supporting and engaging you based on your interests and capabilities. Be sure to explore opportunities like competitions and internships, as practical experience cultivates expertise. Above all, continue your studies actively.

A message for undecided students
If you are fighting with uncertainty about joining us, do not hesitate to talk to us. That is because we value a friendly atmosphere. Alternatively, if you prefer to delve into reading beforehand, you can search for the text titled "60 Years of Experience, 30 Years of Youth: The School of Computer Science MFF UK". It offers valuable

insights about us. We promise you high-quality and engaging education, supported by cutting-edge research. You will have a significant workload but time will show that the effort pays off.

A message for international students in uncertainty
Search for the text "60 Years of Experience, 30 Years of Youth: The School of Computer Science MFF UK". This resource will help you in locating our computer science geographically and thematically. We eagerly anticipate the cultural diversity you will bring to our community and are committed to ensuring that you feel as comfortable as possible during your time here.

A message for teachers
The way computer science is commonly taught in schools often falls short of true computer science education. Students typically acquire only basic user skills. We are dedicated to exploring effective methods for teaching "new computer science" at the elementary school level. Our goal is to develop fresh didactic materials and tools.

A message for research and business colleagues
We want to continue to search for, create and develop new trends in basic research and applications, and also in teaching. This is not a revolutionary vision, we are already doing it. However, especially with regard to the rapid development in artificial intelligence, we will have to be more dynamic and operative in this activity. We will engage ourselves more intensively in interdisciplinary cooperation as well as we will investigate the connections and application potential of machine learning, e.g. for understanding biological processes at the molecular level, in algorithmic game theory, in the digitalization of social sciences and humanities. At the same time, we will continue to explore the potential of machine learning as a mathematical task, e.g. in a combination of neural networks and symbolic methods.

Efficient data management serves as the cornerstone for effective data operations, not solely within the field of IT. We plan to

incorporate artificial intelligence as an assistant of a software and data super engineer into this process. Our objective is to overcome challenges related to unstructured textual data and various other aspects. We are driven by the aspiration to motivate researchers to share data while creating an enabling environment for such activities, even encompassing legislative considerations. In addition to data, knowledge holds significant importance. Hence, we are committed to exploring methodologies that automate the extraction of formal knowledge from data and facilitate its efficient utilization. Our motivation stems from real-world challenges, and we apply our strategies to address these challenges. Our interaction with robots continues to evolve, fueled by an increasingly comprehensive understanding of their capabilities.

Within the software domain, we are ready to introduce models for fluid software architectures and self-optimizing systems in software architectures. We are dedicated to enhancing the applicability of our formal verification tools for large-scale software projects. Moreover, we are actively pursuing methods to automatically analyze specific code properties without the need for pre-existing specifications. Our aim is to seamlessly integrate software effectiveness monitoring into the software development process, thereby enhancing the overall efficiency of data centers and applications. Simultaneously, we are persistently improving language services. Despite the significant progress achieved through machine learning in language technologies, we are committed to delving into exploring natural languages and their underlying structures, considering the universality of their representation. Our dedication to game development remains passionate, driven by the goal of transforming lives through captivating interactive experience. Furthermore, we aspire to make a meaningful impact on the lives of the visually impaired by developing computer systems that can partially restore their visual abilities.

We are considering the possibility of establishing a university spin-off focused on the area of 3D printing.

We intend to actively participate in cultivating public discussions about artificial intelligence, primarily through showcasing our

achievements. We recognize that significant potential for improvement exists in this area. As highlighted in the article “Artificial Intelligence Poverty” by Patrik Zandl (Lidové noviny, September 22, 2022), the author rightfully raised concerns: *“Are you familiar with the artificial intelligence translator Google Translate? Most likely. German DeepL? Probably yes, it’s excellent. At Charles University, a translator was developed that is similarly good, but unfortunately, no one invested money either in its user-friendly web version or in its promotion, so no one uses it or knows it…”*

A message for others

You may choose to pass the bottle forward as you wish.

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