Rūsiņš Mārtiņš Freivalds

In Memoriam

Rūsiņš Mārtiņš Freivalds at Lone Pine Koala Sanctuary in Brisbane, Australia.
Photo: Solvita Zariņa

Rusins Freivalds, one of the leading Latvian scientists of his generation, passed away at the age of 73 on January 4, 2016.

Freivalds was highly recognized in both Latvia and internationally. He was a recepient of the Grand Medal of Latvian Academy of Sciences (the highest award for research achievements in Latvia) and one of only 6 Latvians elected to Academia Europaea. Freivalds was also my first research supervisor and played a major role in my development as a researcher.

Freivalds was born on November 10, 1942 in Cesvaine, Latvia. He studied at the University of Latvia and, during his studies, he had an opportunity to spend two years in Novosibirsk (3500 km East of Latvia), one of leading theoretical computer science research groups in the Soviet Union. Akademgorodok (Academic Town), on the outskirts of Novosibirsk, was a quiet place without many distractions which housed several top-class research organizations. There, he started working with Boris Trachtenbrot, one of leading Soviet computer scientists, who supervised his Ph.D. dissertation (defended in 1971).

After returning from Novosibirsk, Freivalds, together with other Latvians who studied in Novosibirsk (most notably, Jānis Bārzdiņš) established a research tradition in computer science at the University of Latvia. In fact, most of the faculty at our Faculty of Computing are academic descendents (students or students of students) of Bārzdiņš or Freivalds!

Worldwide, Freivalds is best known for his probabilistic algorithm for testing matrix multiplication, invented in 1977 (https://en.wikipedia.org/wiki/Freivalds'_algorithm). Finding faster algorithms for matrix multiplication is a major research challenge. Freivalds' discovery was that, given the result of matrix multiplication, one could check its correctness substantially faster than the time for multiplying the matrices with the best algorithm that is known. Freivalds' algorithm is now a part of standard textbooks on probabilistic algorithms and is taught in courses in many universities. It was also mentioned as an important inspiration by Manuel Blum in his 1995 Turing Award lecture.

More generally, Freivalds was one of the first to study probabilistic algorithms and to compare the power of algorithms that use random coin flips with algorithms that do not use randomness. His focus was on finding situations in which one could prove that randomness increases the computational power. For example, Freivalds showed that there is a language that can be recognized by a probabilistic 2-way finite automaton but not by a deterministic 2-way finite automaton. In 1970s, this was a cutting edge research and Freivalds was one of the pioneers of a new research field.

Being in Soviet Union, it was quite non-trivial for him to keep up with the research developments in the West. When I worked with him, Soviet Union was gone but I saw English-language books that were copied by him from a library in Moscow by taking a photograph of every page of the book - this was the only way how he could obtain a copy. And I heard stories of how he was only allowed to travel outside the Soviet Union once in two years. Freivalds used this to go to MFCS (Mathematical Foundations of

Computer Science) conferences in Czechoslovakia and Poland and tried to keep up with what was happening on the other side of the Iron Curtain as much as possible.

I started attending Freivalds' seminar in my first weeks at the University of Latvia, as a first year undergraduate. Working with undergraduates and trying to introduce them to research was extremely important for Freivalds. And being able to find research questions that were explainable to an undergraduate student like me (a smart person but without much background knowledge) was one of his talents.

I ended up working together with Freivalds for 5 years, until I finished my Masters'. We worked on a number of topics, primarily in inductive inference (a recursion-theoretic theory of learning) but also in communication complexity and complexity of finite automata. During this period, I had 15 research papers, some of which we wrote together and some were written by just myself but on topics suggested by Freivalds.

This research experience built my skills as a researcher and made me recognizable outside Latvia. It was the main reason why I was admitted to Ph.D. program in computer science at Berkeley and went on to do things that I have done.

It is interesting that Freivalds was also the first person who suggested quantum computing to me. In 1993, he came back from a conference (FOCS'93), showed me one of the very early papers on quantum computing and said "This is the thing to work on!" While we did not do any work on quantum computing at that time, it is very remarkable that Freivalds saw the potential of it, at the time when only a small number of people were working on it. (Shor's quantum algorithm which started the boom of quantum computing came one year later, in 1994.)

By coincidence, I took a course on quantum computing at Berkeley in 1997. And, when I came back to Latvia for Winter break, I talked with Freivalds and discovered that he has started working on it too. We collaborated on quantum computing research for the next 5 years and it was helpful for both of us. I also helped with mentoring some of his students in quantum computing. And, besides being interesting as research, this also helped me to maintain connection to Latvia (which eventually led me to coming back to Latvia in 2007).

Freivalds was an excellent teacher. In 2006, University of Latvia students voted him to be the "Teacher of the Year" for all of the natural sciences. And my teaching methods have certainly borrowed from him quite a bit. (By coincidence, another person who has been a major influence on my teaching style is prof. Agnis Andžāns who trained myself and other Latvian students for mathematics olympiads. He did his Ph.D. in theoretical computer science with Freivalds and there is quite a bit of similarities between their styles.)

Freivalds is one of a very small number of people who have influenced my life trajectory in a fundamental (possibly, life-changing) way. I am not sure where I would be without him as an advisor as an undergraduate. I am very thankful to him for guiding me.

Andris Ambainis