https://doi.org/10.4038/ucr.v4i1.127

Computer Sciences and inter-disciplinary research

Thank you very much for inviting me to speak about the challenges in computing research. The organizers have identified some key points for the discussion and I will talk about these points based on computing research. The first one is about acceptable or typical methodologies in the discipline. To talk about that let me explain a little bit about the origin of computing. The discipline started during the last hundred years or so and now it has become a very strong discipline. The discipline started from two places: that's the Faculty of Science and the Faculty of Engineering. In the Faculty of Science, it started as Computer Science and in the Faculty of Engineering, it is computer engineering. So, when a new discipline is created having roots in both these two areas, research development and the methodologies are also based on those origins. In abstract terms, we discover unknown knowledge in the universe using the scientific approach irrespective of a particular discipline. And on the other side, in engineering they do not neglect the theories but they consider the structures. They wanted to build some structures using their disciplinary approaches, validate these structures or models and then try to present those models to society. So, if I go back to the origin of computing, computer science, the parent academic place is the Department of Mathematics. People really wanted to see how mathematical applications could be automated. Even the first computer was a machine for computing – an adding machine. So, its parent discipline is mathematics - but statistics and computer science are like siblings. The main thing is that it cannot survive without interacting with the other disciplines. Not only science, it has to interact with disciplines even outside science, otherwise that discipline doesn't grow. That's the major thing we saw at the beginning.

Computer science is not pure science. It's an applied science generally. However, somewhere around the 1990s, people wanted to combine these two things. Today, we see the theoretical computer science, where we see lot of work done, a lot of papers and models starting from even the algorithm level. On a personal note, I graduated from the Department of Statistics and Computer Science, Faculty of Science. But for my postgraduate studies, my placement was in the Faculty of Engineering at the Hiroshima University in Japan where, once they evaluated me, I could register for a PhD programme straightaway because of this combination of computer science and computer engineering aspects in my first degree.

Considering the computing and technology outcome of science and engineering, once you combine science and engineering what comes out is Information Technology. So Information Technology is the third sub-discipline that comes from Computing, and research and development methodologies come from construction, validation, simulation and experimental work. Software Engineering is another discipline that came up because it's mainly concerned about Intangible

Product Development. Information Systems is the fifth sub-discipline that came in computing where there is an integration with other disciplines. This is an area where you see lots of interdisciplinary, multi-disciplinary and cross-disciplinary work. So, I see these things like five fingers, in computing there's Computer Science, Computer Engineering, Software Engineering, Information Systems and Information Technology. Artificial intelligence and machine learning, data science and cyber security are the three new fingers that have come into computing now. So there may be more things to come because of the integration of different methodologies.

If you look at the literature, people sometimes say that computing research methodologies are not very strong. What is accepted in the field of computing is a 'working solution'. Most of the time things are judged by people based on that. Theoretical descriptions are good, but at the same time whatever is presented as the output should be compatible with current technology environment and trends. Openness and reusability are considered highly in computing academia because then only can it promote further the development of knowledge. If I tell you a quick, simple example; Microsoft Windows is a proprietary product but Linux is an open-source based operating system. But Linux has made a greater impact in computing and I would say is the strongest operating system among the research community today.

Now the next question - at what stages of research is research published or disseminated? Usually, review papers are what people really want to see because there are lots of things happening which we don't know. So, we consider that as a good starting point. For the work in progress to be presented, conferences are the best places. We prefer conference papers to journal papers because you will find the latest developments in conferences rather than journals. Journal papers are still needed and people promote it, but we always say you need to have enough progress, if you really want to show your contribution.

Why have these conventions evolved as such? Because of the competition in the domain of computing and because success can be outdated, we must show progress before contribution. Today's novelty will be challenged tomorrow and things are changing very fast. And do we have threats? Yes of course, there are lots of threats as you can see: bogus solutions and predatory publications; incomplete solutions and publications; one-sided views; unethical research and a lack of contribution to the domain knowledge of computing. Thank you very much.

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