CS-Can/Info-Can State-of-the-Discipline and Planning Retreat (18w2240)

Kellogg S. Booth (UBC), Yvonne Coady (University of Victoria),
Doina Precup (McGill University), Carey Williamson (University of Calgary)

November 16-18, 2018

A representative group drawn from the Canadian Computer Science (CS) community gathered in Banff in November 2018 to discuss the future of our discipline. The attendees included a diverse selection of about 30 Canadian CS academics, students, and industry representatives, all of whom were extremely passionate about CS research, education, and innovation. The retreat was organized by CS-Can/Info-Can [10], which is the new national organization for Computer Science in Canada. The retreat helped foster a shared vision for the organization, and identified how it can better support the evolving needs of CS in Canada.

1 Overview of the Field

Computer Science as a discipline is about 50 years old, having emerged from its mathematical and engineering roots in the late 1960's and early 1970's at most academic institutions in Canada, and subsequently coming to the forefront as a significant scientific discipline within the past three decades.

Modern CS is typically characterized into three branches: *Theory* (e.g., algorithms, graph theory, complexity theory, numerical analysis, optimization), *Systems* (e.g., operating systems, networks, distributed systems, computer architecture, databases, programming languages), and *Applications* (e.g., artificial intelligence, computer graphics, human-computer interaction (HCI), software engineering, gaming). Canada is a recognized world leader in several areas of CS, such as Artificial Intelligence (AI), Theory, and HCI.

The CS discipline continues to grow and evolve, with Machine Learning (ML), Data Science, and Cyber-Security as three examples of areas of significant growth at many Canadian universities [9]. There are also many emerging multi-disciplinary areas based on important applications of CS that are increasingly receiving attention (e.g., augmented reality, digital humanities, health informatics, and social computing).

2 Recent Developments and Open Problems

The most vexing problem for CS in Canada has been the lack of a visible and effective national organization. Although the former CACS/AIC (Canadian Association of Computer Science/Association d'Informatique Canadienne [1]) had existed for about 25 years, it was viewed as a "heads only" administrative organization based on a departmental membership model that had minimal engagement with research funding organizations such as NSERC, and low visibility among faculty members within its constituent departments. The recent transition from CACS/AIC to the new CS-Can/Info-Can organization (launched in September 2016) is intended to help the organization have much more impact on the discipline and on the role of CS within Canada. CS-Can/Info-Can is modeled in part on the 40-year-old Computing Research Association (CRA [6])

in the United States, as well as on other national academic organizations in Canada (e.g., Canadian Association of Physicists [2], Canadian Mathematical Society [4]). Its mandate is CS research and education.

One general trend in CS globally right now is growing *enrollments*, especially at undergraduate levels, with a 20-50% increase in students in recent years [7, 8, 11]. The same trend has occurred in CS departments across Canada, as students see new opportunities in areas such as ML, data science, social networking, mobile computing, and entrepreneurship. While this is great for our discipline, it is difficult to accommodate these students without additional budgetary resources, and many CS departments in Canada are facing this challenge right now.

Another pernicious problem in CS and Engineering disciplines is achieving *diversity*, especially for female enrollment, which is typically only 10-15% of the undergraduate student population at most institutions. Curiously, CS enrollment was much closer to being gender-balanced in the 1980's, but has seen a steep decline in female enrollment since then. While recent efforts at remediating this problem are starting to have an impact, with female enrollments nearing 25-30% at some institutions, there is still a long way to go to reach gender parity. Furthermore, the CS pipeline needs to consider all aspects of diversity, not just gender (which itself is undergoing a significant transition from its historical binary dichotomy to a broader and more nuanced understanding), since there are many other under-represented groups (e.g., First Nations). Addressing these diversity issues is important for the long-term health of the discipline.

Another perennial issue for CS researchers is finding the right *balance* between fundamental (theoretical) research and applied (practical or industry-oriented) research. The trend in our national funding agencies is toward partnership programs featuring university-industry interaction. However, an over-emphasis on this type of applied research has the potential to polarize our community into "haves" and "have-nots". Furthermore, Canada's Information and Communication Technology (ICT) industry is uniquely characterized by a preponderance of Small and Medium Enterprises (SMEs), not all of whom have the resources to undertake partnership programs like larger companies do. This is especially true of start-up companies that do not have well established research groups that can partner with academic researchers. As a result, CS as a discipline feels disadvantaged by some of these granting programs. While multi-disciplinary collaborative research programs are definitely a viable opportunity for CS, oftentimes the focus is on using CS as a tool to advance research in other disciplines, rather than focusing on CS research itself. As a result, CS researchers sometimes see themselves marginalized in these programs, which is why CS is often under-represented in major grant applications. These issues have been well-documented [13] by the former (2011-2016) NSERC CS Liaison Committee [12], which in turn helped spur the creation of CS-Can/Info-Can.

3   Presentation Highlights

The retreat was structured into a combination of plenary sessions for all attendees, and working breakout sessions for subgroups of the attendees.

The opening plenary session helped set the general context and goals for the retreat. Specific highlights included the perspectives shared by the representative from the US-based CRA (Andy Bernat), as well as the strategic views on governance and policy articulated by Arvind Gupta (University of Toronto) from his senior leadership experiences at MITACS and UBC. Other plenary sessions were used for brainstorming vision and mission statements for CS-Can/Info-Can, and to share results from the breakout sessions.

The breakout sessions were designed to address particular issues identified prior to the retreat and refined on site. There were six breakout sessions, with themes on *Membership*, *Education*, *Research*, *Industry*, *Outreach*, and *Communication*. Each attendee participated in three of the six breakout sessions, which were run concurrently (two at a time). The breakouts allowed deeper small-group discussions on the chosen topics, with results brought back for sharing with the group as a whole in subsequent plenary sessions.

The notes and blackboard photos from all of the sessions have been collected and archived into the Google Documents maintained by the leadership of CS-Can/Info-Can as resources for the working groups that will continue activities initiated at the retreat. A summary of the discussions and recommendations will be shared with the Canadian CS research community at the next CS-Can/Info-Can Annual General Meeting, which will take place at McGill University on June 3-4, 2019.

4 Progress Made

Substantial progress was made on new vision and mission statements for CS-Can/Info-Can. We need a vision statement that is pithy, meaningful, and easy to articulate both within and outside of the CS community. The mission statement will make this vision more concrete, by outlining the specific thrusts to address the needs of our CS stakeholder communities. A working group was identified at the retreat and tasked with completing our vision and mission statements, which will then be shared with the larger group.

The retreat helped build a stronger sense of community for those in leadership positions within CS in Canada, who share a similar vision for our discipline, and much passion for it as well. One tangible result was raising the collective awareness about CS initiatives taking place across the country (e.g., outreach, K-12 CS education, industry collaborations, research funding opportunities, Can-CWiC [3], CUCSC [5], UCOSP [14]), several of which we believe can be brought together under the umbrella of CS-Can/Info-Can. Another tangible result was the formation of a set of working groups to follow up on selected retreat topics (e.g., Diversity Committee, Vision/Mission statement working group, Industry Advisory Board, mentoring network for large research grant applications).

5 Outcome of the Meeting

The retreat was viewed as a success by the organizers, as well as the attendees. One major outcome was the set of initial steps in defining a vision for CS in Canada, which will help CS-Can/Info-Can in its ongoing strategic planning. Another important outcome was clearly identifying the many different stakeholder groups for CS in Canada (e.g., government, industry, K-12, funding agencies, under-represented groups), and identifying strategies to address their specific needs. Last but not least, the retreat helped build the "people network" of key CS leaders (past, present, and future) across the country, and identify resources to help move our discipline forward.

As with any strategic planning exercise, the hard part still remains, namely identifying and carrying out an actionable plan that makes a difference. As a group, however, we are extremely optimistic about the future of CS in Canada as a research-based academic discipline and as an important contributor to the Canadian economy and society at large. Our retreat at BIRS has helped galvanize a shared vision for CS that will allow CS-Can/Info-Can to become a much more effective and impactful national organization.

References

[1] Canadian Association of Computer Science, `https://cacsaic.org`

[2] Canadian Association of Physicists, `https://www.cap.ca`

[3] Canadian Celebration of Women in Computing, `https://www.can-cwic.ca`

[4] Canadian Mathematical Society, `https://cms.math.ca`

[5] Canadian Undergraduate Computer Science Conference, `http://www.cucsc.ca`

[6] Computing Research Association, `https://cra.org`

[7] Computing Research Association (2017), *Generation CS: Computer Science Undergraduate Enrollments Surge Since 2006*, 51 pages. `http://cra.org/data/Generation-CS/`

[8] Computing Research Association (2016), *CRA Annual Report*, 31 pages. `https://cra.org/wp-content/uploads/2017/09/Annual-Report-FY-16.pdf`

[9] Computing Research Association (2018), *Analysis of Current and Future Computer Science Needs via Advertised Faculty Searches for 2019*, November 2018, 17 pages. `http://web.cs.wpi.edu/~cew/papers/CSareas19.pdf`

[10] CS-Can/Info-Can, `https://cscan-infocan.ca`

[11] New York Times, *The Hard Part about Computer Science? Getting into Class*, January 2019. `https://www.nytimes.com/2019/01/24/technology/computer-science-courses-college.html`

[12] NSERC CS Liaison Committee, `http://cs-nserc.ca`

[13] NSERC CS Liaison Committee (2013), *Computer Science in Canada: Assessment and Analysis*, 118 pages, March 2013. `http://cs-nserc.ca/wp-content/uploads/2013/04/Computer-Science-in-Canada-Assessment-and-Analysis-March-2013.pdf`

[14] Undergraduate Capstone Open Source Projects, `http://ucosp.ca`