

Envisioning Computer Science Futures and Frontiers: A Call for Participation

The Computing Community Consortium (CCC) of the Computing Research Association (CRA) is conducting a series of visioning exercises to discuss and identify the new grand challenges in computing that will dominate the decade-after-next. The community has been overwhelmed with innovation and acceleration over the last decade, resulting in a world in which information, communication, and computational technologies dominate the fabric of the planet and form essential functions for human society. These exercises aim to consider the whole of the field of computing in this context and ask what the new fundamentally “computer science” issues might be that could produce a new set of “Grand Challenge” questions for our field. In the way in which challenges around Health, Climate, Energy, Sustainability and Food draw those from many disciplines (including computer science) into their grand challenges, what are the fundamentally new computer science questions that could inspire and motivate a similar global, interdisciplinary response? What computer science challenges are truly “Grand Challenges”?

Inspiration for this effort comes from several sources, including the National Academy of Engineering’s Grand Challenges for Engineering for the 21st century¹ (2008) as well as previous fundamentally computer science activities such as DARPA’s Strategic Computing Initiative², which envisioned and laid the foundations for the capabilities seen in today’s micro-electronics, robotic systems and language models. CRA has led in such efforts at the AI Roadmap³ (2018) and previously supported discussion of grand challenges in computing and engineering⁴ that produced, among other things, a report for Grand Challenges in Trustworthy Computing⁵ (2003). Today’s technologies, both corporate and academic, available data, and investments in chips and software have established a new foundation on top of which new interdisciplinary challenges need to be anticipated and envisioned.

“What are the important problems in your field ... and why aren't you working on them?”
--- “The Hamming Question”, Richard Hamming (1915-1998)

Invitation to participate

CCC expects to host 3-to-5 virtual visioning sessions in spring 2024. We expect to convene this series of 90-minute roundtable visioning discussions aimed to gain a shared perspective on the current frontiers of our discipline: what are the most exciting current developments and where might be the important open issues for the field of computer science to address over the period of the next 10-to-15 years? As each session is a facilitated, virtual discussion, participation is limited to approximately 16 individuals per session in order to ensure the opportunity for all participants to contribute.

¹ <https://www.engineeringchallenges.org/challenges.aspx>

² https://en.wikipedia.org/wiki/Strategic_Computing_Initiative

³ <https://cra.org/ccc/visioning/visioning-activities/2018-activities/artificial-intelligence-roadmap/>

⁴ <https://archive.cra.org/grand.challenges/>

⁵ <https://archive.cra.org/reports/trustworthy.computing.pdf>

The discussions at these visioning roundtables will serve to inform and help identify the components of what we hope would be tangible and compelling grand challenges for our discipline in the coming decade and beyond. We anticipate a cumulation of these roundtables with activities at CRA's summer 2024 Snowbird conference as well as one or more reports to the community and to various federal agencies that are sponsors of our community's research.

"It is difficult to make predictions, especially about the future."

— Neils Bohr (attributed)

A key question: what makes a challenge a “grand” challenge for computer science?

While there have been many efforts at visioning and challenges in which computer science is an essential component, it is our belief that the discipline is at a moment, due to its centrality to society, in which there are emerging problems that are central to computer science that require inspiring those from other disciplines to help the community address them. These challenges are appearing at the frontier of our own discipline, such as where computer science is meeting physical laws by which nature processes information or where sociotechnical systems affect all aspects of human commerce, communication, and governance.

This CCC activity aims to identify grand challenges unique to computer science that:

- Inspire effort over multiple academic generations of projects and researchers;
- Focus on a compelling application or “use-inspired” objectives;
- Require collective effort from many different disciplines that need to work together;
- Produce tangible results, products and capabilities along the route to the challenge; and,
- Advance current or establish new foundational testbeds and infrastructure that is required to build the instruments and tools that achieve the goals of the challenge.

How to get involved

We invite individuals to respond to this “**Request for Information**” using the listed CRA webform. The organizers are seeking the following information:

- Name, title, affiliation (including a URL);
- 1-to-2 sentence description of your background and research;
- A brief description of 3-to-5 emerging topics, recent developments, or scientific citations that are within your field of expertise that you believe are indicators of positive (or negative) futures in computer science that compel additional study; and,
- A brief description of 3-to-5 topics, recent developments, or citations/publications that are outside your direct field of expertise (i.e., developments elsewhere in computer science, or elsewhere in the global scientific and technological landscape, in other disciplines or fields) that you believe represent unique, possibly disruptive, challenges in which computer science may prove central in addressing. Examples here might come from life sciences, social science, economics, sustainability, law and government, etc. This aims to get at the Hamming Question.

Based on responses to this RFI, CCC will assemble diverse groups for sessions aimed to further explore this landscape and develop a broad assessment of the fringes of emerging understanding and the landscape upon which future grand challenges might be developed.⁶

Submission Instructions for this Request for Information

To submit a response to this RFI and be considered for participation in one of the upcoming visioning sessions, [please fill out this form](#). For best consideration, **please complete the form by March 1st.**

⁶ <https://cra.org/ccc/visioning/visioning-activities/2018-activities/artificial-intelligence-roadmap/>