

Science of Information Summer School

As a National Science Foundation Science and Technology Center [1], the Center for Science of Information has held an annual summer school every summer since 2011. The school is a week long gathering of graduate students, postdoctoral researchers, advanced undergraduates, and faculty from around the world which facilitates the production and sharing of new ideas related to information science [2]. This document discusses the design and implementation of the summer school in light of the Center's educational mission.

Supporting the Center's Educational Mission

The Center's educational mission is to advance interdisciplinary understanding, knowledge, skills of analysis, and application of science of information techniques and tools to problems across multiple domains at both undergraduate and graduate levels. The summer school has served as one of the vehicles for advancing this mission.

The Center's education program has designed the summer school's programming to effectively introduce key concepts to researchers in early stages of exploring information science. As these researchers have collaboratively explored information science they have grown into a community of practice [3]. Many Center-affiliated students attend the summer school, and they consistently describe its programming as excellent and highly effective. Their feedback indicates the programming is effective not only in helping students reach their own goals, but also helping the Center advance its educational mission.

Overview of Summer School Programming

The summer school advances the Center's educational mission through its focused, flexible programming, which have consisted primarily of faculty research presentations, student poster sessions, professional development labs, and faculty training workshops.

Outcome survey results show students gained significant value from the faculty talks, and even more importantly from presenting their own research through the poster sessions to their peers and faculty. Anonymous surveys of participants aggregated across school years show that students report an average rating of 3.42/4 on obtaining useful feedback to their research from peers and faculty, and an average rating of 3.24/4 that they were able to start some level of professional connection with their peers for possible collaboration. Importantly, students indicate that they increase their awareness of Center research and overall efforts from being involved in the school. The surveys afforded attendees the chance to provide open-ended comments about their experiences at the summer school. Trends among these comments indicate that satisfaction with the programming remained high even among attendees with differing levels of familiarity with the programming's technical content. Overall attendance at the school increased across the first four years, as demonstrated in Figure 1.

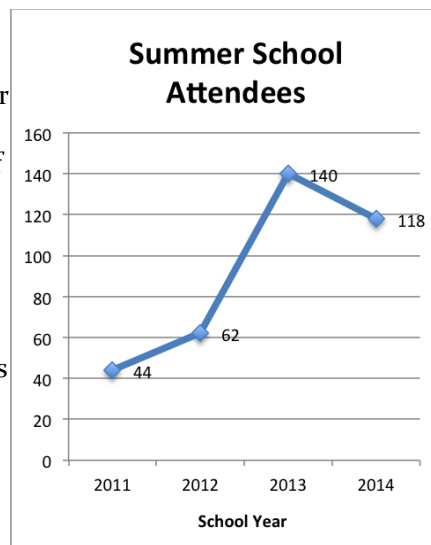


Figure 1: Aggregate Attendance by Year

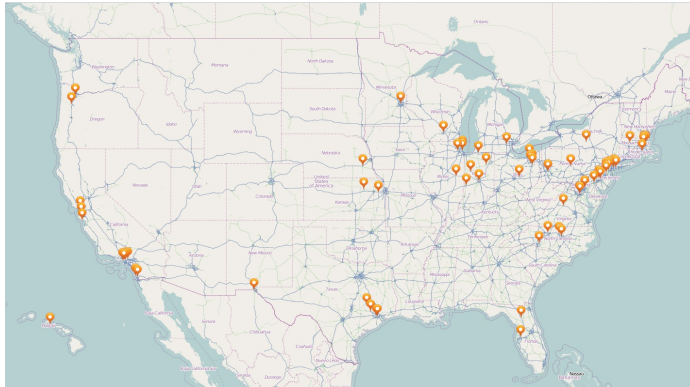


Figure 2: Home Institutions of Attendees

The summer school has been a vehicle for establishing student and faculty networks that lead to collaborations, and has helped broadened the impact of the Center by reaching students and faculty at 76 different universities in the U.S. (See Figure 2.)

Tutorials

The Center invites leading researchers to speak on topics in their field related to information science. In all cases, presenters facilitate audience interaction through

question and answer sessions and opportunities to extend the discussion beyond the session. The diversity of presentation topics reflects the diversity of the emerging field, but certain patterns have emerged over the last four years. The presentation topics can be foundational, such as Wojciech Szpankowski's "Shannon Legacy and Beyond" (2011); theoretical, such as Emina Soljanin's "The Secret Lives of Codes: From Theory to Practice and Back" (2013); or multidisciplinary, such as David Tse's, "Information Theory: From Communication to DNA Sampling" (2012). The tutorials have been videotaped and are organized as play lists for each year of the school on the Center's YouTube channel: <https://www.youtube.com/user/ScienceofInformation/playlists>

The research presentations advance the Center's educational mission in a variety of ways. First, the summer school is well attended by Center members both as attendees and as presenters, so the presentations increase the circulation of new ideas within the Center. The school is a uniquely advantageous format for this internal networking because Center members' home universities span the entirety of the continental United States, and many members have additional international affiliations.

The presentations help establish a community of practice through their attentiveness to interdisciplinary collaboration. As previously noted, some presentations make multidisciplinary research their main focus. However, many presentations that focus on a topic within one discipline still highlight the potential for collaborations outside the Center and connect information science with other disciplines such as life sciences. For example, at the 2013 Annual Summer School, Madhu Sudan's presentation "Reliable Communication Amid Uncertainty" dealt primarily with the loss of reliability in data as it is compressed, a question which has occupied information theorists for decades. However, questions from the audience prompted professor Sudan to discuss the applicability of his presentation to issues in cyber-security.

Student Poster Sessions

During poster sessions, student and postdoc attendees have the opportunity to discuss their research with each other and the mentoring faculty. Since many attendees are Center members, the poster sessions are a strategic means of internal networking. Presenting a poster is a key element of the student attendee's experience. By design, reducing one's research to a poster and five-minute talk poses a challenge. Meeting this challenge increases students' ability to succinctly yet effectively promote their research, a skill they frequently need as they near degree completion. By adeptly promoting their research to a variety of subsequent audiences, the students increase the Center's visibility and hence its ability to anchor a widespread community of practice.

Professional Development/Labs

During the first school the Center was able to take advantage of a smaller group of students and offered a series of computing labs (sequences and pattern matching, Markov models for text analysis, and asymptotic equipartition property), working problems (most popular node, network graphing), as well as a discussion on quantum mechanics and information theory.

As the school has grown in attendance the Center has held discussion panels on topics such as diversity and mentoring, multidisciplinary research lab tours, with plans to offer a new open source lab at the 2015 school on scientific computing using IPython and Notebooks.

Faculty Teaching Workshops

Several iterations of the summer school have included faculty development workshops that focused on teaching science of information. These have resulted in significant broadening of the Center's impacts to include a wide variety of faculty and postdoc scholars from diverse institutions. Four workshops (two held during summer schools) over the past several NSF periods brought together a total of 101 faculty and postdocs, primarily from outside the Center, to discuss science of information from a teaching and classroom perspective [4]. These exchanges have been valuable to the attendees, as well as the Center. A core group of faculty emerged from these workshops to develop specific topics and teach courses at their respective institutions in coordination with the center. The workshops were held at Bryn Mawr College, Purdue University, and UC San Diego.

Future Trends for the Summer School

In light of these outcomes, CSol will extend similar forms of programming into future years. In 2015, with encouragement from the Center's advisory board, CSol will partner with the IEEE Information Theory Society to make the school a joint endeavor. It will be hosted at UC San Diego. CSol is also offering smaller-scale, targeted workshops to bring students together around specific topics. Such workshops have already shown promise as a means of fulfilling the educational mission while also facilitating closer collaborations among researchers, faculty, and partner organizations.

The summer school is managed by Brent Ladd, the CSol Director of Education. He welcomes the opportunity to discuss the school or any other features of the Center's educational endeavors. He can be reached at education@soihub.org.

[1] National Science Foundation Science and Technology Centers – Office of International and Integrative Activities. <http://www.nsf.gov/od/iaa/programs/stc/>

[2] Science of Information Summer School - <https://www.soihub.org/summer-school.php> provides outcomes summary, and documentation for each installment of the school.

[3] E. Wenger, R. McDermott, W.M. Snyder. Cultivating Communities of Practice: a guide to managing knowledge. Boston: Harvard Business School Press, 2002.

[4] Science of Information Teaching Workshops – the most recent workshop presentations, schedule, and outcomes available online <https://www.soihub.org/events/course-workshop.php>