Computing Community Consortium

Dr. Erwin Gianchandani
Director, Computing Community Consortium
Computing Research Association

Georgetown University
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http://cra.org/ccc
Objective

- Overview of the Computing Research Association
- The Computing Community Consortium - and our visioning process
- Future directions for the field
CRA as an organization
Mission and activities

- Strengthen research and education in the computing fields
  - Working to influence policy that impacts computing research
  - Encouraging the development of human resources
- Contributing to the cohesiveness of the professional community

- Collect and disseminate information about the importance and state of computing research

Table 1. PhD Production by Type of Department and Rank

<table>
<thead>
<tr>
<th>Department, Rank</th>
<th>PhDs</th>
<th>Avg. per PhD</th>
<th>PhDs Next Year</th>
<th>Avg. per Dept</th>
</tr>
</thead>
<tbody>
<tr>
<td>US CS 1-12</td>
<td>215</td>
<td>17.9</td>
<td>241</td>
<td>20.1</td>
</tr>
<tr>
<td>US CS 13-24</td>
<td>51</td>
<td>10.0</td>
<td>205</td>
<td>8.4</td>
</tr>
<tr>
<td>US CS 25-36</td>
<td>22</td>
<td>6.5</td>
<td>962</td>
<td>8.4</td>
</tr>
<tr>
<td>US CS Other</td>
<td>541</td>
<td>10.0</td>
<td>1,696</td>
<td>11.3</td>
</tr>
<tr>
<td>US CS Total</td>
<td>1,501</td>
<td>10.0</td>
<td>1,696</td>
<td>11.3</td>
</tr>
</tbody>
</table>

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What is the CCC?
What is the CCC?

- Established in 2006 through a multi-year cooperative agreement between the National Science Foundation and CRA

- Provides a voice for the national computing research community

- Facilitates the development of a bold, multi-themed vision for computing research - and communicates this vision to stakeholders
A broad-based Council

Leadership:
- Ed Lazowska, U of Washington (Chair)
- Susan Graham, UC-Berkeley (Vice-Chair)
- Erwin Gianchandani, CRA (Director)

Terms ending 2014:
- Deborah Crawford, Drexel
- Gregory Hager, Johns Hopkins
- John Mitchell, Stanford
- Bob Sproull, Oracle (ret.)
- Josep Torrellas, UIUC

Terms ending 2013:
- Randy Bryant, CMU
- Lance Fortnow, Northwestern
- Eric Horvitz, Microsoft Research
- Hank Korth, Lehigh
- Beth Mynatt, Georgia Tech
- Fred Schneider, Cornell
- Margo Seltzer, Harvard

Terms ending 2012:
- Stephanie Forrest, U of New Mexico
- Chris Johnson, U of Utah
- Anita Jones, U of Virginia
- Frans Kaashoek, MIT
- Ran Libeskind-Hadas, Harvey Mudd
- Robin Murphy, Texas A&M

Rotated off:
- Bill Feiereisen, Intel (2011)
- Dave Kaeli, Northeastern (2011)
- Dick Karp, UC-Berkeley (2010)
- John King, U of Michigan (2011)
- Peter Lee, Microsoft Research (2009)
- Karen Sutherland, Augsburg U (2009)
- Dave Waltz, Columbia (2010)

Meets three times a year, including an annual summer meeting in Washington, DC
A multitude of activities

- Community-initiated visioning:
  - Workshops that bring researchers together to discuss “out-of-the-box” ideas
  - Challenges & Visions tracks at conferences

- Outreach to the White House, Federal funding agencies:
  - Outputs of visioning activities
  - Short reports to inform policy makers
  - Task Forces -- Health IT, Sustainability IT, and Data Analytics

This Week’s Highlight:
Fruit Fly Suggests New Solution to Computer Networking Problem
Visioning: Robotics success

4 meetings during summer 2008
Roadmap published May 2009
Extensive discussions between visioning leaders & agencies

- OSTP issues directive to all agencies to include robotics in FY 12 budgets
- National Robotics Initiative is announced

Henrik Chistensen
Georgia Tech

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## Community visioning activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Participants</th>
<th>Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Networking science &amp; engineering</td>
<td>109</td>
<td>44</td>
</tr>
<tr>
<td>Cyber-physical systems</td>
<td>100</td>
<td>47</td>
</tr>
<tr>
<td>Robotics</td>
<td>141</td>
<td>79</td>
</tr>
<tr>
<td>“Big Data” Computing</td>
<td>81</td>
<td>46</td>
</tr>
<tr>
<td>Theoretical computer science</td>
<td>39</td>
<td>26</td>
</tr>
<tr>
<td>Global development (ICT4D)</td>
<td>56</td>
<td>37</td>
</tr>
<tr>
<td>Learning technologies</td>
<td>55</td>
<td>30</td>
</tr>
<tr>
<td>Health information technology</td>
<td>121</td>
<td>102</td>
</tr>
<tr>
<td>Cross-layer reliability</td>
<td>121</td>
<td>45</td>
</tr>
<tr>
<td>Free &amp; open source software</td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>Advancing computer architecture</td>
<td>In progress</td>
<td></td>
</tr>
<tr>
<td>Interactive technologies</td>
<td>In progress</td>
<td></td>
</tr>
<tr>
<td>Sustainability &amp; IT</td>
<td>In progress</td>
<td></td>
</tr>
</tbody>
</table>
“Transition Team” white papers

- Sensed and seized an opportunity to influence Federal science policy through the Presidential transition team
- 19 papers produced in late 2008 & early 2009
  - 30 separate authors
- Many highly influential:
  - Re-envisioning DARPA - Peter Lee, Randy Katz
  - Infrastructure for eScience & eLearning/Unleashing Waves of Innovation - Ed Lazowska, Peter Lee, Chip Elliott, and Lary Smarr
  - Security is Not a Commodity - Stefan Savage, Fred Schneider
  - Synthetic Biology - Drew Endy
  - Big Data Computing - Randy Bryant, Randy Katz, Ed Lazowska
  - The Ocean Observatories Initiative - John Delaney, John Orcutt, Robert Weller
  - Cyber-Physical Systems - Janos Sztipanovits, Jack Stankovic
A multitude of activities

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- Outreach to the White House, Federal funding agencies:
  - Outputs of visioning activities
  - Short reports to inform policy makers
  - Task Forces -- Health IT, Sustainability IT, and Data Analytics

- Public relations efforts:
  - Library of Congress symposia
  - Research “Highlight of the Week”
  - CCC Blog [http://cccblog.org/]

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“Improving Brain-Computer Interfaces”

A Science Nation story published today describes a public-private partnership funded in part by the National Science Foundation (NSF) that is attempting to link mind and machine to ultimately improve the living conditions of those with “locked-in syndrome” — a malady in which people with normal cognitive brain activity suffer severe paralysis, often from injuries or an illness such as Lou Gehrig’s disease.

From the Science Nation article (see a video after the jump):

Read more: “Improving Brain-Computer Interfaces”
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- Nurturing the next generation of leaders:
  - Computing Innovation Fellows Project
  - “Landmark Contributions by Students”
  - Leadership in Science Policy Institute
Next generation: CIFellows Project

- Established in 2009 with NSF/CISE funding
- Provides recent CS Ph.D.s one- to two-year postdoctoral positions
- Goal is to retain new Ph.D.s in research & teaching during difficult economic times
- 60 CIFellows funded in 2009
  - 19 left the program after year I
  - 39 have now found tenure-track faculty or industrial research positions
- Another 47 CIFellows funded in 2010, 20 in 2011
- A research project in and of itself...
Next generation: Postdocs in CS

Numbers of New Ph.D.s Hired

- Industry
- PostDocs
- Tenure-track faculty
- Teaching faculty
- Research faculty
- Other

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Next generation: Postdocs in CS II

Numbers of New Ph.D.s Hired

- PostDocs
- Tenure-track faculty
- Teaching faculty
- Research faculty

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Next generation: Undergraduates

Welcome! This website is intended to help undergraduates in computing fields find summer research opportunities and resources for applying to graduate school.

http://cra.org/ccc/csgs
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Future directions
“As the rest of the country fights stubbornly high unemployment, the shortage of qualified engineers has grown acute in the last six months, tech executives and recruiters say, as the flow of personal or venture capital investing has picked up. In Silicon Valley, along the southern portion of the San Francisco Bay in California, and other tech hubs like New York, Seattle and Austin, Tex., start-ups are sprouting by the dozen, competing with well-established companies for the best engineers, programmers and designers. At the same time, all the companies are seeking ever more specialized skills.”

-- “Silicon Valley Hiring Perks,”
March 25, 2011
By the numbers perks

* Extraordinary competition for CS majors right now

* Starting salaries as high as $105,000

* Weekly lessons about entrepreneurship

* Free meals, haircuts, iPads, shuttle busses, and stock options

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The New York Times
Actual, Projected IT Occupational Employment, 2006-2016

Computer and information scientists, research
Computer programmers
Computer software engineers, applications
Computer software engineers, systems
Computer support specialists
Computer systems analysts
Database Administrators
Network and computer systems administrators
Network systems and data communications analysts
Computer specialists, all other

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Promising signs: Tale of four cities

CMU (applicants)

Stanford (enrollments)
- Previous record in 1999-2000: 762 students
- Bottomed out in 2006-07
- New record in 2010-11: 1,087
  - Year-to-year growth of 51%
  - Spring enrollment up 120%

UW (enrollments)

MIT (enrollments)
- Introductory CS course is single most popular course (out of 2,000+ MIT courses in a broad range of fields)
A report on the future of the field

- Issued by the President’s Council of Advisors on Science and Technology (PCAST)

- About the nationwide Networking & Information Technology R&D ("NITRD") initiative

- An excellent roadmap for the field

- About a third of PCAST’s Working Group was comprised of CCC Council members
The PCAST report

- Health information technology
  - “Go well beyond the current national program to adopt electronic health records”
  - “Make possible comprehensive lifelong multi-source health records for individuals; enable both professionals and the public to obtain and act on health knowledge from diverse and varied sources as part of an interoperable health IT ecosystem; and provide appropriate information, tools, and assistive technologies that empower individuals to take charge of their own health and reduce costs.”
Health IT

- Workshop with 100+ computer scientists, systems engineers, social scientists, care practitioners
- Produced a report summarizing key research questions and directions
- NSF/CISE initiated Smart Health & Wellbeing in FY 2011

- From data to knowledge to action -- enabling evidence-based healthcare
- Empowering people -- providers and consumers -- improves healthcare quality
- Computer-based augmentation of human learning, reasoning, decision-making, and physical motion significantly enhances human capabilities
- Healthcare is a complex, large-scale, adaptive distributed evolving system
- The Importance of Collaborative Government Investment

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The PCAST report II

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- Energy and transportation
  - “dynamic power management broadly; interoperable standards for real-time control; low-power systems and devices; and improved surface and air transportation.”
Computational Sustainability

- Workshop with 60+ computer scientists, systems engineers, social scientists, “sustainability scientists”
- Produced a report outlining key research questions and directions
- NSF has announced several FY2012 solicitations as part of its SEES initiative

Special tracks at AAAI, ACM SIGDEV, CHI, ICML, and Pervasive, with CCC “Best Paper” awards

- Big Data
  - Temporal & geographic
  - Very large, heterogeneous (graphical structures, sampled measurements, images, extensive notes/comments, social network metadata, provenance, federation, curation, analytics, archiving)
  - Aggregations of personal data
  - Targeting feedback systems
  - Quality & transparency of models
  - Understanding human needs, encouraging behavior changes

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Improving health care
Enabling the smart grid
Revolutionizing transportation
Ensuring our national defense
Enabling the future of networking
Delivering personalized education
Empowering the developing world
Driving advances in all fields of science & engineering
Key drivers
"It’s become glamorous to become the next Mark Zuckerberg, and everyone likes to think they have some great idea."

--- Keila Fong, Yale University undergraduate
* Just about every field is becoming an information field

* “NIT is arguably unique among all fields of science and engineering in the breadth of its impact ... Recent technological and societal trends place the further advancement and application of NIT squarely at the center of our Nation’s ability to achieve essentially all of our priorities and to address essentially all of our challenges ... All indicators - all historical data, and all projections - argue that NIT is the dominant factor in America’s science and technology employment.

-- PCAST report, December 2010
The shift toward interdisciplinary

Driving forward the “application” domain...
...and driving forward the field of computing.

numbers of new PhDs

Artificial Intelligence/Robotics
Numerical Analysis/Scientific
Operating Systems/Networks
Theory & Algorithms
Database/Information Systems

Hardware/Architecture
Programming Languages/Compilers
Software Engineering
Graphics/Human Interfaces
Other/Unknown

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A community effort

- Propose visioning activities, white papers, Challenges & Visions tracks at research conferences
- Put together short videos for undergraduates
- Contribute to the CCC Blog
- Send us a research highlight for the Highlight of the Week

Get involved today:
erwin@cra.org or 202-266-2936
http://cra.org/ccc or http://cccblog.org/