A Report on

US-India Program for Exploratory Experiences for Researchers and Students (PEERS)*

Sukumar Ghosh
Department of Computer Science
University of Iowa
Iowa City, IA 52242

* This was supported by grant # 0912210 from the National Science Foundation.

US-India Program for Exploratory Experiences for Researchers and Students (PEERS)

1. Introduction

1.1 The Background

With funding from the National Science Foundation, the US-India PEERS workshop was held during January 4-5, 2009 at the International Institute of Information Technology (IIIT) Hyderabad, with the objective of promoting growth of Computer Science education and research in the US as well as in India through the exchange of ideas and collaboration between the two countries. To get some extra visibility, the event was co-located with the International Conference on Distributed Computing and Networking (ICDCN 2009) that was organized in the same venue during January 3-6, 2009. The major concerns addressed by PEERS were the following: While USA has been at the forefront of research in the cutting edge areas of computer science, attracting and retaining students in Computer Science higher education in recent years has not been easy. On the Indian side, the major problem is the declining interest in research and a low Ph.D. production rate. It was an invitation-only workshop: the invitees were chosen on the basis of their reputation and availability during the workshop period. PEERS examined if and how the two countries can establish collaboration to identify unique challenging problems relevant to the individual contexts, and integrate them into research and teaching activities that will benefit both countries.

1.2 The structure of the workshop

Nineteen computer scientists, ten from US and nine from India, attended this workshop. In addition, three Ph.D. students from US and three Ph.D. students from India were invited to attend the workshop, and participate in the deliberations. The list of participants is shown in the Appendix.

The discussions centered around three topics: (1) Undergraduate education, (2) Graduate education, and (3) Collaborative research. Following a general welcome (Krishna Kant) and an initial presentation about the state of CS education and research as well as the problems on the table (Sukumar Ghosh), a few invitees made presentations on their view of the problems. Later, small breakout sessions were held on each of the three topics, along with a special group involving all the student invitees, where the invitees brainstormed on ideas to tackle the issues. Each group had two moderators: one from the US side and one from the Indian side. Following this, the moderators from each group submitted their recommendations. These recommendations form the basis of this report.

2. The problems addressed

There are issues with the state of the CS education and research, both in US and in India, although the problems are of a somewhat different nature in the two countries.

2.1. Graduate Education

In the US, international students now constitute more than a third of US science and engineering graduate-school enrollments [2] but they constitute nearly 58% of all doctoral recipients in computer engineering, and 54% in computer science [1]. U.S.

graduate schools have clearly benefited from this wonderful talent from around the world. But at a time when national security policies, as well as better opportunities in a flat world are slowing the flow of foreign talent into US, its inability to develop a robust domestic talent pool for doctoral study in Computer Science and Engineering is approaching a national crisis. The US produced more than 1,700 Ph.D.s in computer science in 2008, which is nearly double the number of Ph.D.s produced five years ago (Fig. 1) but the domestic pool has declined to an alarming level. While this may be expected during the current economic slowdown, the gradual decline in the domestic talent pool in the CS doctoral programs needs serious attention. By stark comparison, India's annual computer science Ph.D. production languishes at roughly 40 [3], with perhaps a similar number of Ph.D.s being annually produced in the computer engineering area. Research laboratories and the new teaching institutes producing CS graduates are also in dire need for qualified Ph.D.s as researchers and faculty members.

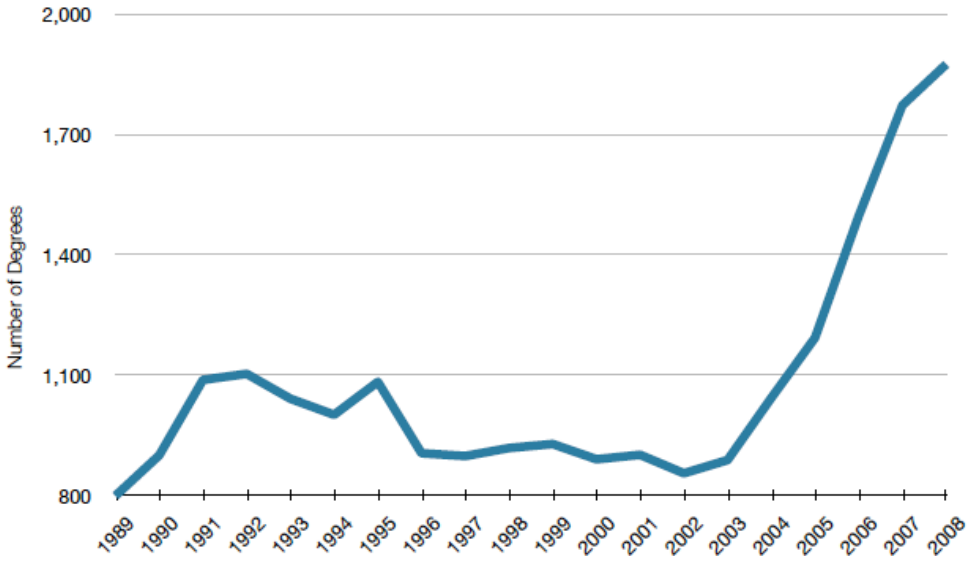
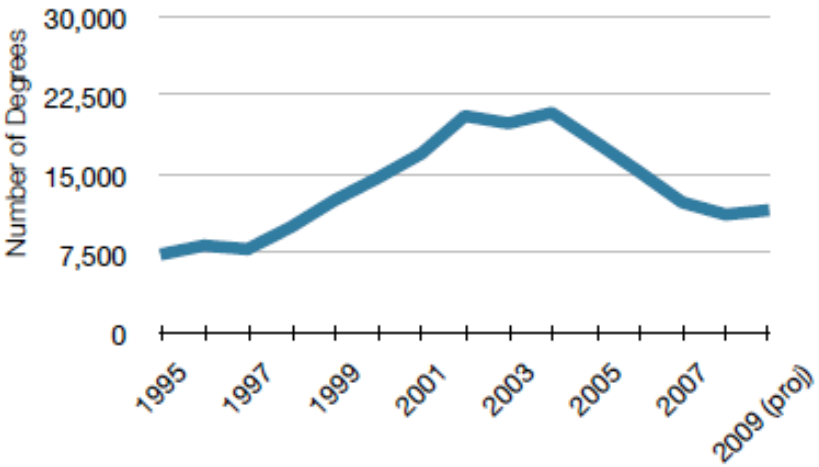


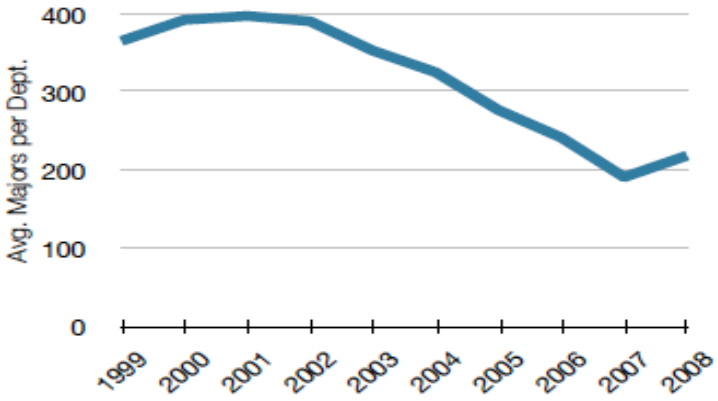
Fig. 1. Computer Science and Computer Engineering Ph.D. production in US and Canada (Source: 2007-2008 CRA Taulbee Survey [1])

2.2 Undergraduate Education

In the undergraduate CS programs of US, the enrollment has declined by nearly 50% over the past five years (Fig. 2). Considering the recent number of students who declared CS/CE as major, and assuming the yield to be nearly 60% of this population, the number is likely to go down further. This directly affects the domestic pool planning to go for graduate education and research. Also of concern is the widening gender gap among CS students, which is prevalent in the graduate level too. For motivating undergraduate students towards research, US faculty members prefer to handpick top students, but the general body of undergraduates has no clear idea of what research is, or why writing papers is important. Many of them do not realize the value of doing research.



(a)



(b)

Fig. 2. (a) BS production in CS/CE. (b) BS total enrollment: average majors per US CS department (Source: 2007-2008 CRA Taulbee Survey [1])

In contrast, in the Indian front, there is still a substantial demand for people with basic skills in the IT area, and the pay is good by the Indian standard, so undergraduate enrollment is steadily burgeoning. In choosing IT as a profession, parental persuasion and peer pressure play important role. The seven Indian Institutes of Technology (IIT), and the five more that are coming up, can admit only a small fraction of the students, but they are known to produce some of the best graduates in the world. At the next level, the 17 National Institutes of Technology (NIT) and some other top first and second-tier state universities with established reputation produce a tiny fraction of graduates with decent preparation, but together they account for only less than 5% of the graduates produced in the country. To bridge the growing demand, numerous private engineering colleges have been set up to boost the production of graduates in IT / CS. The quality of many graduates from these institutions leaves a lot to be desired. However, regardless of their innate abilities and preparation, due to the huge demand, most of them find employment to perform basic level jobs, with little motivation to go for advanced studies in CS.

In India, the input to the undergraduate CS/CE programs is extremely good due to a rigorous selection process. Nearly 20,000 students enter the engineering programs

every year, which is approximately 70% higher than the corresponding figure for US in the recent years. However, except the IITs and some other top first and second tier institutions, the quality of the output is not up to the mark. One concern is whether heavy-duty course work is burning out students. Do the students get excited to learn the beauty of Computer Science topics? Are they challenged enough to reach the levels of excellence? Amongst other reasons why students are not motivated to conduct research, it was felt that in the second and third tier institutions, the teachers hardly motivate, and are unable to communicate the enthusiasm across to the students. The vast majority of students have neither any involvement with interesting research projects, nor any exposure to creative research. As a result, there is no incentive to do research – the students do not see exciting and well-paying post-Ph.D. career opportunities after spending 4-5 years in research. While lack of motivation is one factor, another factor is the lack of awareness: in the R&D departments of the industrial sector, well paying jobs requiring research skills are on the rise. The net result is that, students see little alternative but to look for jobs that pay much better than typical academic or research jobs. Spending time in research is often considered a waste of time.

2.3 Research

On the Indian side, the primary shortcomings are poor research output, and the lack of a vibrant research culture. Undergraduates are not involved in research -- even the Masters students rarely participate in research. Participation at the international conferences is much below the desired level. Also, funding international travel for participation in important research conferences is a problem that negatively impacts gaining international experience, a key factor in improving research quality and productivity. On the US side, inadequate international research collaboration limits the US researchers' access to qualified peers and well-trained students, and thus limits the opportunity to work on a richer set of research problems with broad scopes.

3. Observations

In the US, NSF's CPATH (CISE[1] Pathways to Revitalize Undergraduate Computing Education) program is a major effort to rejuvenate the undergraduate CS programs, by challenging its partners – colleges, universities and other stakeholders committed to advancing the field of computing and its impact - to transform undergraduate computing education on a national scale, to meet the challenges and opportunities of a world where computing is essential to US leadership and economic competitiveness across all sectors of society. NSF's REU (Research Experience for Undergraduates) program is an avenue for including and motivating qualified undergraduates towards research. NSF also has a RET (Research Experiences for Teachers) program that allows research investigators to work with high school teachers and create awareness in research, and thus build a bridge with the high school students.

Computing has historically been narrowly defined, but should be more broadly defined. Following the example of Georgia Tech, students may be allowed to enter the program from multiple entry points, and fulfill the requirements in different ways, helping the students to prepare themselves for a variety of opportunities.

[1] Computer & Information Science & Engineering

Several institutions in the US have launched Informatics programs, where applied computing curricula have been introduced to advance skills of students and researchers in other areas of science and engineering. Examples include Indiana, Cornell, University of California at Irvine, Illinois, Michigan, Iowa etc.

Indo-US Science & Technology Forum (IUSSTF) makes a valuable contribution to the strengthening of the bilateral US-India relationship by exploring and identifying fruitful areas of cooperation through sponsoring workshops, scientist exchanges and meetings in all disciplines of Science and Engineering. IUSSTF has recently instituted programs for the exchange of young researchers and students between US and India[2]. Other forms of research collaboration between the two countries in CS / CE areas are mostly based on isolated initiatives taken by individual researchers in the leading institutions. Most of these mechanisms involve students and faculty exchanges, but there is no regularity, and they lacks symmetry in as much as mostly US researchers visit their Indian counterparts, with far fewer researchers from India visiting US institutions in a similar capacity. In many cases, the non-resident Indian faculty members in the US institutions and research laboratories play a major role. The mechanism of funding such exchanges is also unclear or somewhat ad-hoc. There is no official framework where an Indian faculty member and her/his US counterpart jointly supervise Ph.D. research. There is, however, institutionalized research collaboration between India and other countries, and these are funded by bilateral arrangements. Examples include (1) The Indo-French program, (2) UK-India Education and Research Initiative (UKIERI), (3) IIT-DAAD[3] program between the IITs and Germany.

In collaborative research, NSF's PIRE (Partnerships for International Research and Education) program seeks to catalyze a higher level of international engagement in the U.S. science and engineering community by supporting innovative, international research and education collaborations. The program enables U.S. scientists and engineers to establish collaborative relationships with international colleagues in order to advance knowledge and enable discovery at the frontiers of science and engineering, and to promote the development of a diverse, globally engaged U.S. scientific and engineering workforce. However, there is not enough awareness about the PIRE program, and its scope.

The student participants of this workshop collectively believed that their perception of the scope of CS undergraduate and graduate education was flawed in the early years. Computer science is much more than acquiring programming skills only, but many undergraduate programs in India and some in the US do not expose the beginning students to the big picture in computing. The generic view of computing and its broad applicability in a broad range of tools should be communicated to the high school and the undergraduate students. Broad CS skills facilitate job migration to new fields and should be a huge incentive to potential students as it promises diversity of engagements and dynamic job stability (i.e., guaranteed employment within a collection of disciplines). Skills like the art of modeling, testing / verifying complex systems, theory of algorithms, complexity theory, the art of optimization are portable across disciplines, and have everlasting importance. Also, shorter and more focused courses on complex and content-

[2] Researcher exchange: http://www.indousstf.org/fellowship.htm and for student exchange: http://www.indousstf.org/indousresearch/rise_program.html

[3] Deutscher Akademischer Austausch Dienst, the German Academic Exchange Service.

rich topics are likely to be better received by the students for efficient knowledge transfer, and textbooks should cater to such needs.

4 Recommendations

Here are some of the recommendations for the Indian and the US sides in bringing change in the state of CS education and research.

4.1 For the Indian side

4.1.1. Short-term action items

1. Rejuvenate the undergraduate program; expose the students to the beauty of Computer Science. There should be greater emphasis on teaching the fundamentals, and strengthening problem-solving skills. Passionate faculty members with proven teaching skills should teach introductory and foundational courses.

   Action: Take the matter to the departmental chairs or deans as appropriate for immediate implementation.

2. Bring research to the undergraduate classrooms by posing challenges, allowing flexibilities, and emphasizing on projects. Research teams should include undergraduate students, and enable them to interact with senior members of the group. Formal courses on technical writing should be introduced to hone writing / presentation skills. Periodically research-aware workshops should be organized for the undergraduates to expose them to cutting edge research themes.

   Action: Rope in bright undergraduates into research teams, explain the research goals, and delegate responsibilities to them. Organize research workshops - each involving an invited speaker who will present her / his research at the workshop, and encourage undergraduates to attend these workshops. Be on the look out for visiting researchers in the area, and invite them. Make department colloquium a regular feature.

3. Introduce flexibility in course selection for the research-minded undergraduate students. The International Institute of Information Technology (IIIT) at Hyderabad introduces students to research at the beginning of the second year, and allows flexibility in the coursework to research-minded students, which leads to 15% of them joining their MS programs. The Indian Institute of Science (IISc) at Bangalore is currently considering an undergraduate program with similar objectives. Other institutions in India may follow these examples to motivate their own students to the graduate programs.

   Action: Discuss the possibility of introducing such flexibilities with the departmental chair and dean as appropriate. If this is worked out, then identify research-minded undergraduates early, and encourage them to go to the research track.

4. Create opportunity for international experience, which is a key ingredient in enhancing the quality of graduate education and research. Lack of funding for international travel is often a major impediment, as it limits the participation of

graduate students and researchers in the international events. Create ways to solve this problem, using government and / or private sector funding.

Action: Leverage the clout of the movers and shakers in the key positions of the institution / its governing body to create or explore funding opportunities that can lead to international experience. Also, carefully look at the existing programs instituted by IUSSTF, and try to make the best use of them. Two are highlighted under the next item (item 5).

5. Increase the number of qualified teachers with Ph.D. degree, hire bright students with MS degrees as faculty members and send them overseas for short-term training or exchange to complete a part of their Ph.D. coursework/research. Such visits and collaborations can be worked out informally at several US institutions, and are good short-term solutions – formalizing such issues is time consuming.

   Action: IUSSTF already has programs for researcher exchange (see http://www.indousstf.org/fellowship.htm) that allows young Indian researchers from all disciplines in Science and Engineering to travel to US for collaborative research. IUSSTF and Oak Ridge Associated Universities (ORAU) are partners to launch Research Internships in Science and Engineering (RISE) (http://www.indousstf.org/indousresearch/rise_program.html) to create unique opportunities for science, technology, engineering and medical students from India to undertake internships in national laboratories, federal research centers, academic research institutes, and private R & D laboratories in the United States. Objectives of the internships are to provide students with unique opportunities to live and work in an international context, gain practical experience, and acquire professional skills. Internships are envisaged as a source of mutual cultural and professional enrichment for both the interns and their host institutions. Encourage the CS / CE students to avail this opportunity, in addition to using your own contacts: look for US faculty members willing to mentor students from India, and work out arrangements for sending the students for summer internship with those faculty members

6. Enhance collaborative research by utilizing the available Fulbright program that supports bidirectional exchanges. Currently there are nearly 100 visitors in each direction, and this number will be doubled soon. However, most of these awards go to recipients belonging to the non-engineering disciplines. Since success in securing scholarships is directly proportional to number of applications, encourage a ten to twenty fold increase in the number of computer science and engineering applicants for a major increase in the number of awards.

   Action: Aggressively publicize the Fulbright exchange program, and encourage promising individuals to apply.

7. Use available technology to enhance research exposure of Indian graduate students. For example, Skype video and high quality cameras can be used to broadcast the

weekly seminars from the leading US universities. Video conferencing technologies can be used to maintain regular contact between research groups from both countries.

Action: Form a team within the institution to explore the possibility of receiving live and / or pre-recorded colloquia from reputed US universities. Arrange for appropriate technology upgrades at the receiving end. Apply for funding to meet the necessary expenses, and involve the local chapters of ACM and IEEE.

4.1.2. Long-term action items

1. Top ranking institutions like the IITs, and some other top-tier universities/ institutions are doing a reasonably good job of involving their undergraduates to challenging research problems, but the second and third tier institutions are significantly lagging behind.

   Action: Motivate and involve undergraduates into research by introducing NSF REU type programs in the majority of Indian institutions, and arrange to sustain their involvement and interest via continued collaboration with peer groups in the front-ranking institutions.

2. In India, more than 95% of the Computer Science / Computer Engineering / Information Technology undergraduates are produced by some 2000 private colleges (these figures are approximate). In these colleges, there are many teachers who don't have Ph.D. degrees. A fraction of them are strongly motivated and dedicated (discussed during the IUCEE[4] Summer 2008 meet), but work in poor working conditions, and don't have access to qualified mentors to make progress in research. The existing summer faculty intern programs can accommodate a small number of faculty members, and thus do not scale. By organizing advising forums with qualified international and national faculty members at a larger scale, these untapped talents can be motivated to finish their Ph.D. degrees, which will boost Ph.D. production Another useful step is to develop remedial self-study modules to enhance their preparation for Ph.D. work.

   Action: (1) Introduce NSF RET type programs to involve motivated college teachers (instead of high-school teachers) into research. (2) Organize weeklong Dagstuhl-type[5] workshops: invite a few eminent Indian and International researchers in focused research areas, and allow them to mentor these strongly motivated teachers. Devise mechanisms to identify and reach out to the brightest ones. Seek funding from IUSSTF, DST[6] and the private sector to fund these workshops. (3) Organize summer and winter schools for 3-4 weeks duration with motivated researchers and eminent Indian and International scholars to discuss research challenges, develop expertise and research skills. (4) Encourage Indian academicians to contact their US counterparts, and request them to apply to NSF PIRE program.

[4] Indo-US Collaboration for Engineering Education.

[5] Dagstuhl is a computer science research center in Germany. It is located in the historic Dagstuhl castle. They organize such weeklong research meetings on focused topics round the year.

[6] Department of Science and Technology, Government of India

3. There exist good formal models of collaboration between India and other countries – most of them cover many areas of science and engineering. For example, in the Max Planck institute model, 2-3 research groups at each of the several IITs receive up to 40,000 Euros funding per year per group. The India-France collaboration program also covers all issues like budget, visa, funding etc. IUSSTF addresses some issues in collaboration between US and India. To further such collaborations in the specific area of Computer Science / Engineering, NSF, DST, IUSSTF and the private sector can play important role.

   Action: Follow the model of India-France collaboration (which is more comprehensive and balanced) to introduce India-US collaboration. Dr. Arabinda Mitra from IUSSTF recently visited NSF and met two program directors to discuss about the various ways to proceed in this front. These efforts should continue.

4. Introduce joint supervision of Ph.D. research by faculty members from both countries wherever possible. This will raise the interest and the quality of Ph.D. research in the Indian institutions, and create new opportunities for the US mentors.

   Action: Identify appropriate faculty in US institutions interested in joint supervision, and work on the formal steps to make it viable.

5. While US is concerned about the declining inflow into their research programs, India will want these qualified Ph.D.s at home to drive their future needs. The conflict can be resolved by increasing the flow of top-quality students to the US graduate programs, while providing a path home for people once they are qualified.

   Action: Try to attract new Indian faculty with special fellowships, competitive salaries and / or generous startup funds for research. This will enable a fraction of the qualified students to return to academic/ research positions in India and compete internationally.

6. Indian institutions should consider hiring qualified foreign faculty members. Such attempts may target certain countries or regions that produce strong Ph.D.s, but where there are insufficient jobs for academia-oriented graduates. These faculty members can culturally shake up the system towards producing better results.

   Action: Identify volunteer private institutions willing to explore the feasibility, and convince them about the benefits.

4.2 For the US side

4.2.1 Short-term action items

1. Increase the participation of undergraduate students into research and motivate them to go for the Ph.D. programs by introducing more flexible coursework for the right candidates. The NSF REU programs make a good beginning, but in the long run they have limited impact, since the students, after a brief stint of research, have to

eventually fit back into the regular coursework that does not have provisions for them to blossom further. There is little opportunity to sustain their involvement in research after the funding period is over. Also, many research universities do not value the mentoring of undergraduates in the career advancement process, so engaging undergraduates in research becomes a low priority for faculty members. This needs to be fixed.

Action: Create a separate track for the research-minded and promising undergraduates, possibly beginning from the sophomore year. This will have the potential to sustain their interest and make a difference. Arrange for funding to sustain the research of these undergraduate students. Reward undergraduate mentoring in career advancement decisions.

2. Take advantage of the special groups like WISE (Women in Science and Engineering) and WICS (Women in Computer Science) that currently exist in many institutions. In most cases, women students meet with a mentor (typically a woman faculty member) on a weekly or a monthly basis, and they occasionally arrange for talks by leading women scientists who can serve as role models. However, barring a few exceptions, not much is done in terms of actual research other than providing inspiration or discussing about opportunities, so these initiatives rarely bear fruit. Also, established funding sources like Grace Hopper scholarship provide initial opportunities and contacts for women students, but to reduce the gender gap, what is more relevant is to follow through it by exposing them to actual research and advanced materials.

   Action: Arrange for special funding to able mentors under the NSF REU and / or Broadening Participation in Computer Science programs, so that they can engage promising women students in actual research for prolonged periods of time. Recognize and reward such mentors, and value their contributions in the career advancement decisions.

3. Use exchange programs that are excellent vehicles for shaking up cultural barriers and creating new learning opportunities. In addition to the Fulbright program and the NSF PIRE program, IUSSTF has instituted regular exchange programs that US researchers can avail (See http://www.indousstf.org/fellowship.htm). US students can also apply for internships under its RISE program (http://www.indousstf.org/indousresearch/rise_program.html) to spend up to six months in an academic or a research Institution in India (http://www.indousstf.org/indousresearch/rise_program.html).

   Action: Create more awareness about the NSF PIRE program. Fulbright program, and the IUSSTF exchange programs, and encourage US-India collaborations and exchanges through these programs.

4.2.2 Long-term action items

1. Reduce the widening gender-gap and the low presence of minority students in CS undergraduate and advanced levels, which are matters of concern. To interest women and minority students in research, generate excitement at an early stage, and sustain it at the subsequent stages.

   Action: Encourage women and minority students into the CS undergraduate programs. Give the NSF RET programs a much wider publicity, and use it to aggressively recruit women and minority high school teachers and mentors, so that they can convey the excitement and opportunities in the field of computer science to the women and minority students at the high school levels, and prepare them through innovative coursework to meet the challenges.

2. Expand the horizon of computer science, which requires computer science itself to be more broadly defined and perceived as an area. Note that interdisciplinary research over the past decade blurred the boundaries between the Ph.D. fields, and new research problems are emerging. These include green computing, energy-efficient networking and pervasive computing, sensor-based monitoring of water and contaminants, epidemiological research (involving modeling the propagation of infectious diseases), bio-inspired computing etc.

   Action: Help create programs where computing blends with other disciplines to define new challenges. An example is the informatics programs that have started in a few universities in the US. The partner disciplines may be from engineering, natural sciences, health sciences, fine arts etc. These programs will produce the manpower that will lead future interdisciplinary research. Create funding opportunities to encourage research in these newer interdisciplinary areas.

3. Create opportunities for US researchers to do long-term collaborative research with Indian scientists on problems that are not only challenging and relevant to the US-India context, but also have global significance.

   Action: Establish long-term bilateral research collaborations between US and India. Identify relevant research topics, and organize US-India joint workshops to brainstorm on these topics. An area of research collaboration that will prove to be useful is security. In the post 9/11 era, both USA and India have been the targets of terrorism. Both physical and cyber-terrorism are to be tackled. Challenging research problem addressing bilateral security will include sensor-based monitoring of subjects and objects, collaborative data mining, threat monitoring, and intelligent decision-making.

International collaboration with India will help US researchers gain better access to the pool of top-quality students, whose flow in the recent years has been declining. The current state of CS education and research in India is hurting not only the Indian graduate programs, but also the US graduate programs. Bold corrective actions will help both US and India to improve their state of CS education and research.

4.3. The Next Steps

The PEERS interim report has been circulated to all attendees of PEERS workshop, and they have been encouraged to explore the implementation of the recommendations.

NSF has started dialog with IUSSTF about formulating some India-specific programs. Dr. Arabinda Mitra of IUSSTF recently visited NSF, and met Dr. Krishna Kant and Dr. Sajal K. Das to discuss bilateral collaboration issues, and the future steps needed to implement some of these recommendations.

4.3.1. Ph.D. Forum

As a continuation of PEERS activities, ICDCN 2010 (The 11th International Conference on Distributed Computing and Networking held in Kolkata, India during January 3-5, 2010) organized a Ph.D. forum, where graduate students from both US and India were able to showcase their research in an international setting, and discuss these with leaders in the area. The Ph.D. forum particularly encouraged the participation from women candidates. Thirteen students submitted their work, of which 8 were chosen (including 1 woman) for oral presentation, and 5 were chosen (including 3 women) for poster presentation. An international panel of eight scientists evaluated the submitted work and the presentations. Two best paper awards were given out for best presentation. These awards were sponsored by IEEE Calcutta Section Women in Engineering (WIE) Affinity Group and co-sponsored by IEEE Technical Committee on Parallel Processing (IEEE TCPP). It was decided that such Ph.D. forums would be organized in the future meetings of the ICDCN.

Acknowledgment

The PI is thankful to the National Science Foundation for providing financial support to organize the workshop. The PI also thanks Dr. Krishna Kant and Dr. Sajal K. Das for their help with the organization of the workshop, and to all participants and moderators of the workshop for many constructive comments during the preparation of this report.

References

[1] Stuart Zweben: Computing Degrees and Enrollment Trends. In *2007-2008 Computing Research Association (CRA) Taulbee Survey*, http://www.cra.org/statistics/)

[2] *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*: Report of the Committee on Science, Engineering, and Public Policy. The National Academies Press (2007).

[3] Prabhakar Raghavan: India Has the Brains, but Where's the Beef?
http://www.forbes.com/2007/08/05/india-higher-education-oped-cx_prg_0813education.html

Appendix

List of participants from US

1. Andrew Campbell, Associate Professor of Computer Science, Dartmouth College
2. Mainak Chatterjee, Associate Professor, Department of Electrical Engineering & Computer Science, University of Central Florida at Orlando
3. Sajal Das, NSF Program Director, CISE-CNS Division, and Professor of Computer Science & Engineering, University of Texas at Arlington
4. Sukumar Ghosh, Professor of Computer Science, University of Iowa
5. Prasad Jayanti, Professor and Chair, Computer Science Department, Dartmouth College
6. Krishna Kant, NSF Program Director, CISE-CNS Division, and Intel Research
7. David Kotz, Professor of Computer Science, Dartmouth College and Fulbright Scholar at IISc, Bangalore
8. P R Kumar, Professor of Electrical Engineering, University of Illinois at Urbana Champaign
9. Jim Kurose Interim Dean, College of Natural Sciences & Mathematics, Professor (and Past Chair) Department of Computer Science, University of Massachusetts
10. Raj Reddy, Professor of Computer Science & Robotics, Carnegie Mellon University.

List of participants from India

1. Vijay Garg, IBM India Research Lab New Delhi, and Professor, Electrical & Computer Engineering Department, University of Texas at Austin.
2. B.N. Jain, Professor of Computer Science & Engineering and Deputy Director, Indian Institute of Technology, Delhi.
3. Anurag Kumar, Professor and Chair, Electrical Sciences Division at Indian Institute of Science, Bangalore
4. Chandan Mazumdar, Professor of Computer Science and Engineering, Jadavpur University, Kolkata.
5. Sanjoy Paul, Associate Vice President, General Manager-Research and Head of Convergence Technology Lab of Infosys Technologies.
6. Krithi Ramamritham, Vijay and Sita Vashee Chair Professor of the Department of Computer Science and Engineering, and Dean of Research and Development of the Indian Institute of Technology, Bombay.
7. Rajeev Sangal, Professor and the Director of the International Institute of Information Technology (IIIT), Hyderabad.
8. Indranil Sengupta, Professor and Head, Computer Science and Engineering department at the Indian Institute of Technology, Kharagpur.
9. M. Vidyasagar, Executive Vice President, Tata Consultancy Services.

Student participants from US

1. Silvija Kokalj-Filipovic, Ph.D. Student, WINLAB, Rutgers University.
2. Matt Gibson, Ph.D. Student, Computer Science Department, University of Iowa.
3. Jason D. Lee, Ph.D. Student, Computer Science Department, Texas A&M University.

Student participants from India

1. Anirban Sengupta, Ph.D. student Jadavpur University.
2. S. P. Kishore, presently Research Scientist IIIT-Hyderabad and Ph D student CMU.
3. V. Sriram, Ph D student, IIIT Hyderabad.