Date: December 1, 2016
From: Raj Sunderraman, Chair, Computer Science
Subject: Academic Program Review

The Computer Science Department conducted a thorough self-study of its academic programs in the summer and fall of 2016. Our Academic Program Review (APR) Committee was chaired by Yanqing Zhang and had as other members Saied Belkasim, Anu Bourgeois, Xiaojun Cao, Tammie Dudley, Jamie Hayes, Xiaolin Hu, and Kebina Manandhar. The APR Committee met on a regular basis every few weeks and obtained feedback from all faculty throughout the process. The department’s faculty approved the report on November 28, 2016. What follows are salient highlights of the self-study.

Where are we now

This is the second Academic Program Review for the Department of Computer Science, with the first one occurring in 2006. In the fall of 2016, the department has 19 tenure-track and 4 non-tenure-track faculty members and 6 staff members. The student population includes 1404 undergraduate majors, 78 Ph.D. students, and 99 M.S. students.

![Current Trends in Computer Science Department Undergraduate Students](chart)

The undergraduate program has seen unprecedented growths in enrollments during the past 9 years. After dipping to a low of 327 undergraduate majors in fall 2007, the department has seen continuous growth in undergraduate majors reaching a total of 1404 in fall 2016. The growth has accelerated in recent years at the pace of more than 20% each year during 2011 and 2014 and over 14% during 2014-2016, and the end is not in sight. This growth is expected to continue in the coming years based on the societal dependence on technology, especially with the prevalence of impactful new technologies such as Mobile and Ubiquitous Computing, Internet of
Things, and Big Data. The technology industry in the metro Atlanta area is booming with numerous companies such as General Motors, NCR, Anthem, and Honeywell opening large IT Innovation centers bringing 1000s of new jobs to the area. The plethora of jobs in computing is spurring the enrollment growths. Not only are we seeing growth in numbers, but also in quality. Currently, over 120 of our undergraduate majors are part of the Honors College.

The graduate programs have also seen steady increases in enrollments growing from 117 in fall 2007 to 176 in fall 2016, an increase of 50%. The graduate programs are also poised for further growth with the hiring of 4 new tenure-track faculty in Fall 2016 and additional tenure-track hiring expected in the next few years. Computer Science graduated its 100th Ph.D. in May 2016 (the program was established in 2000 with its first graduate in December 2004). Our Ph.D. students publish in the top journals and conferences and have won numerous best paper awards at conferences and workshops. All our M.S. and Ph.D. graduates have gone on to excellent careers in academia (e.g. Marquette University, University of Missouri, Missouri University of Science and Technology, Kennesaw State University, Arizona State University, and Ursinus College), industry (e.g. Google, Microsoft, Amazon, eBay, Yahoo, IBM, Facebook, AirBnB, and Oracle), and government (e.g. CDC, State of Georgia). Our Ph.D. program was also highly ranked in 2010 by the National Research Council ranking among the best in the southeast US and in the top 50 in several categories in the US.

With the unprecedented growths in both the undergraduate and the graduate student populations over the past 9 years, the department has been under great pressure to provide the necessary instruction. The faculty size remained relatively constant (hovering around 18) for the most part until 2016 when finally, new positions were authorized and hired. During this time, class sizes have grown to at least 50 in most cases with some larger classes of 80 or more.
Currently, the department is overly relying on Ph.D. students (between 15 and 20 sections each semester) and part-time instructors (between 3 to 4 sections each semester) to cover the required classes. The student to faculty ratio for undergraduates is at approximately 55:1 in Fall 2016, which is well above the 21:1 GSU average. The figure on page 1 shows how stretched we are; if we were to match the GSU ratio, we should have an undergraduate student population of only 483. These pressures are not allowing us to provide our Honors students with dedicated small sections taught by tenure-track faculty. The tenure-track faculty are also heavily loaded with graduate student mentoring with a ratio of 9.5:1, again one of the highest in GSU.

Computer Science research at GSU is strong and is well funded. During the past 5 years (2012-2016), the department has secured an average of $1.56 million dollars in external grants per year, with a high of $2.16 million in FY 2016. With the hiring of new faculty in big data, Internet of Things, Privacy and Security, and Bioinformatics, we expect increases in grant output in the coming years. The department’s faculty also publish in the top ranked journals and conferences and many of the faculty are leaders in their fields and recognized internationally for their stature. The faculty provide significant service to the field in the form of editorships, conference and workshop organizers, and panel reviewers for funding agencies. The department has hosted numerous international conferences and workshops during the past 10 years that include Granular Computing 2006, International Symposium on Bioinformatics Research and Applications (each year since 2005), Web Intelligence and Intelligent Agent Technologies (WI-IAT 2013), and IEEE SocialCom/SustainCom/BDCloud 2016. Our faculty has won numerous awards and distinctions during the past 10 years. Dr. Sushil Prasad was named ACM Distinguished Scientist in 2013 and received the 2012 IEEE TCPP Outstanding Service Award. Dr. Yi Pan has received the IBM Faculty Award in 2010 and 2011 and the IEEE BIBE Outstanding Achievement Award in 2007.

With the dramatic growth in students over the past 9 years and the recent additions of faculty, the department space needs have not been adequately met, especially in the instructional laboratory space. The department controls only one 30-seat computer laboratory for all its undergraduate and graduate needs. This is clearly not sufficient. Our students are not getting the hands-on laboratory experience that is extremely crucial to their learning in the fast-changing landscape of computing. In the early programming classes, the students meet in break-out laboratory sessions and reinforce programming and problem solving concepts in structured labs. The systems courses also would benefit from hands-on laboratory work, but due to the lack of laboratory space these courses do not have break-out labs yet. In the advanced elective courses, such as embedded systems, mobile application development, network security, the availability of lab space would allow for experiential learning and better outcomes for students. Again, due to lack of laboratory space, our students are missing on this crucial aspect of learning. The department also lacks quality research space for its grant active faculty. Currently, all Ph.D. students are assigned either cubicles or small rooms that seat between 2 and 6 students. The environment is not conducive to conduct research, especially in groups that need the space for
devices and specialized equipment. This lack of research space was clearly one of the important factors that contributed to the loss of two highly productive faculty (Beyah to Georgia Tech and Song to University of Georgia).

**Where we want to go**

Looking ahead to the next 10 years, the Computer Science department faces many challenges if it should excel in providing quality education to its growing student population, make a mark for itself as a strong research department recognized nationally and internationally, increase its interdisciplinary research collaborations, and provide service courses in computing and data science to the rest of the university community.

The foremost challenge we perceive in the coming years is the acquisition of reasonable instructional lab space for both our undergraduate and graduate courses as well as adequate research space for our growing grant-active faculty research groups. For the instructional labs, we would like to have 3 new undergraduate labs, namely the “Programming Lab”, the “Computing Lab”, and the “Systems Lab” catering to the programming, computing, and systems courses respectively. The computing equipment in these labs will be requested from the annual Student Tech Fee competitions. For the graduate courses, we hope to obtain two general purpose labs, an “Internet of Things” lab focused on our systems courses and an “Informatics” lab focused on the data analytics courses. In addition, for the “Cybersecurity” concentration, a closed networks lab would be necessary. For research space, the department’s research focuses on three main areas: Bioinformatics, Data Analytics, and Cyber Physical Systems and we hope to obtain 3 research labs shared by grant-active faculty in these areas. Considering the basic demands of a Computer Science department with multiple servers, clusters, and computing needs, the current IT staff is not sufficient. To meet the growing student and faculty populations, an additional IT staff member is necessary.

Another important challenge is to deal with continued enrollment growths, both at the undergraduate and the graduate levels. We need additional faculty to be able to offer the needed sections for students to make progress towards their degrees. The department has been successful in obtaining two Next Generation Faculty Program awards and expects to add 3 new tenure track faculty in FY 2017. We shall continue to seek additional tenure track research faculty through the Next Generation Faculty Program in the coming few years. However, we also need 3 additional lecturers to teach the increased sections for the undergraduate students. We are also working on limiting enrollments in the major by introducing a pre-major category for newly admitted students. The pre-major student will be allowed to advance into the major only if they meet the criteria of a GPA of 2.70 on CSc 1301 (Programming I), CSc 2510/Math 2420 (Discrete Math), and their first Math course (Pre-Calculus or Calculus). These efforts to deal with the growth in enrollments should have a positive effect on the Retention, Progression, and Graduation (RPG) rates.
On the graduate education front, the department plans to expand its offerings at the Master’s level with new and innovative Masters programs and concentrations such as Computational Data Analytics, Cyber-Security, Computer Engineering, and the Internet of Things. The Computational Data Analytics concentration is already in place with 3 students enrolled in the first Fall 2016 cohort. With the hiring of one dedicated faculty member in the coming year, the department plans to enroll additional students in this concentration. The department is also preparing a concentration in Cyber-Security and hopes that additional resources (faculty and labs) will become available soon to be able to launch this program. The Computer Science Department also has an important role to play in a university-wide interdisciplinary PhD program in Data Science. This program is in the initial stages of discussion and hopefully will be in place within the next few years. The department also plans to strengthen its PhD program by aggressively recruiting high quality students. The department shall seek for external support from national funding agencies such as National Science Foundation, Department of Education, and Department of Defense in the form of training grants and PhD fellowships.

On the research front, the department shall aggressively look to expand its interdisciplinary collaborations and the opportunities are plenty, especially in data analytics, big data, privacy and security, and Internet of Things. Most of our recent tenure track faculty hires are experts in these areas and are already reaching out to colleagues in other disciplines. The faculty hires (3 tenure-track, 1 research assistant professor, and one postdoc) authorized as part of the successful “astro-informatics” and “unstructured data analytics for business” next generation faculty program proposals will initiate cross-discipline research projects. In addition, the department is searching for 2 other tenure-track positions in data analytics and Internet of things to further strengthen the department’s expertise in these areas. The department’s faculty are also reaching out to the College of Education for collaborative projects in Computer Science Education. These initiatives not only have potential for external funding, but also help in alleviating, to some extent, the shortage of expertise in the education space.