Teaching Statement for Richard Han
Full Professor Review

I devote substantial effort and care towards my teaching, and enjoy lecturing and interacting with the students. As an assistant professor 2001-2007, I primarily taught a joint undergraduate/graduate course in Network Systems CSCI 4273/5273, an undergraduate junior-level Operating Systems CSCI 3753, and graduate seminars in mobile computing and (secure) sensor networks. As an associate professor 2007-present, I have expanded the scope of my teaching, and have taught courses new to me such as graduate Distributed Systems CSCI 5673, graduate Advanced Operating Systems CSCI 5573, and an undergraduate sophomore-level course in Computer Systems CSCI 2400, in addition to co-creating the Entrepreneurial Capstone Projects I (CSCI 4348/5340) and II (CSCI 4358/5350).

Overall, my Faculty Course Questionnaire results (FCQs) have averaged 5.2 out of 6 for instructor rating (IR) and 5.1 for course rating (CR), based on statistics from 2009 (the oldest date that I found available on fcq.colorado.edu) to 2017. Minimum IR is 4.2 and maximum IR is 6 over this time frame, while minimum CR is 4.2 and maximum CR is 6. I am thankful for some early advice from the department to attend CU’s Faculty Teaching Excellence Program (FTEP). I believe attending this program substantially strengthened my pedagogy, resulting for example in the reduction of the pace of my lecture presentations to a more reasonable level as well as the introduction of questions into my lectures to improve interactivity with students during the class. In keeping with what I believe are general campus trends, my FCQs are typically higher for smaller voluntary senior/graduate courses, and lower for larger required entry-level courses, e.g. an average of 5.4 IR/5.5 CR for the smaller senior-level Entrepreneurial Projects CSCI 4348+4358\(^1\) (about 20-30 students/semester) compared to an average of 4.5 IR/4.3 CR for the required sophomore-level CSCI 2400 (most recently over 200 students/semester). Another general trend in the department is that class sizes have been increasing, e.g. CSCI 2400 has increased from 135 in 2011 to 215 in 2017.

1 Teaching Undergraduate Students

Perhaps the most prominent example of my commitment to teaching is that I co-created a new two-course capstone sequence on **Entrepreneurial Projects** for graduating seniors in the Bachelors of Science program at the Department of Computer Science of the University of Colorado Boulder. Prior to my efforts, senior CS B.S. students were required to take one of two capstones, either Senior Projects (where students form teams and work on a sponsoring organization’s idea - often a company - for a year, advised by a mentor from the sponsor) or Senior Thesis. As an alternative, I thought that CS B.S. students should have the opportunity to form teams and work on their own projects.

\(^1\)Spring 2016 CSCI 4830 is included in this calculation, as this was the temporary course number before it was assigned the permanent course number CSCI 4358. Also, while a capstone is required for CS B.S. seniors, they can choose one of three options, including Entrepreneurial Projects.
ideas for a year in the context of creating their own IT startup, especially given the success of IT startups in the Internet age. In collaboration with Zach Nies, a CU CS alum and current VP of Education at the renowned startup incubator TechStars, we proposed, developed, and taught a new year-long capstone in Entrepreneurial Projects that provides CS B.S. students with the opportunity to form teams and learn the essential integrated business and CS skills needed to build their own IT startups. We both bring startup experience to this effort. We first spent two years 2013-2015 teaching three versions of a one-semester startup essentials course, carefully crafting, testing, and iteratively evolving this pilot course’s curriculum. Based on this experience, we then developed the full-year capstone, which debuted in Fall 2015. Both qualified B.S. and B.A. CS students are allowed to enroll in this capstone, and we also offer a section of the course for graduate students to participate in both semesters.

I believe this new capstone is producing substantial benefits for the students who take this capstone, strengthens the CS department by expanding its entrepreneurial presence on campus, grows the relationship between CU and the local entrepreneurial community in Boulder, and ultimately improves the economy of the state and country by graduating new computer scientists able to contribute immediately to entrepreneurial innovation. We have brought in guest speakers and panelists from the local Boulder startup ecosystem, such as VC Jason Mendelson of Foundry Group, CTOs and marketing/finance/sales/IP law experts. We have also brought in professors from the CU Business and Law Schools to guest lecture on topics such as “How to Get Your First 10 Customers” and legal issues surrounding company formation. We have further partnered with organizations such as HackCU to co-sponsor the local startup2students job fair. We have won two $10K Entrepreneurial Seed Grants to help the students in the course to evaluate their startup ideas and build their software/hardware prototypes. The student teams have won $6K in prize money competing at the CU New Venture Challenge, and also multiple awards at the CS Expo, the year-end fair of the CS department. The capstone has helped strengthened engagement with our alumni, as we’ve brought in a panel of CU CS entrepreneurial graduates each year to share their experiences with this year’s capstone students. Our students have also engaged with the local startup community, pitching at public events such as the Longmont New Tech Meetup, the CS Expo, and our own Demo Day.

The Faculty Course Questionnaires (FCQs) attained so far seem to reflect substantial student satisfaction with this new capstone, averaging 5.4 IR/5.5 CR as noted above. We hear anecdotally from some students that taking this course sequence has been a transformative experience for them. I believe that it was in large part because of the contributions of this CS Entrepreneurial Projects capstone to the overall atmosphere of entrepreneurship at the University of Colorado that I was recognized with the CU campus Frank Moyes Award in 2016, which ”...annually recognizes an individual whose passion for entrepreneurship at CU makes a unique impact upon students and helps catalyze entrepreneurship across the campus.”

Early in my career, one of my favorite pedagogical experiences was co-creating and co-teaching a new undergraduate course with graduate student Brian Shucker called CSCI 4830 Sensor Networks in Fall 2004. This course consisted of 10 undergraduate students. Brian and I earned an A+ on the final FCQ instructor rating (under the prior pre-2009 rating system). I believe the reason this course was so successful was that we taught and organized it as a projects course, motivating the undergraduates to become highly involved working together as a single coordinated team to achieve their final project objective. Our approach was to empower the students with a feeling of ownership in their project, wherein they selected amongst themselves the application project for the semester,
self-organized into smaller teams to each carry out their portion of the project (e.g. networking, database, Web user interface, etc.), coordinated with each other to ensure compatibility between different software and hardware components, and demonstrated their final sensor-based location finding application at the end of the course. We guided the students throughout the process, introducing the class to a variety of key processes such as specifying design requirements, timelines, and interfaces. The students were incredibly motivated and enthusiastic about being able to work together as a team towards the same goal on a collective software project.

I created new curricular materials for two important undergraduate CS systems courses, namely Operating Systems (OS) CSCI 3753 and Network Systems CSCI 4273. For OS, I created a complete set of new lecture slides, because the prior material was fairly lacking in my opinion. My slide deck integrated the best concepts from a variety of OS textbooks as well as the Web. I believe Professor Mishra and Frank Miller have used this set of slides when they taught OS. I also largely replaced the programming assignments in OS with new ones of my design (in collaboration with my TAs), such as adding a system call to Linux, adding a device driver to Linux by installing a kernel module, building a synchronized multi-threaded Web application, and implementing a secure file system in user space. Similarly, I created a complete set of new lecture slides for Network Systems, and updated the course to include for example new Ethernet and IP routing assignments in the Telecomm switch lab. Sangtae Ha used some of the material from these slides when he taught Network Systems.

Finally, even though I was comfortably established in teaching two key systems courses in OS and Network Systems, I saw a major need in the CS department that was developing around 2012, namely there was not enough manpower to sustainably teach a required foundational sophomore-level course CSCI 2400 Computer Systems. As a result, I volunteered to teach Computer Systems despite the extra (and in retrospect, substantially large) effort needed to learn this technically challenging curriculum for an entirely new course. I believe this action helped to better position the CS department to handle the rapid rise in enrollment that has occurred recently.

2 Teaching Graduate Students

I have enjoyed teaching a number of important graduate-level systems courses, such as Network Systems, Distributed Systems and Advanced Operating Systems, as well as a variety of graduate seminars in topics ranging from sensor networks to mobile computing. As noted earlier, I have created new curricular materials for Network Systems, which is a joint undergraduate/graduate course. In addition, I conducted a major revision to the curriculum of the Distributed Systems course, updating it with more current cloud-based content such as Google File System, Map Reduce, and Chord/distributed hash tables, as well as new programming assignments on Amazon’s Elastic Computer Cloud. I also generated a new set of lecture slides that adapted material from a course at another university with our existing lecture slides, resulting in about 70% new content. Professor Mishra said that he used some of this material when he taught the course.

I have also offered a number of CS 7000-level graduate seminars in mobile computing, wireless sensor networks (WSNs), and secure WSNs. I have highly enjoyed teaching the students about leading edge research ideas, and guiding the students through the process to create innovative graduate-level research projects. Seminars also offered a unique forum for stretching my teaching skills in a different dimension than a large lecture hall-style course. I created both the WSN and secure WSN CSCI 7143-xxx graduate seminars. These two WSN courses are distinct because the
secure WSN required a substantially different reading list of security-focused papers compared to the general WSN course. My FCQ instructor ratings were A- or better (prior rating system) for my seminars.

I believe my high ratings for these seminars arise from the highly interactive manner in which I conduct these small classes, and the comprehensive training I give the students in the full process of conducting research. I assign students to read selected research papers that provide the fundamental background for the research area. Students must submit written critiques of each paper, which hones their critical thinking abilities that are so crucial for effective research. Students are also assigned on a rotating basis to present the selected papers to the class. We discuss each paper in detail, questioning the “expert” student presenter of the paper. This interactive approach improves each student’s presentation skills, including real-time analysis and response, which are needed as the students progress deeper into their research careers. Finally, each student is required to contribute to creating a novel final research project that must be presented in class and also written up in a final report. I hold meetings with each student team throughout the semester, discussing the research issues of their respective team projects, and guiding the teams toward exciting research outcomes. As a result, students are exposed to all aspects of the creative research process.

To improve the WSN seminar experience, my research group developed a teaching tool called SWARMS, which is software middleware for managing a testbed of 50+ sensor nodes. SWARMS 50+ node testbed represents a considerable educational advance over the previous technique where each student was given only 2-3 nodes to learn on. This real live SWARMS testbed was used in the fall 2006’s WSN graduate seminar to teach the graduate students about how to perform embedded programming in WSNs, and how to evaluate the performance of wireless networking on actual hardware over real wireless links.

As further evidence of the impact of my teaching approach in graduate seminars, I have had considerable success publishing the final student research projects that have emerged from my seminars. Out of my fall 2002 seminar alone, we were able to publish four out of five research projects and a total of seven refereed papers, including INSENS intrusion-tolerant routing (1 journal paper, 1 workshop paper), the lightweight multithreaded Mantis OS (1 ACM journal, 1 workshop), a sensor-enabled user interface (1 workshop), an approach to location-based privacy (1 HOT workshop), and SLIMCAST secure multicast (1 conference) - all for WSNs. The students were excited and highly motivated by the opportunity to publish their projects as refereed papers.

### 3 Advising Students

Especially rewarding to me has been advising and guiding students through their academic career. We have been fortunate to have excellent students in my research group. I have been the primary advisor to and graduated 8 Ph.D students, 7 M.S. Thesis students, and 7 B.S. Senior Thesis students. 6 of my Ph.D students work in industry, 1 is an assistant professor, and 1 is a post-doctoral researcher at USC’s Information Sciences Institute. I currently advise 3 Ph.D students. In addition, I collaborate closely on scholarly work with other professors such as Professors Lv and Mishra, effectively co-advising some of their Ph.D students in the joint research projects that we conduct together.

Many of my Ph.D students have achieved considerable success publishing their academic work as refereed papers. For example, my first Ph.D student Jing Deng graduated in May 2006 with a Ph.D. dissertation in Computer Science entitled “Securing Wireless Sensor Networks Through
Intrusion-Tolerant Design”. Jing published 14 refereed papers with me prior to graduating, and his body of work has now attracted about 2000 citations. Jing is currently employed at Apple. More recently, my Ph.D student Homa Hosseinmardi graduated in May 2016 with a dissertation entitled ”Multimodal Labeling and Characterization of Social Network Data for Detection and Prediction of Cyberbullying”. She published 8 refereed papers with me prior to graduation, and is currently a post-doctoral researcher at USC’s ISI.

I have also supervised a fair number of M.S. thesis students, who have achieved considerable success. For example, Carl Hartung’s M.S. thesis was published as a paper at the prestigious ACM MobiSys conference in 2006, and received a best paper award. Baishakhi Ray graduated with a Ph.D from the University of Texas and is now an assistant professor at the University of Virginia.

I have made a substantial effort to involve undergraduates in my research, as evidenced by the significant number of B.S. Senior Thesis students that I have graduated. Many of these students achieved refereed publications with me by the time they graduated. One has gone on to found a company and another received his Ph.D from MIT. I have also supervised over 35 independent studies of both undergraduate and graduate students.

My research advisees at CU have collectively generated a body of scholarly work that has attracted in aggregate about 8500 citations.

4 Future Plans

I would like to integrate entrepreneurial thinking sooner and more pervasively into the CS curriculum, namely in the freshman, sophomore, and junior years. Students should not have to wait until their senior year while taking the startups capstone to engage in entrepreneurial efforts on campus. I have started discussing options for doing this with a variety of stakeholders in the CS department, the CU campus, and the Boulder startup ecosystem. Some ideas that we’ve considered are bringing in successful startup founders as guest speakers to the required freshman seminar, introducing a new sophomore one-semester course in startup essentials, and partnering with ATLAS (they have a mobile app development course) to create a suggested entrepreneurial track in Computer Science. In general, these efforts aimed at improving the entrepreneurial mindset in CS appear to be well-aligned with the new Dean of Engineering Bobby Braun’s interest in expanding entrepreneurship throughout the College.