Teaching Statement

Yanif Ahmad, Computer Science Department, Cornell University.

After more than two decades sitting as a listener and learner in classes, I am drawn towards rhetoric and pedagogy in addition to research – the ability to convey, to nurture, and to have impact both on and through others is as much a challenge and reward as pursuing the next eureka moment. I eagerly await the chance to help future generations find the same enjoyment in continually learning and discovering computer science, mathematics and technology concepts as I myself have found. I have also come to the realization that my foundations of being an educator are the result of experiential learning of university-level education, and I look forward to expanding my knowledge on both learning theories and educational methods.

Teaching Plan

I view teaching as a intricately coupled with research, in terms of achieving outreach and involving students in a research program, driving an active retention of foundational material, and as an opportunity to expand my expertise by presenting the state-of-the-art in my research community to a computer science audience. The first task above is particularly critical for educators today, and I eagerly await the challenge of making computer science appealing to high school students and undergraduates.

Experiences, and Philosophy. I feel fortunate to have been exposed to two quite different educational systems with my undergraduate degree from Imperial College, followed by a Masters and Ph.D. at Brown, and their respective positions on foundations and applications, and breadth and depth. My undergraduate courses coupled lectures with recitations and supervised lab sessions, with advanced graduate students, which led to high quality instruction but provided limited opportunities for teaching experience. At Brown, I was a teaching assistant during the first run of a novel undergraduate course on building high-performance systems (CSCI1610), which provided valuable insight into the effort involved in bootstrapping courses, including preparation of lectures, homework assignments, and a final project on building an IMAP mail server, in addition to grading. The material in this course lacked a well-established textbook, thus we used technical articles, classical papers, surveys and retrospectives to introduce undergraduates to well-established concepts. I found the undergraduates were very receptive to such material and enjoyed being exposed to research-oriented technical writing. I have informally mentored group projects for graduate-level seminars on sensor networks and large-scale distributed systems at Brown (CSCI2950-T), and databases at Cornell (CS6230), where students undertook projects aligned to research topics, and consulted on assignments for an undergraduate course on information systems (CSCI1380). For the projects, I witnessed that keeping a pool of diverse hardware resources such as PDAs, cell phones, sensor motes and webcams to support exploration of data management techniques in everyday contexts particularly encouraged creative thinking and self-interest from students. For the assignments in CSCI1380, I saw how students felt a greater sense of reward when working on a series of assignments that built upon each other, from a simple communication library to a distributed key-value store, that was in turn used in a networked game. I have given a variety of guest lectures at Brown and Cornell on the aforementioned, as well as a course on computer game design (CSCI1340). This course was a series of guest lectures form industry and other disciplines and highlighted how learning from other disciplines and industry conveyed the potential for impact in the topics studied and acted as a strong motivator for students. All in all, my experiences have left the following desiderata in designing classes: i) to develop material and a course structure that promotes student-driven interest in the topic; ii) to enable opportunities for students to both learn how to work as individuals and as team players; iii) to expose students to both the core foundations and principles of the topic at hand, and their impact and application in society.

Courses. I am interested in teaching the full gamut of introductory courses that expose incoming computer science students and students from other fields to both basic programming languages and computer science foundations such as algorithms, data structures and discrete mathematics. I am also interested in teaching introductory courses on a variety of systems topics including networking, operating systems and compilers, in addition to courses at any level on databases and distributed systems. In terms of novel courses that would have refined and expanded the curricula at familiar institutions, I am interested in teaching an advanced undergraduate course on applied data structures, aimed at taking some of the core data management research that has focused on scalability and robustness into mainstream computer science. This would include topics such as out-of-core data structures, spatio-temporal and aggregate indexing, cache-oblivious approaches and networked data structures such as key-value stores and distributed hash tables. For seminar courses, I would initially be interested in recent research directions such as cloud computing, similar to recent courses at Brown and Cornell, as well as model-based databases covering work on processing time series, constraint databases and semi-algebraic sets for polynomials, and probabilistic databases for applying queries to models obtained via Kalman and particle filtering amongst other techniques. Finally following further research, I would be interested in teaching a computational finance course, potentially in an interdisciplinary manner with either a business school or economics department, spanning tools and numerical methods for automated trading, and running a simple automated trading competition amongst students.

Mentoring Plan

I have had the pleasure of working with a diverse set of researchers, and student collaborators to provide insight into both research and mentoring styles, and have begun to pass these on by acting as a big brother for junior Ph.D. students, and mentoring both masters and undergraduate-level students at both Brown and Cornell. I have distilled the following tenets from my experiences.

Graduate mentoring. While the role of an advisor changes throughout a graduate student's progression in a Ph.D. program, I believe there are two constant tasks, namely to continually help students set and meet their own expectations throughout the degree, and to foster leadership and communication skills. For the former, the first step is to prepare the student to engage and understand the responsibilities in performing research, and subsequently ensure exposure to a diverse set of career paths, including through internships, and through full disclosure of day-to-day events and tasks as faculty. I plan to accomplish the latter by encouraging both mentoring amongst students, and student-run groups, such as reading groups, and project groups to collectively maintain a research code base and share development expertise. Another challenge is that of developing research taste. I hope to involve graduate students in longer-term research planning, for example in writing grants, and visionary brainstorming sessions with external collaborators as I experienced on the Borealis project. By its nature, the Ph.D. program leads to highly specialized individuals, and such specialization can also lead to students feeling isolated. I would encourage graduate students to maintain both a research community and departmental presence as best possible, for example by engaging in research dialogue with graduate students from other areas, by taking on roles within the graduate student body such as the czarships at Brown, or by attending regional events. In the New England area, we were fortunate to have a significant mass of database researchers leading to monthly seminars with the NEDS series, and similar regional events occur with the New York DB/IR day, the Midwest DB Research symposium, the Carolina DB Research group.

Undergraduate mentoring. I believe the best course of action to inspire undergraduates to pursue graduate level studies is to provide as many opportunities to get involved in research as possible, and to structure research projects appropriately to facilitate this involvement. I have found that building systems naturally provides opportunities in subtopics that are interesting but not necessarily appropriate for a Ph.D. thesis, and that involving an undergraduate as opposed to a Masters student can lead to a more fruitful outcome due to the additional time available to develop background. In the particular case of undergraduates, who are often involved in many diverse activities, I have found that physical presence greatly speeds up progress, and hope to be able to allocate space for undergrads to sit near, observe and collaborate with graduate students in a lab environment. Mentoring undergraduates encompasses a much broader role than solely as a researcher, and I would challenge undergraduates to consider how they can impact both the computer science community and software industry, encouraging them from a systems and tools aspect, including pursuing entrepreneurship opportunities, getting involved in programming contests such as the ACM International Collegiate Programming Contest, the ICFP and the ACM SIGMOD programming contests, and to contribute to open source projects whenever appropriate, potentially through programs such as Google's Summer of Code.