Teaching Statement of Ranjan Pal

My goal in teaching is to help students gain knowledge, and develop in them the skills and skepticism necessary to become independent, rational, and practical thinkers, irrespective of the profession they decide to take up post studies. Given my research style, this translates to training students to learn how to tackle challenging practical problems using appropriate theory tools and to realize the solutions in practice. Normally, most research students look at problems from a single dimension, i.e., a CS theory student looks at a problem merely from an algorithmic and mathematical perspective, whereas a systems student solely thinks of the design, analysis, and experimentation of engineering system components from a technical perspective. As cyber-space and networked systems grow more complex, I personally feel the need to look at quite a few problems not only from a technical perspective, but also from the eye of an economist, strategist, social scientist, and policy maker. While the single dimensional approach has and will prove to be useful and valuable over time, suppressing innovative ideas which arise from the cross-pollination of domains might just restrict a problem solver from arriving at a potentially great solution to the challenging problems in today’s networking and security space. My goal is to train students to bridge this divide between multiple domains, and arrive at cross-disciplinary solutions to problems. I plan to equip students with the appropriate analytical tools to understand and research on theoretical methods, but also insist on careful cross-disciplinary system design and its practical realization. Both, social-based and technical-based experimental evaluations impart hard to teach skills and learnings which you get only from doing; such as measuring the effect of human and organization factors, and their incentives on the interplay of various systems components, taking correspondingly appropriate approaches to improve system performance, reasoning counter-intuitive behavioral patterns, and above all validating theory.

Beyond supervising research, I enjoy teaching students within the classroom setting. I served as a teaching assistant (TA) for the core graduate “Analysis of Algorithms” class at USC. This course was attended by students from various departments including computer science, electrical engineering, biological sciences, and mathematics. I was responsible for conducting weekly recitations, holding office hours, and co-designing and grading problem sets and exams. The recitations were held in two halves: the first half was dedicated to clearing concepts taught during lectures, and the second half dealt with solving a wide spectrum of problems (easy to hard), most of which I designed myself. I kept the problem solving sections collaborative, and interactive to enable students grasp solution intuitions better and faster. I observed that students are able to think more clearly in interactive settings when compared to non-interactive settings. Apart from co-designing the usual midterms and the finals, I was involved with the course instructor to design short surprise quizzes before the start of lectures. These quizzes tracked the weekly progress of students and alerted them to not fall behind in class. To overcome my biggest challenge of making a hard subject like algorithms interesting and manageable for students from diverse backgrounds, I administered the formation of study groups for problem sets. As a result, I observed that most students learned the basic concepts well and it got reflected in their exam scores. I got very good TA feedback, specifically for this ‘study group’ concept. For my efforts as a TA, I received the accolade of being one of the top five TAs in the Viterbi School of Engineering for the year 2012-2013.

Given my research background, I am qualified to teach a variety of fundamental courses including engineering probability, economics and game theory for engineers, communication networks, performance analysis, algorithms, and mathematical optimization. I am particularly excited to start and teach a new graduate class on economics of security, which will give students an interdisciplinary perspective to improving cyber-security. It is common knowledge amongst the security community that technical solutions, though important, are not enough to ensure a robust state of security. Currently, students only learn the technical concepts behind computer security in a single class. Probably only a few of those students take courses in either of economics, game theory, or public policy. Even if they do, the classes often are disconnected from each other, are unlikely to cover security applications, and more importantly do not provide a holistic view to improving cyber-security. Through a new course, I plan to educate students on ways to improve cyber-security by adopting concepts from multiple disciplines, and help them think more rationally on global security issues. I plan to cover basics of interdisciplinary subjects relevant to the course so that students need not worry of getting the required background from other courses. The course would have students read and present seminal papers in the area of security economics, work on problem sets, write short quizzes, and finally execute a research project with the aim to have a paper out of it. Finally, I believe that an important component of teaching is to communicate ideas not only within the university, but also to the general research public outside. I plan to give talks at conferences and seminars, present tutorials at relevant venues, and speak about my research in other schools. I realize that it is very important to disseminate to the research community new advanced techniques, and ideas from other fields that may have a positive impact on existing and future cyber-security research. On the other hand, I expect to benefit the same when my peers disseminate their research ideas. And last, but not the least, academia today recognizes that to excite, motivate, and inspire students to pursue careers in cyber-security, we will have to do a better job of communicating our research vision, intuitions, and style of thinking to them. I hope I will have the opportunity to do my bit in this endeavor.