Teaching Statement

Namrata Vaswani

I have always had a passion for teaching. In my opinion, good teaching goes a long way in preparing students for a future career in research or industry. A good grasp of the fundamentals at the undergraduate level and of some more advanced topics at the graduate level is very important before plunging into research. For engineering classes, this means both building the students’ intuition as well as giving them rigorous justification about algorithms and why they work. Correct intuitive reasoning helps students quickly apply what they have studied to practical problems, while rigorous justification is required to be able to extend the methods in future research.

Another issue that I would like to stress on, especially in graduate classes, is relating what is taught in class to real life problems. Many times, challenging homework problems or class projects can interest students in a particular research area. Encouraging students to write term papers comparing and critiquing various approaches to a problem, or analyzing one particular paper in great depth can be very useful. Theoretical courses can be made more practically relevant by making students look at a practical algorithm in literature and analyze it using the theoretical tools taught in the class.

I have helped many students at Maryland, both with their courses and with their research. In particular, I worked closely with one student of Prof. Shihab Shamma who was trying to use my research for a neural signal processing problem. At Georgia Tech, I am informally co-advising one graduate student of Prof. Allen Tannenbaum and one graduate student of Prof. Anthony Yezzi. I also organized a mini-course in the Biomedical Imaging Lab at Georgia Tech on stochastic filtering algorithms - Kalman filtering, extended Kalman filtering, Particle Filtering and change detection. In Spring 2005, I plan to help Prof. Yezzi with his classes.

My informal teaching experience includes seminars in various courses that I took as part of my graduate curriculum. These involved giving an hour long lecture explaining a chosen topic to the students. Some of the talks that I have given are: “Convergence results for particle filters” (which involved explaining the nonlinear filtering problem, the particle filtering algorithm, the concepts of convergence of a sequence of random probability measures and the convergence results); “Sequential Quadratic Programming (SQP)” (involved explaining the nonlinear programming (NLP) problem, the SQP idea of approximating the NLP by a quadratic programming problem at each iteration and the various algorithms for solving the SQP); “Markov Random Fields (MRFs) for image texture segmentation” (involved explaining the concept of a Markov Random field as an extension to a one dimensional Markov chain, the Gaussian and Line MRF models for segmenting images and various approaches to segmentation); and “Wavelet based statistical signal processing using HMMs” (involved explaining wavelet transform and HMM basics, the EM algorithm, Wavelet domain HMMs and their applications).

To summarize, I have a fairly broad background in signal and image processing, computer vision, statistics and optimization. I am eager and qualified to teach the following undergraduate and graduate classes - engineering probability and statistics, signals and systems, linear algebra, estimation and detection theory, stochastic processes, image processing, computer vision, pattern recognition, optimization and basic information theory. Besides this, I would also like to introduce special topics’ classes on Bayesian state estimation (forward-backward and Viterbi algorithms for discrete state HMMs, Kalman and particle filters for continuous state HMMs and Bayesian networks); on Monte Carlo methods in engineering (sequential Monte Carlo and Markov Chain Monte Carlo algorithms, convergence results and applications) and on shape analysis (and applications in medical image processing and computer vision).