

Statement of Purpose

Lyric Liu

When I was an undergraduate in college, I did not learn much advanced mathematics. I only took one multivariate calculus class, in which I did not do well at all because I found it boring and impractical. This experience kept me away from mathematics until I started my graduate study in the forestry department at The University of Montana (UM) in August 2011. I enrolled in two statistical methods classes required for forestry graduate students, which opened my eye to the field of statistics. I had never known the existence of the t-distribution as compared to the normal distribution. I had never known that the averages of any distribution can be normally distributed when certain conditions are met, as stated in the Central Limit Theorem. I had never realized that statistics is such a powerful tool for scientific research. As a result of my growing interest in statistics, I applied for the master's program in the Mathematical Sciences Department at UM, yearning to develop professional analytical skills, which would be very useful in my career in forestry. After I started the graduate program in mathematics, I was inspired by the theoretical depth of the faculty in my department through taking higher level classes. The course in mathematical statistics transformed me from a forestry student to a statistics student. The linear models theory course showed me the beauty of manipulating matrices in solving statistical problems. The spatial statistics course fascinated me and introduced my research interests. With more and more exposure of both theory and applications of statistics, my desire to pursuing a Ph.D. in the field became stronger and stronger. I then started taking real analysis courses as my advisor suggested. The pure mathematics courses enhanced my understanding of calculus and better prepared me as a qualified prospective Ph.D. student in statistics. With all of this theoretical preparation in statistics and mathematics, I am more than ready to enter a Ph.D program in statistics to receive the necessary training for solving complex real life statistical problems.

Harvard's motto, "Veritas," means truth. As a statistics student, I pursue truth by making estimations and inferences from limited available information. My research interest broadly is in spatial statistics. Noel Cressie says in his book *Statistics for Spatial Data*, "knowing 'why', 'how' and 'when' was not enough for me." Questions about "where" interested him greatly. After doing my research, I have started to realize what his words mean and have become intrigued by spatial analysis. My thesis topic concerns the implementation of ridge estimators in spatial autologistic models, a family of flexible models for a binary response that allows for covariate information and accounts for both spatial and temporal autocorrelations. As a result, predictors can be highly correlated leading to unstable predictions or estimations. To solve this problem, I adapted a method using ridge estimators (a.k.a. Tikhonov regularization) inspired from one of my applied mathematics classes. Although my work is yet to be completed, I have already obtained some positive results. I look forward to continuing my study of Spatial Statistics in the Biostatistics Department at Harvard T.H. Chan School of Public Health (HSPH), which has a group of faculty working on methodological and applied research in spatial statistics. I am excited about potential research opportunities involving air pollution and disease modeling. These are problems that matter to real people. Dr. Cory Zigler's Bayesian approach to

solving complex spatial problems especially appeals to me and I would love to study and make contributions to this field.

I love teaching statistics, but as a foreign student, teaching was challenging for me initially. The first time I taught probability class, I mispronounced “foul” shots as “fool” shots and one student corrected me. In the moment I felt embarrassed but recovered quickly and screamed out: “Oh no! Why are you in my third lab instead of the first one? I have been saying ‘fool’ shot all morning!” Everyone laughed. Another time in my class I claimed to my students that their average weight is 75 pounds when I was thinking about kilograms. After seeing their confused faces I asked, “don’t you guys want to lose weight?” Although I try to be humorous in class, I am not a teacher who only tries to amuse students. I care about how well my students learn. I thoroughly prepare for each class because I think it is not OK to say “I don’t know” to students when they ask about course content. I am helpful after class and willing to spend time to answer their questions and ensure they really understand. Because of this, many of my students provided very positive comments in their course evaluations “You are the best teaching assistant I have ever had”. For me, teaching was a very pleasant experience and is an activity I hope to continue as part of my future goals.