

Statement of Purpose

It is my desire to pursue a Ph.D. in Economics as part of my long-term professional goal of becoming a professor. I have a strong interest in applied economics and econometrics.

After graduating from college, I spent three years working for MSH China¹ to meet my student loan obligations. I then began the next phase of my education – a Master degree in Actuarial Studies at Monash University². My plan was for this degree to facilitate a future career as an actuary. However, I discovered a passion and talent for academic research. This self-discovery stems from the Introductory Econometrics course taught by Professor Farshid Vahid. I found three mistakes in the formulas of the OLS estimator while doing extracurricular reading on the textbook (Wooldridge 2016). I brought this to Farshid and even he was surprised by these typos. He wrote to Wooldridge, which resulted in a thank you from Wooldridge, public praise, and extra credit points from Farshid. I was highly encouraged by these positive experiences; the more I studied Econometrics, the more I enjoyed it. I decided to pursue my interest and transfer to Master of Applied Economics and Econometrics.

In the year that followed, I achieved the highest mark in seven out of eight courses. In April 2018, I was chosen as one of the four representatives to participate the Econometric Game³. We were required to write a paper around the topic of the economics of happiness over the course of two days. I can still feel the passion every time I remember how we worked together under great pressure discussing ways of measuring “wellbeing”, constructing the Ordered Probit model, and screening for the relevant variables. I felt deeply proud of ourselves for being able to tackle the meaningful and interesting economics problems, while also being stimulated greatly to learn more.

Inspired by the diverse expertise of the PhD students from other top universities, I wanted to equip myself with the modern techniques such as machine learning and data visualization to do cutting-edge research in Economics. Returning from the econometric game, I began work on my master thesis on computer vision with rigor. This project was supervised by Professor Di Cook. The central research question was: can we train the computer to read residual plots? Residuals plots contain more information than single statistics (Anscombe 1973). It has been shown that the hypothesis testing of human observations of visualized plots is valid

¹MSH China is the Asia pacific headquarter of MSH INTERNATIONAL, a world leader in the design and management of international healthcare solutions. <http://www.mshchina.com/>

²Monash University is a public research university based in Melbourne, Australia.

³The Econometric Game is hosted by the University of Amsterdam. <http://econometricgame.nl/>

(Majumder, Hofmann, and Cook 2013). In the hope that previously manual process, human evaluation, can be aided and supplemented by computers, I built a binary classifier using a deep learning algorithm to detect linear relationships from no structure in a scatter plot. Having trained a satisfactory model using simulated data, I tested it against a large unseen test set, as well as the same dataset used by Majumder et al. An interesting discovery was that the power $(1 - \beta)$ of the deep learning model was always close to the conventional t-test holding the Type I error (α) constant. Given that the t-test is the known uniformly most powerful test under such experimental settings (J.Neyman and E.S.Pearson 1933), this finding gives hope that the deep learning model may be able to approach the unknown best test in more complicated situations. The study was then extended to test heteroscedasticity from homoscedasticity using the binary classifier. To provide a reference level of the test accuracy, a small experiment of human observations was conducted via online questionnaire and a specific form of the White test (White 1980) was employed. In this experiment, the classifier achieved much higher accuracy than both the White test and humans. Our research innovated the use of computer vision on hypothesis testing and provided evidence of its validity when the structure in the plots is very specific. A draft paper is currently being written to be submitted to the .

After completed the master degree, I was excited to accept the offer from Professor Heather Anderson as a research assistant to work on a paper about the high-dimensional predictive regression with the Lasso estimator (Koo et al. 2016). In this project, I reviewed literature to investigate the compatibility (or restricted eigenvalue) condition and its implication of choosing the tuning parameter λ for the ℓ_1 norm to achieve the prediction optimality, while taking into account the potential consequences in consistency for variable selection of the Lasso (Bühlmann and Van De Geer 2011). The comparison between the Lasso, the adaptive Lasso and the group Lasso is also considered. In addition, the mean squared error of forecasting GDP and inflation using the Lasso on 146 economics variables is tested against other approaches including an Autoregressive model and a principal component analysis. The potential co-integrating relationships in the selected variables are being studied. I find it is intriguing to observe the series chosen by this data-driven methodology and seek possible economical theory-based explanations.

Meanwhile, I am working for the learning and teaching team in Monash University to analyze the treatment effect of the education innovations, such as live streaming, used in the lecture by the IV estimation. To establish the validity of the online survey conducted for the users experience, we adapted explanatory factor analysis.

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