THE UNIVERSITY OF CHICAGO

Department of Statistics

DISSERTATION PROPOSAL

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Flexible Bayesian Tools for Large Data

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ABSTRACT

My research focuses on developing flexible Bayesian tools for the analysis of large datasets and on providing theoretical justifications for their effectiveness. One strand of my work has focused on **dynamic factor analysis (DFA)** for high-dimensional time series. We have developed a comprehensive Bayesian framework for sparse factor analysis endowed with the following features: (1) time-varying factor dimensionality, (2) residual stochastic volatility and (3) dynamic sparsity priors on the factor loadings. Our new scalable EM implementation has extended the reach of Bayesian DFA to larger datasets. To highlight the efficacy and usefulness of our proposed method, we applied our model to a large-scale balanced panel of macroeconomic variables covering multiple facets of the US economy. Our model captures dynamic changes in the factor structure and dimensionality, in particular around the Great Recession. Future research in this line of work will focus on the development of **factor models on graphs**. This project is motivated by a large dataset of dynamic professional networks of investors across various VC firms. The second area of my research revolves around developing **theory for BART** (Bayesian Additive Regression Trees). Invented by *Chipman, George and McCulloch in 2010*, BART has been broadly successful in regression and classification tasks across many contemporary applications. Theoretical aspects of BART, however, have been grossly understudied. We have been bridging this gap by providing convergence rate results. Building on our paper studying BART in non-parametric regression, we are now focusing on classification. We are particularly interested in discrete choice models which are the centerpiece of marketing applications and which have, insofar, relied on strong parametric assumptions. This line of work will be accompanied with empirical demonstrations.

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