School of Mathematical and Statistical Sciences
Arizona State University

MEMORANDUM

DATE: June 28, 2022

TO: Faculty and Students

FROM: Professor(s) Dan Cheng Yunpeng Zhao
Chair/Co-Chairs of Zhibing He
Defense for the PhD in Statistics
Committee Members Hedibert Lopes
John Fricks
Ming-Hung Kao

DEFENSE ANNOUNCEMENT

Candidate: Zhibing He

Defense Date: 06/29/2022

Defense Time: 2:00 PM

Virtual Meeting Link: https://asu.zoom.us/j/6318189372

Title: Statistical Inference for Implicit Network Structure and Multiple Change Points in Linear Models

Please share this information with colleagues and other students, especially those studying in similar fields. Faculty and students are encouraged to attend. The defending candidate will give a 40 minute talk, after which the committee members will ask questions. There may be time for questions from those in attendance. But, guests are primarily invited to attend as observers and will be excused when the committee begins its deliberations or if the committee wishes to question the candidate privately.

ABSTRACT
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ABSTRACT

This dissertation studies on two research projects: Multiple Change Points Detection in Linear Models and Statistical Inference for Implicit Network Structures.

In the first project, a new and generic approach to detect change points based on differential smoothing and multiple testing is presented for long data sequences modeled as piecewise linear functions plus stationary ergodic Gaussian noise. As a generalization of the STEM algorithm for peak detection proposed by Schwartzman, Cheng and He [57, 19, 17], the method detects change points as significant local maxima and minima after smoothing and differentiating the observed sequence. The algorithm, combined with the Benjamini-Hochberg procedure for thresholding p-values, provides asymptotic strong control of the False Discovery Rate (FDR) and power consistency, as the length of the sequence, the size of the jumps and the change of slopes get large. Numerical studies show that FDR levels are maintained in non-asymptotic conditions and guide the choice of smoothing bandwidth. .

In the second project, identifiability and estimation consistency under mild conditions in hub model are proved. Hub Model is a model-based approach, introduced by Zhao and Weko [72], to infer implicit network structuress from grouping behavior. The hub model assumes that each member of the group is brought together by a member of the group called the *hub*. Furthermore, this dissertation generalizes the hub model by introducing a model component that allows hubless groups in which individual nodes spontaneously appear independent of any other individual. The new model bridges the gap between the hub model and the degenerate case of the mixture model – the Bernoulli product. Furthermore, a penalized likelihood approach is proposed to estimate the set of hubs when it is unknown.