



The Hong Kong University of Science and Technology

Department of Mathematics

PHD THESIS EXAMINATION

**Flexible and Accurate Methods for Estimation and Inference
of Gaussian Graphical Models with Applications**

By

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ABSTRACT

The Gaussian graphical model (GGM) incorporates an undirected graph to represent the conditional dependence between variables, with the precision matrix encoding partial correlation between pair of variables given the others. To achieve flexible and accurate estimation and inference of GGM, we propose the novel method FLAG, which utilizes the random effects model for pairwise conditional regression to estimate the precision matrix and applies statistical tests to recover the graph. Compared with existing methods, FLAG has several unique advantages: (i) it provides accurate estimation without sparsity assumptions on the precision matrix, (ii) it allows for element-wise inference of the precision matrix, (iii) It achieves computational efficiency by developing an efficient PX-EM algorithm and a MM algorithm accelerated with low-rank updates, and (iv) it enables joint estimation of multiple graphs using FLAG-Meta or FLAG-CA. The proposed methods are evaluated using various simulation settings and real data applications, including gene expression in the human brain, term association in university websites, and stock prices in the U.S. financial market. The results demonstrate that FLAG and its extensions provide accurate precision estimation and graph recovery.

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Time : 10:00 a.m.

Venue : Room 4472 (Lift 25/26)

Zoom ID: 943 4930 8389 (passcode: hkust) ~ EE opted via online mode.

<https://hkust.zoom.us/j/94349308389>

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(Open to all faculty and students)

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).