



INDIAN STATISTICAL INSTITUTE

Theoretical Statistics and Mathematics Unit, Kolkata

SEMINAR

Date: December 18, 2023, Monday

Time: 12:00 Noon

VENUE:

L-infinity

(5th Floor, A.N. Kolmogorov Bhavan), ISI Kolkata

TITLE:

Precision Matrix Estimation under the Horseshoe-like Prior–Penalty Dual

SPEAKER:

Sayantana Banerjee

IIM Indore

ABSTRACT:

Precision matrix estimation in a multivariate Gaussian model is fundamental to network estimation. Although there exist both Bayesian and frequentist approaches to this, it is difficult to obtain good Bayesian and frequentist properties under the same prior–penalty dual. To bridge this gap, our contribution is a novel prior–penalty dual that closely approximates the graphical horseshoe prior and penalty, and performs well in both Bayesian and frequentist senses. A chief difficulty with the graphical horseshoe prior is a lack of closed form expression of the density function, which we overcome in this article. In terms of theory, we establish posterior convergence rate of the precision matrix that matches the convergence rate of the frequentist graphical lasso estimator, in addition to the frequentist consistency of the MAP estimator at the same rate. In addition, our results also provide theoretical justifications for previously developed approaches that have been unexplored so far, e.g. for the graphical horseshoe prior. Computationally efficient EM and MCMC algorithms are developed respectively for the penalized likelihood and fully Bayesian estimation problems. In numerical experiments, the horseshoe-based approaches echo their superior theoretical properties by comprehensively outperforming the competing methods. A protein–protein interaction network estimation in B-cell lymphoma is considered to validate the proposed methodology.

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