NETWORK-BASED NEIGHBORHOOD REGRESSION

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Time：Wed, Dec 25th, 11:00 - 12:00
Tencent Meeting Number：141 146 700
Password：112358

Abstract:

Given the ubiquity of communities in biological systems, cluster-level regulation analysis is vital for understanding biological systems across various levels and their dynamics. In this talk, I will present a novel network-based neighborhood regression framework whose regression functions depend on both the global community-level information and local connectivity structures among entities. An efficient community-wise least square optimization approach is developed to uncover the strength of regulation among the network modules while enabling asymptotic inference. With random graph theory, we derive non-asymptotic estimation error bounds for the proposed estimator, which also achieves minimax optimality. Unlike the root-n consistency typically in canonical linear regression setup, our model exhibits linear consistency in the number of nodes n, highlighting the advantage of incorporating neighborhood information. The effectiveness of the proposed framework is further supported by extensive simulation studies and an application to an Autism genetic dataset.