Contribution ID: **13** Type: **Oral Presentation**

The Invariance Partial Pruning Approach to The Network Comparison in Longitudinal Data

Wednesday 23 July 2025 18:00 (15 minutes)

Oral presentation

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Abstract

Network models from time-series and panel data have been powerful tools to investigate the dynamical relations among variables. A common goal of empirical research is to compare the networks of different groups, such as treatment and control, to understand how inter-variable relations are shaped by the grouping variable. However, existing methods to compare idiographic networks are merely global tests that cannot tell specific location of edge difference and equality. Furthermore, there is a lack of easily applicable methods to compare networks from panel data where just a few time-points are available per person. We therefore present the invariance partial pruning (IVPP) approach, which first evaluate the presence of heterogeneity with the network invariance test, and then determine the exact locus of edge equality and difference with partial pruning. Through simulation studies, we discovered that network invariance test based on AIC and BIC performed well, but LRT was prone to false discovery. Comparison with the fully constrained model revealed superior performance than comparison with the fully unconstrained model. Partial pruning successfully uncovered specific edge difference with high sensitivity and specificity. We conclude that IVPP is an essential supplement to the existing network methodology by allowing the comparison of networks from time-series and panel data, and also allowing the test of specific edge difference. The method permits the network comparison of both different groups/persons, or different time periods of the same group/person. We implement the algorithm in the R-package IVPP.

Keywords

network comparison, (intensive) longitudinal data

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Session Classification: Session 13 : ”Longitudinal models and Individual variability”

Track Classification: Statistical analyses: Statistical analyses