

Network modeling with covariates for high-dimensional longitudinal data

Hassan Pazira¹, Iuliana Ciocanea-Teodorescu², Wessel N. van Wieringen^{1,3}

¹Department of Epidemiology and Biostatistics, Amsterdam UMC, location VUmc, The Netherlands

²Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden

³Department of Mathematics, VU University Amsterdam, Amsterdam, The Netherlands

E-mail for correspondence: w.vanwieringen@amsterdamumc.nl

Abstract: The longitudinal data containing high-dimensional outcomes and covariates are prevalent in a wide range of scientific disciplines, including healthcare and medicine. Alongside the characterization of the individual's traits molecularly (as outcomes), clinical information of the individual (as covariates) could be available, which may be time-varying (e.g. pre-post treatment indicator) or constant (e.g. age/gender). In this work, we developed a network model including the covariates effects to detect changes in networks. Indeed, we are interested in potential effect modification by covariates in the relation among the individual's traits, e.g. the cohesion of the molecular entities. To investigate these effect modifications, using the penalized mixed models as prior information from networks reconstructed from observation studies, the (fixed and random effects) parameters of the model were estimated by the generalized (fused) ridge penalties. The efficacy and performance of the proposed network model (against networks with no covariates effects) is evaluated in the simulation and application studies.

Key words: network; high-dimensionality; longitudinal data; penalized mixed model .