Estimating Network Structure from Time to Event Data

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Abstract

Currently there are many statistical methods for estimating network structure. However, those methods mainly focus on estimation from non-censored continuous or binary data. In this paper we propose a statistical method for estimating network structure from right-censored data. Under our method, we modeled the hazard function of a node as a function of event time of other nodes. We then estimated the hazard function by maximizing a pseudo partial likelihood function subject to an L^1 norm constraint on parameters in the hazard function. To make our estimation robust, we combined our method with the stability selection method, identifying network links with a pre-specified risk control on the number of false discovered links. Simulation study shows that under this hybrid procedure, the number of false discovered links was tightly controlled while the true links were well recovered. We applied our method to estimate paths of diffusion for donation behavior among 146 firms from the campaign contribution records collected during the 2008 Taiwanese legislative election. Our analysis shows that firms affiliated with elite organizations or firms of monopoly were more likely to act as mediators for diffusing donation behavior. In contrast, firms belonging to technology industry were more likely to act independently on donation.

Keywords: Networks; Right-censored data; Partial likelihood function; Stability Selection; Random graph models.