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Mathematical optimization for social network analysis

Online social networks have become crucial communication channels used by a variety of stakeholders including entities with commercial interests such as companies. The latter increasingly incorporate campaigns promoted via social networks into their marketing mix. Fundamental problems that arise in quantitative social network analysis in the context of (viral) marketing include (i) the identification of influential network nodes that may trigger a large information propagation cascade referred to as influence propagation, and (ii) the identification of homogeneous communities referred to as community detection. We discuss recently studied optimization problems arising from these two aspects, various mixed integer programming formulations for them as well as exact solution algorithms. The latter include decomposition algorithms such as (generalized) Benders decomposition, branch-and-cut, and column generation. Finally, shortcomings of existing models and directions for future research are outlined.