# Relaxing conditional independence assumptions in networks: the case of community detection and reciprocity


## *A seminar by Caterina De Bacco*

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## Room Benvenuti and live Zoom
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Probabilistic latent variable models are popular models for learning patterns in networks, systems made of many individual elements interacting in pairs. Latent variables inferred from these types of data can provide useful insights such as detection of communities or clusters of similar nodes. However, recent works have shown that these approaches fail to reproduce relevant structural network properties, for instance reciprocity, the tendency of two nodes to form mutual connections. We conjecture that this may be related to a common conditional independence assumption made in these approaches: edges are independent, conditional on the latent variables (e.g. community membership). In this talk we present two variants of probabilistic generative models that relax this assumption while preserving the good properties of standard models. In particular, we present two distinct ways of relaxing conditional independence between edges: one that specifies conditional probabilities and relies on a pseudo-likelihood approximation and one that jointly models pairs of edges with exact 2-edge joint distributions.

We show how these first attempts to break this assumption result in improved performance in terms of various inference tasks such as recovering communities and edge prediction. Remarkably, these models are now capable of generating synthetic networks that replicate the reciprocity values observed in real networks, thus overcoming the limitations of standard models and better serving the needs of practitioners interested in modeling this structural property.



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