

# Modelling Networks via Sparse Beta Model

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## Abstract

We propose the Sparse Beta Model, a novel network model that interpolates the celebrated Erdos-Renyi model and the Beta Model. We show our Sparse Beta Model is a tractable model for modelling both "local" and "global" sparseness of a network, along with the core-periphery network or the leaders-followers network. Core-periphery networks appear frequently in financial networks, e.g. conventional OTC markets.

When the sparsity is unknown, we formulate a penalized likelihood approach with the  $l_0$  penalty. We overcome the seemingly combinatorial computational problem due to the  $l_0$  penalty by utilising the sufficient statistics of the network.

We apply the proposed model and estimation procedure the famous microfinance take-up example, a.k.a. Banerjee et al. 2013, and find our beta-centrality (from our sparse beta model) is significantly related to eventual microfinance participation -- which shows our work can provide insights on the role of social importance (node position/attribution in a network), through providing new network statistics such as beta-centrality, on program participation.