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Unnormalized and normalized forms of gefura measures in directed and undirected networks

Key words: Networks subdivided in groups, Partitions, Gefura measures, Q-measures, Brokerage role, Directed and undirected networks, Brandes' algorithm

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Overview

- Gefura measures Γ – previously known as Q-measures – are indicators of a node's brokerage role between groups in a network
  - They measure to what extent an article (node) play a bridging role between journals (groups) in a citation network?
  - They are analogous to betweenness centrality

- Main contributions of this article:
  - Gefura measures in directed networks
  - Two types of normalization
  - Efficient algorithm to calculate gefura measures

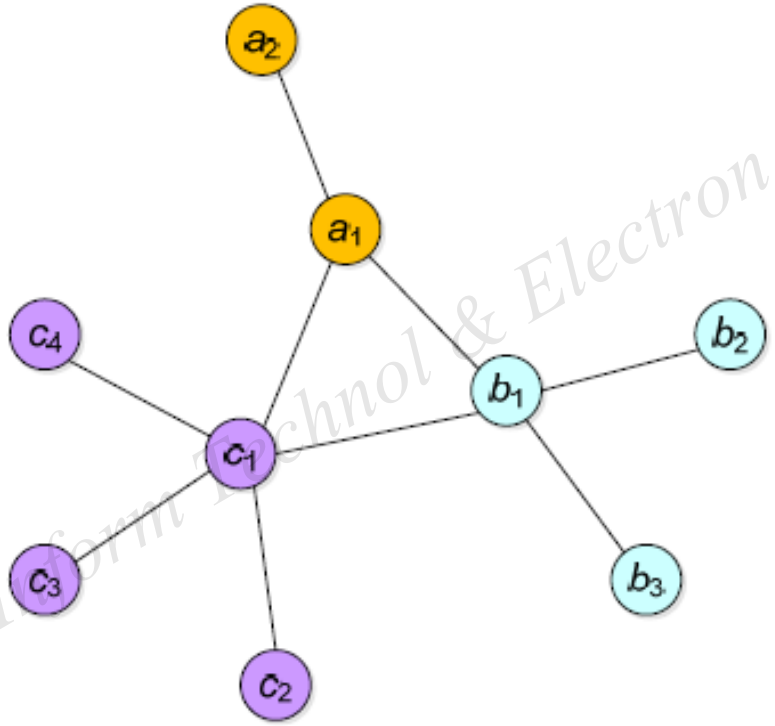
Unnormalized gefura

$$\Gamma_G(a) = \sum_{\substack{g,h \in V \\ \text{group}(g) \neq \text{group}(h)}} \frac{p_{g,h}(a)}{p_{g,h}}$$

where:

- $p_{g,h}$: number of shortest paths from g to h
- $p_{g,h}(a)$: number of shortest paths from g to h through a

Two normalizations



Structural normalization: $\Gamma(a_1) = \Gamma(b_1) = \Gamma(c_1)$ → group level
Basic normalization: $\Gamma(a_1) < \Gamma(b_1) < \Gamma(c_1)$ → node level

Algorithm

- Adaptation of Brandes' (2001) algorithm for betweenness centrality
- Time complexity: $O(nm)$
- Implementation available