

Node Centrality of Weighted Networks Considering Connectability to Nodes within Two Degrees of Separation

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Weighted networks have been extensively studied because they can represent various phenomena in which the diversity of edges is essential. To investigate the properties of weighted networks, various centrality measures have been proposed, such as strength, weighted clustering coefficients, and weighted betweenness centrality [1]. In such measures, only direct connections or entire network connectivity from arbitrary nodes have been used to calculate the connectivity of each node. However, in weighted networks composed of autonomous elements such as humans, middle ranges from each node are also considered to be meaningful for characterizing each node's connectability. For example, consider a relationship between three people, A, B, and C. If person A is a common friend of B and C, then person B has a high probability of encountering and communicating with person C. This possibility has already been dubbed the 'forbidden triad' by Granovetter in social science [2]. In this study, we define a new node centrality in weighted networks to consider connectability to nodes within a range of two degrees of separation. In addition, we apply this new centrality to face-to-face human communication networks in corporate organizations which are detected by a Business Microscope (Hitachi, Ltd, Japan) [3]. Our results show that the proposed centrality distinguishes inherent communities corresponding to the job types in each organization with a higher degree of accuracy than typical conventional centralities. This indicates the possibility that connectability to nodes within two degrees of separation reveals potential trends of weighted networks that are not apparent from conventional measures.

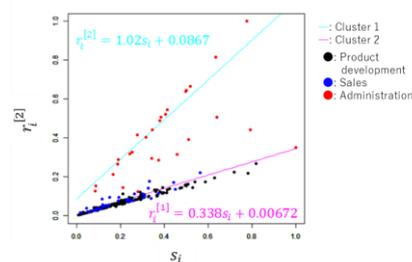


Figure 1: The scatter diagram of node strength and the proposed centrality in the corporate organization.

References

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