Schillo M, Funk P, Rovatsos M (2000) Using trust for detecting deceitful agents in artificial societies. Appl Artif Intell 14(8):825–848

Tadelis S (2003) Firm reputation with hidden information. Econ Theory 21:635–651

Teacy WTL, Patel J, Jennings NR, Luck M (2006) Travos: trust and reputation in the context of inaccurate information sources. Auton Agents Multi-Agent Syst 12:183–198

Xiong L, Liu L (2004) Peertrust: supporting reputation-based trust for peer-to-peer electronic communities. IEEE Trans Knowl Data Eng 16(7):843–857

Zacharia G (1999) Collaborative reputation mechanisms for online communities. PhD thesis, Massachusetts Institute of Technology

Zhang J, Cohen R (2008) Evaluating the trustworthiness of advice about seller agents in e-marketplaces: a personalized approach. Electron Commer Res Appl 7:330–340

Zhou R, Hwang K, Cai M (2008) Gossiptrust for fast reputation aggregation in peer-to-peer networks. IEEE Trans Knowl Data Eng 20(9):1282–1295

Computer Literacy

▸ Networks in Rural Sociology

Computer-Mediated Group

▸ Online Communities

Connecting Communities

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Glossary

Community A set of highly and mutually connected nodes in a network

Bridge An edge that provides the only path between its end points

Local Bridge An edge whose end points have no common neighbors. Its degree is the length of the shortest path between the end points when that edge is eliminated

Vertex/Edge Betweenness Centrality Given a vertex/an edge, the number of all shortest paths between pairs of vertices that go through it

Modularity Given a partition of a network, the fraction of the edges that connect nodes in the same community minus the expected value of the same quantity with the randomly rewired network

Conductance Given a set of nodes in a network, the number of cut edges between the set and the remainder of the network divided by the number of internal edges inside the set

Definition

One of the most important applications of community detection in large-scale networks is exploring the community structure. From connections between communities, we can gain insight on their relationships and information flow in networks. Recent studies on real network data have shown interdisciplinary research areas from researcher communities, related industry segments from communities of companies, functional similarities of proteins from protein-protein interactions, and diffusion of information through communities in social media. This entry describes concepts that explain the connections between communities. In sociology, Gravenotter (1973) pointed out "the strength of weak ties" in social networks from his observations that indicated that people often found their new jobs through an acquaintance, not a close friend. He assumed that the tie strength is strong or weak depending on the proportion of common neighbors of its end points and a transitive property such that if a person A has strong ties with person B and C, there is at least a weak tie between B and C. Under these assumptions, a strong tie cannot be a bridge that provides the only path between its end points. A strong tie cannot also be a local bridge whose end points have no common neighbors. It means that only weak ties may be (local) bridges, and such weak

ties play significant roles in connecting strongly tied communities and in spreading information over communities.

Early empirical studies on large-scale community detection were done on Web graphs. Flake et al. (2000) defined a Web community as a set of pages in which each page has more links within the community than outside the community and proposed a max-flow-based algorithm. In this definition, connections between communities can be viewed as minimum cuts that separate communities from the remainder of the Web graph. Gibson et al. (1998) proposed another approach for extracting Web communities consisting of authoritative pages densely co-cited by hub pages, and Kumar et al. (1999) enumerated such communities by extracting bipartite cliques from a huge Web graph. Toyoda and Kisturegawa (2001) extracted connections between authority-hub based-Web communities from a graph of authorities connected by co-cited relationships by hubs. Web communities were extracted as a union of three cliques (or triangles) that share edges in the graph, and the strength of community relationships is calculated by the number of edges between communities. It enables us to navigate through related communities through their connections.

Girvan and Newman detected the community structure in which tightly connected nodes compose communities between which have looser connections. Girvan and Newman (2001) proposed a method for detecting communities by eliminating bridge-like edges. To measure the influence of edges, they introduced the concept of the edge betweenness centrality. It is the extension of the betweenness centrality of a vertex defined as the number of all shortest paths going through that vertex. The betweenness centrality of an edge is defined as the number of all shortest paths going along that edge. It measures the flow of information along the edge, and high edge betweenness means that the edge is connecting communities. Newman and Girvan (2004) proposed the modularity for measuring the quality of communities. Newman applied various betweenness measures, such as current-flow betweenness and random-walk betweenness, and evaluated them by the modularity. In this entry, Newman visualized the connections between communities, in which each community was represented by a node with size varying by the number of nodes in the community, and nodes were connected by edges weighted by the number of original edges between nodes in both terminal communities. Newman mentioned that this kind of visualization will be invaluable in helping us to understand the large-scale network structure.

If the definition of community allows overlaps of nodes between communities, the overlaps indicate strong relationships between the communities. Palla et al. (2005) defined a k-clique community as a union of k-cliques that share $k - 1$ nodes. In this definition, a single node can belong to multiple communities. The number of overlapping nodes can be considered as the strength of connections, and the nodes themselves play an important role in connecting different communities, such as interdisciplinary research areas in social networks of researchers.

The community structure in large-scale networks was extensively studied in Leskovec et al. (2011). This study showed that the best communities in the whole graph according to the conductance measure exist at the size scale of roughly one hundred nodes, and such communities often connected to the remainder of the network by just a single edge. The conductance value of communities was getting worse above the size scale of roughly 100 nodes. It indicates that communities gradually blend into denser portion of the network, as they grow larger. Such knowledge of the community structure will be important when designing visualization for navigating communities in the future.

Cross-References

▸ Community Detection, Current and Future Research Trends
▸ Competition Within and Between Communities Within and Across Social Networks

▸ Extracting and Inferring Communities via Link Analysis
▸ Inferring Social Ties

References

Flake GW, Lawrence S, Giles CL (2000) Efficient identification of web communities. In: Proceedings of the 6th ACM SIGKDD international conference on knowledge discovery and data mining, Boston, pp 150–160
Gibson D, Kleinberg J, Raghavan P (1998) Inferring web communities from link topology. In: Proceedings of the 9th ACM conference on hypertext and hypermedia, Pittsburgh, pp 225–234
Girvan M, Newman MEJ (2001) Community structure in social and biological networks. Proc Natl Acad Sci 99(12):7821–7826
Granovetter MS (1973) The strength of weak ties. Am J Soc 78(6):1360–1380
Kumar R, Raghavan P, Rajagopalan S, Tomkins A (1999) Trawling the web for emerging cyber-communities. Comput Netw 31(11–16):1481–1493
Leskovec J, Lang KJ, Dasgupta A, Mahoney MW (2011) Community structure in large networks: natural cluster sizes and the absence of large well-defined clusters. Internet Math 6(1):29–123
Newman MEJ, Girvan M (2004) Finding and evaluating community structure in networks. Phys Rev E 69:026113
Palla G, Derenyi I, Farkas I, Vicsek T (2005) Uncovering the overlapping community structure of complex networks in nature and society. Nature 435(7043): 814–818
Toyoda M, Kitsuregawa M (2001) Creating a web community chart for navigating related communities. In: Proceedings of the 12th ACM conference on hypertext and hypermedia, Arhus, pp 103–112

Connections

▸ Mapping Online Social Media Networks

Connectivity

▸ Human Behavior and Social Networks

Consequences of Publishing Real Personal Information in Online Social Networks

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Synonyms

Risks involved in sensitive identifiable personal information disclosure in online social networks

Glossary

Personally Identifiable Information Information that can uniquely identify an individual user, such as name, social security number, home address, e-mail address, or credit card information
Anonymous Information Information about an individual user that does not identify her/him personally, such as age group and gender
Pseudonymous Profile A collection of information about a particular individual user that identifies the user by a randomly generated nickname
Digital Dossier An electronic file containing detailed information on the same subject, for example, about a particular individual or topic. In a case of an Internet user, her/his digital dossier records and aggregates every possible item of information published online about her/him

Introduction

By 2004 the Internet was based on Web 1.0 technology, which included static pages meaning the simple movement of information worldwide. With the evolution of the Internet and with the arrival of Web 2.0, it became possible for the