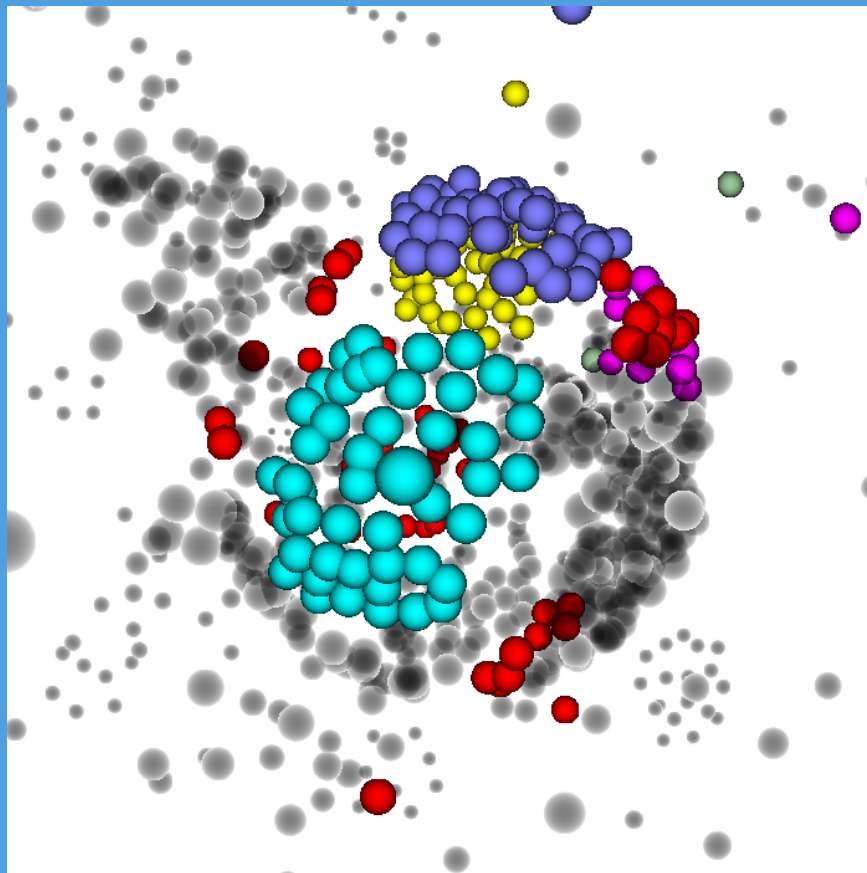Roldan Pozo
Clement Rey
Terrence Griffin

complex systems

IMAGE OF THE MONTH

March

Understanding Community Structure in Complex Networks

More information available at: http://www.itl.nist.gov/ITLPrograms/ComplexSystems/

This figure represents a 3D visualization of the community structure of information at the web site of the Computer Science Department of George Washington University. Such a web graph, where nodes are individual web pages and edges (not shown) connect pages which reference each other via a hyperlinks, denotes the relationship of web content and aids in the understanding of information structure of the World Wide Web. Here, communities of highly related webpages contained in the web domain have been identified by color by one of several community-detection heuristics.

The largest groups (seven in this case) are colored individually. The remaining smaller groups (179) are colored a transparent grey, and individual nodes can be selected using a cross-hair glyph and its URL displayed in a box tethered to the node with lines. In addition, the web page that the node represents can be brought up, so researchers can investigate its content and validate relationships.

Understanding community structure in large graphs is one of the fundamental challenges in Network Science. This line of research probes at the underlying structure of complex systems, and is important in understanding graph evolution, synchronization, and the dynamics of networks. In various application contexts, communities classify customers' purchasing tastes, determine graph layouts for visualization, model the spread of infectious diseases, and help identify crime cells.

A community is loosely defined as a subset of nodes which are highly connected to each other, but less connected to the remaining graph. Identifying such groups is a computationally challenging task (formulation of basic algorithms are NP-complete) with various heuristics yielding different results.

To investigate the validity of such algorithms, we utilize 3D visualization techniques that allow one to walk through and analyze the communities in real time. Such interactive platform allows researchers to verify the quality of algorithms by analyzing web content and graph structure.

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