New analysis of networks reveals surprise patterns in politics

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A new computer analysis technique developed at the University of Michigan that separates networks into communities yielded some surprises when used on real-world networks like political books, blogs, and metabolic systems.

For instance, researchers used the algorithm to sort books sold on Amazon.com into left- and right-wing groups, and they found the book most appealing to conservatives was actually written by Democrat Zell Miller.

Miller, the former governor of Georgia and U.S. senator, angered Democrats by endorsing George Bush during the last presidential election. Miller's book, "A National Party No More, The Conscience of a Conservative Democrat," was the book most central to the community of conservative book buyers, according to researchers.

A network is a system of nodes connected by links and the nodes sometimes divide into groups or communities, said U-M physics associate professor Mark Newman, who developed the technique. By analyzing these groups, scientists better understand the structure and function of the network. Although methods for detecting groupings in networks have been proposed before, the U-M technique performs it faster and more accurate than other methods, Newman said. It also adds a new element to the analysis: it weighs how tightly members are bound to their groups, which can affect their functions or the roles that they play.

In the example of political books, Newman looked at 105 political titles recently sold on Amazon.com. The network was compiled by Valdis Krebs, a management consultant friend of Newman's, who looked up each book and noted which books were commonly purchased by the same buyers---information that Amazon includes on its website. The links in the network represent purchasing connections between books.

When analyzed using Newman's method, the network of books separated into four communities, with dense connections within communities and looser connections between them. One community was composed almost entirely left-wing books, and the other almost entirely of right-wing ones. Centrist books comprised the other two categories. The computer algorithm doesn't know anything about the books' content---it draws its conclusions only from the purchasing patterns of the buyers---but Newman's analysis seems to show that those purchasing patterns correspond closely with the political slant of the books.

"It is particularly interesting to note that the centrist books belong to their own communities and are not, in most cases, merely lumped in with the liberals or conservatives," the paper stated. "This may indicate that political moderates form their own purchasing community.

In another example, Newman used the algorithm to sort a set of 1225 conservative and liberal political blogs based on the network of web links between them. When the network was fed through the algorithm, it divided cleanly into conservative and liberal camps. One community had 97 percent conservative blogs, and the other had 93 percent liberal blogs, indicating that conservative and liberal blogs rarely link to one another. In a further twist, the computer analysis was unable to find any subdivision at all within the liberal and conservative blog communities.

"This behavior is unique in our experience among networks of this size and is perhaps a testament not only to the widely noted polarization of

the current political landscape in the United States, but also to the strong cohesion of the two factions," the paper stated. The network of blogs was compiled by another U-M professor, Prof. Lada Adamic of the U-M School of Information.

Newman's methods have also been adapted by researchers working in molecular biology to study metabolic networks, the chemical networks that power cells in human and animal bodies. In a recent paper in the journal Nature, researchers Roger Guimerà and Luis Amaral from Northwestern University in Evanston, Ill., found that metabolites that straddle boundaries between groups in metabolic networks show persistence across species. Commenting on the work of Guimerà and Amaral, Newman says that this could be a sign that the division of the network into modules corresponds to different roles that metabolites play within the cell, and could suggest new directions for interpreting data on biochemical networks.

Newman's findings will appear in the June 6 print issue of the *Proceedings of the National Academy of Science*, in a paper entitled "Modularity and community structure in networks."

Source: University of Michigan