Math Matters

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The math behind...
Online Social Networks

Technical terms used:

Complex network theory, graph structure, nodes, clusters, power-law, weakly-connected component (WCC), degree distributions, scale-free network, eccentricity

Uses and applications:

Spam reduction, browser plug-ins, enhanced web searching, marketing strategies, political campaigning, epidemiology, offline sociological analysis

How it works:

Online social networks consist of a set of users and the links between these users. Some popular examples of online social networks include Facebook, Twitter, and MySpace. These networks have drawn considerable attention in recent years for the information they provide and the potential influence they wield over a large portion of the global population.

Standardized terminology is used in social network analysis. For example, users are "nodes," the number of links users have to other users is their "degree," and linked users are called "neighbors." Online social networks differ from other websites, which tend to have the majority of their traffic flowing either into or out of the site, whereas social networks are more symmetric with most links between users being reciprocal. Moreover, in online social networks, high-degree users are more likely to be linked with other high-degree users and low-degree users are more likely to be linked with other low degree-users. This is known as a high scale-free metric and has important implications.

Because online social networks have high scale-free metric, there are a relatively small number of high-degree users who form a tightly interlinked core. This core has the power to connect quickly to virtually any member of the system, a property which lends itself readily to marketing, rapid information dissemination, and virtual epidemics (like viruses). Users are much more likely to adopt a new product if a certain number of their neighbors adopt it and this information is used by political, advertising, and research groups to design algorithms for the most efficient ways to penetrate the core and reach the broadest range of users.

Interesting fact:

The concept of "six degrees of separation," is modeled well with large online social networks which generally have an average distance of five or six degrees between two random users. However, the average number of degrees of separation between any two websites chosen at random (following outgoing links) is over 16 degrees.

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