

Internet usage patterns may signify depression

May 17 2012

(Phys.org) -- In a new study analyzing Internet usage among college students, researchers at Missouri University of Science and Technology have found that students who show signs of depression tend to use the Internet differently than those who show no symptoms of depression.

Using actual Internet usage data collected from the university's network, the researchers identified nine fine-grained patterns of Internet usage that may indicate [depression](#). For example, students showing signs of depression tend to use file-sharing services more than their counterparts, and also use the Internet in a more random manner, frequently switching among several applications.

The researchers' findings provide new insights on the association between [Internet use](#) and depression compared to existing studies, says Dr. Sriram Chellappan, an assistant professor of [computer science](#) at Missouri S&T and the lead researcher in the study.

"The study is believed to be the first that uses actual Internet data, collected unobtrusively and anonymously, to associate Internet usage with signs of depression", Chellappan says. Previous research on Internet usage has relied on surveys, which are "a far less accurate way" of assessing how people use the Internet, he says.

"This is because when students themselves reported their volume and type of Internet activity, the amount of Internet usage data is limited because people's memories fade with time," Chellappan says. "There

may be errors and social desirability bias when students report their own Internet usage." Social desirability bias refers to the tendency of survey respondents to answer questions in a manner that will be viewed favorably by others.

Chellappan and his fellow researchers collected a month's worth of Internet data for 216 Missouri S&T undergraduate students. The data was collected anonymously and unobtrusively, and students involved in the study were assigned pseudonyms to keep their identities hidden from the researchers.

Before the researchers collected the usage data from the campus network, the students were tested to determine whether they showed signs of depression. The researchers then analyzed the usage data of the study participants. They found that students who showed signs of depression used the Internet much differently than the other study participants.

Chellappan and his colleagues found that depressed students tended to use file-sharing services, send email and chat online more than the other students. Depressed students also tended to use higher "packets per flow" applications, those high-bandwidth applications often associated with online videos and games, than their counterparts.

Students who showed signs of depression also tended to use the Internet in a more "random" manner - frequently switching among applications, perhaps from chat rooms to games to email. Chellappan thinks that randomness may indicate trouble concentrating, a characteristic associated with depression.

The randomness stood out to Chellappan after his graduate student, Raghavendra Kotikalapudi, examined the "flow duration entropy" of students' online usage. Flow duration entropy refers to the consistency of

Internet use during certain periods of time. The lower the flow duration entropy, the more consistent the Internet use.

"Students showing signs of depression had high flow duration entropy, which means that the duration of Internet flows of these students is highly inconsistent," Chellappan says.

At the beginning of the study, the 216 participating students were tested to determine whether they exhibited symptoms of depression. Based on the Center for Epidemiologic Studies-Depression (CES-D) scale, about 30 percent of the students in the study met the minimum criteria for depression. Nationally, previous studies show that between 10 percent and 40 percent of all American students suffer from depression.

To ensure that participants were not identified during the study, each participant was assigned a pseudonym. The campus information technology department then provided the on-campus Internet usage data for each participant from the month of February 2011.

The researchers' analysis of the month's worth of data led Chellappan and his colleagues to conclude that students who were identified as exhibiting symptoms of depression used the Internet differently than the other students in the study.

A paper describing the research, titled "[Associating Depressive Symptoms in College Students with Internet Usage Using Real Internet Data](#)," has been accepted for publication in a forthcoming issue of *IEEE Technology and Society Magazine*.

Chellappan is now interested in using these findings to develop software that could be installed on home computers to help individuals determine whether their Internet usage patterns may indicate depression. The software would unobtrusively monitor Internet usage and alert

individuals if their usage patterns indicate [symptoms of depression](#).

"The software would be a cost-effective and an in-home tool that could proactively prompt users to seek medical help if their Internet usage patterns indicate possible depression," Chellappan says. "The software could also be installed on campus networks to notify counselors of [students](#) whose Internet usage patterns are indicative of depressive behavior."

Chellappan also believes the method used to connect Internet use and depression could also help diagnose other mental disorders like anorexia, bulimia, attention deficit hyperactivity disorder or schizophrenia.

"We could also investigate associations between other Internet features like visits to social networking sites, late night Internet use and randomness in time of Internet use with depressive symptoms," he says. "Applications of this study to diagnose and treat mental disorders for other vulnerable groups like the elderly and military veterans are also significant."

Provided by Missouri University of Science and Technology

Citation: Internet usage patterns may signify depression (2012, May 17) retrieved 25 April 2024 from <https://phys.org/news/2012-05-internet-usage-patterns-signify-depression.html>

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