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Researchers develop new indicators to detect loneliness risk in remote work

By analyzing workplace chat data, the study examines employees' online activity and social connectedness, helping organizations detect isolation risks and take timely action.

Fukuoka, Japan—Messages sink without a reply, and mentions disappear from group chats. Small oversights quietly fuel workplace loneliness.

In today's increasingly digital workplaces, flexible hours and remote work offer freedom and convenience, but also bring risks of developing mental health issues. While subtle cues in face-to-face settings can reveal when employees are struggling, how can organizations detect signs of loneliness online before it's too late?

A team led by Professor [Yutaka Arakawa](#) of [Kyushu University's Faculty of Information Science and Electrical Engineering](#) is looking for clues in our digital footprints—the traces left by everyday online communication. In a recent paper published in the *Journal of Information Processing*, they analyzed workplace chat data to identify employees potentially at risk of loneliness.

"Digital footprints can actually tell us a lot about people's internal states," Arakawa explains. "Office platforms such as Slack provide statistics on channel activity, but they don't cross-analyze interactions to reveal the patterns between individuals. We wanted to visualize the network of relationships by sensing and analyzing online communication."

Using data from public Slack channels, Arakawa's team developed two new indices: contribution level and adjacency level. The former measures how actively someone initiates discussions and replies to messages, and the latter captures how connected one is to others through mentions and reactions.

The team applied the two metrics to their lab's Slack workspace, analyzing the digital footprints of 48 members and clustering individuals into groups. The results were visualized in a network graph, where each person was represented as a colored dot. Larger dots with many connecting lines indicated individuals who interacted widely across the organization, while smaller dots with fewer connections showed those who might be more isolated.

To see whether this graph mirrored actual feelings, the research team used a widely adopted psychological measure, the UCLA Loneliness Scale. The results showed that members reporting lower levels of loneliness had significantly higher adjacency levels, suggesting a potential link between active online communication and stronger in-person social connections. However, employees who communicate less online do not necessarily feel lonelier.

"One possible reason is that our analysis focused only on public channels, excluding private messages," Arakawa explains. "Some lab members may rarely post in group chats but maintain active one-on-one communication with their supervisors."

Recognizing the limits of their sample size, the team is now collaborating with companies to refine the algorithms behind these indicators and broaden their applicability. Meanwhile, Arakawa is partnering with experts in occupational health and policy research as part of a larger research project on social loneliness, funded by the [Research Institute of Science and Technology for Society](#) (RISTEX). Besides developing measurable indicators of workplace loneliness, the initiative explores its underlying causes and turns the findings into practical strategies, including prevention and timely interventions.

Arakawa is also working on guidelines for using workplace chat platforms to reduce isolation risks.

"Even a small action, like reacting with an emoji, shows that someone's message has been acknowledged," he says. "I hope we can build a society where such gestures of consideration come naturally, even in digital environments."

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For more information about this research, see " Visualization of Online Communication and Detection of Lonely Users Using Social Graphs Based on Contribution Level and Adjacency Level," Ryosuke Takizawa, Isshin Nakao, Kensuke Taninaka, Akihisa Takiguchi, Toshiki Hayashida, Shusaku Kita, and Yutaka Arakawa, *Journal of Information Processing*, <https://doi.org/10.2197/ipsjip.33.765>

About Kyushu University

Founded in 1911, [Kyushu University](#) is one of Japan's leading research-oriented institutes of higher education, consistently ranking as one of the top ten Japanese universities in the Times Higher Education World University Rankings and the QS World Rankings. The university is one of the seven national universities in Japan, located in Fukuoka, on the island of Kyushu—the most southwestern of Japan's four main islands with a population and land size slightly larger than Belgium. Kyushu U's multiple campuses—home to around 19,000 students and 8000 faculty and staff—are located around Fukuoka City, a coastal metropolis that is frequently ranked among the world's most livable cities and historically known as Japan's gateway to Asia. Through its [VISION 2030](#), Kyushu U will "drive social change with integrative knowledge." By fusing the spectrum of knowledge, from the humanities and arts to engineering and medical sciences, Kyushu U will strengthen its research in the key areas of decarbonization, medicine and health, and environment and food, to tackle society's most pressing issues.

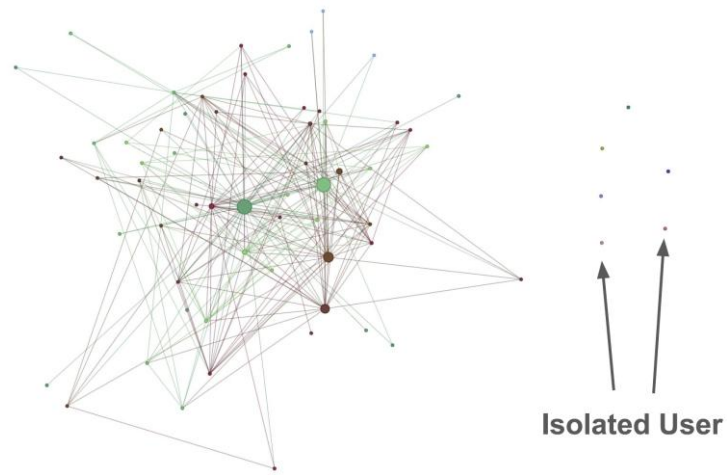


Fig. 1. **Social graph with clustering created from lab members' digital footprints**
Each member from the lab appears as a colored dot. Larger dots with many connecting lines indicate individuals who interact widely across the organization, while those with little activity in public channels are shown as isolated users. (Kyushu University)

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