

Researchers suggest uncertainty may be key in battlefield decision making

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Army graphic designed by ARL graphic artist Evan Jensen delivers the key idea

that making decisions under uncertainty may not be such a bad thing after all.
Credit: US Army Graphic Designer Evan Jensen

Army researchers have discovered that being initially uncertain when faced with making critical mission-related decisions based on various forms of information may lead to better overall results in the end.

Army collaborative research has studied networked teams and asked the following question: "Does the [uncertainty](#) regarding shared information result in lower [decision](#) making performance?"

The answer seems to be "not necessarily," as the findings suggest that uncertainty may actually be helpful in certain situations.

This finding may sound counterintuitive, as many algorithms specifically incorporate the objective to reduce uncertainty by removing conflicting or irrelevant data.

Reducing uncertainty is desirable when decision makers are processing high-quality information which is correct, timely, complete and actionable.

Additionally, in automated settings requiring no human input, prior beliefs may not impact decisions and it is not necessary to consider the impact of uncertainty on beliefs.

However, many real-world scenarios do not correspond to this idealized setting and hence more nuanced approaches may be needed.

"We are continuously flooded with large amounts of unverified information from social and news media in our daily lives," said Dr. Jin-

Hee Cho, a project lead of the trustworthy multi-genre networks with the U.S. Army Research Laboratory's Network Science Division. "Hence, we may find ourselves unable to make a decision due to too much information as opposed to too little."

In the context of battlefield situations, different information through diverse channels is available for a [decision maker](#), for example, a commander.

The commander needs to incorporate all opinions or evidence to make a final decision, which is often closely related to time-sensitive mission completion in a given military context.

"Investigating how uncertainty plays a role in forming opinions with different qualities of information is critical to supporting warfighters' decision making capability," Cho said. "But, what if we cannot reduce uncertainty further?"

Recently, Cho presented her research paper entitled "Is uncertainty always bad: The effect of topic competence on uncertain opinions" at the Institute of Electrical and Electronics Engineers' International Conference on Communications.

This research is completed in collaboration with Professor Sibel Adali at Rensselaer Polytechnic Institute, where Cho and Adali have been working together through ARL's collaborative program called the Network Science Collaborative Technology Alliance.

In the paper, the researchers pointed out that although past work investigated how uncertain and subjective opinions evolve and diffuse in social networks, there is little work on directly showing the impact of uncertain, noisy information and topic competence on forming subjective opinions and beliefs as well as decision making performance.

"Information often has multiple attributes that all contribute to decision making in conjunction with the competence, knowledge and prior beliefs of individuals in the given topic," Adali said. "Many information models tend to oversimplify the problem abstracting out these factors which become quite important in situations involving uncertain, noisy or unreliable information."

The key motivation of this study is to answer the following question: "When we are stuck with high uncertainty due to noisy, not credible information, how can an individual maximize the positive effect of a small pieces of good information for decision making?"

To study this problem, Cho and Adali extended the subjective logic framework to incorporate interactions between different qualities of information and human agents in scenarios requiring processing of uncertain information.

In their recent research paper, the following lessons are presented as answers to this key problem:

One, as human cognition is limited in detecting good or bad information or processing a large volume of information, errors are inevitable.

However, as long as an individual is not biased towards false information, systematic errors do not cascade in the network.

In this case, high uncertainty can even help the decision maker to maximize the effect of small pieces of good information because the uncertainty can be largely credited by being treated as good information.

Another insight is that less information is better, particularly when the quality of information is not guaranteed.

"A non-biased view is vital for correct decision making under high uncertainty," Cho said. "You don't even have to favor true information either. If we are not biased, it allows even small pieces of true information to lead you to the right decision."

So, when faced with tough decisions on the battlefield, warfighters need not rely solely on one way of thinking and processing [information](#), as the answer they need to successfully make a move or complete a mission could be right in front of them in the form of an uncertain feeling.

Provided by The Army Research Laboratory

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