DeepER tool uses deep learning to better allocate emergency services

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Emergencies, by their very nature, are hard to predict. When and where the next crime, fire or vehicle accident will happen is often a matter of random chance.

What can be measured, however, is how long it takes for emergency services personnel to consider a particular incident to be resolved—for instance, suspects apprehended, flames extinguished or damaged cars removed from the street.

New York City is among the large urban areas that maintain those kinds of statistics, and a team of researchers at Binghamton University, State University of New York has used deep-learning techniques to analyze the numbers and suggest improved public safety through re-allocation of resources.

Arti Ramesh and Anand Seetharam—both assistant professors in the Department of Computer Science at the Thomas J. Watson College of Engineering and Applied Science—worked with Ph.D. students Gissella Bejarano, MS '17, and Adita Kulkarni, MS '17 (who earned her doctorate earlier this year), and master's student Xianzhi Luo to develop DeepER, an encoder-decoder sequence-to-sequence model that uses Recurrent Neural Networks (RNNs) as the neural network architecture.

The research utilized 10 years of publicly available data from New York City's five boroughs, broken down by categories and subcategories reflecting the types of emergencies as well as the time between when the incident was reported and when it "closed."

"Multiple events can occur at the same time, and we would expect the timetable to resolve those incidents to be longer because the personnel, resources and equipment are going to be shared across the incident sites," Seetharam said. "That is reflected in the resolution times. Then we use that to predict what's going to happen in the future."

This latest study builds on previous research looking at similar data for non-emergency events—essentially all of the 311 calls throughout New York City.

"The differences between the two sets of data are that emergency incidents are fewer in number, and non-emergency incidents are a little more predictable," Seetharam said.

"Emergency incidents are harder to predict, such as when a fire is going to start or the nature of that fire. The resolution time would depend on how big the fire is. Non-emergency incidents are more predictable. A streetlight is not working, a repair technician is sent, and it gets fixed."

The research team believes that DeepER could be tweaked for other large cities such as Los Angeles and Chicago, or possibly a cluster of smaller cities with similar characteristics that would provide enough data to make predictions.

"You need to understand the characteristics of that particular city," Seetharam said. "For instance, Los Angeles may have fewer incidents related to structural problems during winter because they do not see snow. That could be a different set of incidents.

"The only practical difficulty would be how they collect their data and how they label their data. If similar incidents are labeled in the same way, we can train the model on these other numbers."

Provided by Binghamton University