AI helps place drones in remote areas for faster emergency response

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A recent study shows the potential for AI to help emergency responders make informed and efficient decisions in settings where data is limited. Credit: Ian Usher via Unsplash

For residents of rural and underserved areas, access to emergency

medical care can be a matter of life and death. With limited access to health care services and long ambulance wait times due to distance, these communities face challenges that can significantly affect their health and well-being. In the case of cardiac arrest, when every minute counts, finding solutions to improve response times is critical to saving lives.

USC researchers are exploring the use of AI-powered decision making to deploy life-saving equipment in data-scarce settings like rural neighborhoods to enable faster emergency response times, improve the design of emergency response systems and potentially save lives. Results from a recent study show the potential for AI to help emergency responders make informed and efficient decisions in settings where data is limited.

The study, published in the journal *Operations Research*, focuses on developing a new method for using data to choose between candidate ways to design a system. To demonstrate their method, the researchers examined a case study involving a Toronto-based pilot program that deploys drones in conjunction with ambulances to respond to calls about cardiac arrest events.

"Our methods have the potential to revolutionize the way we design and optimize systems in data-scarce settings that extend beyond emergency response. It can help us make more informed and efficient decisions across a range of fields where data is limited," said corresponding author Michael Huang, a doctoral candidate in the Data Science and Operations department at the USC Marshall School of Business.

No data, no problem: AI-driven methods fill the gaps

When a bystander calls in to report someone near them is experiencing cardiac arrest, emergency responders in the Toronto pilot program have two options: They can either send an ambulance, or they can send an

ambulance and deploy a drone with an automated external defibrillator (AED) attached. The AED is a small device that bystanders can use—with no medical training—to attach to the patient and restart their heart before the ambulance arrives. The drone's ability to get to the patient faster than the ambulance can significantly improve their chances of survival.

This raises key questions about where to place drone depots and how to determine the appropriate response to an emergency situation.

"We initially thought that the main question was where to deploy the drone, but in reality, the first-order question is where to put the drone depots," said Vishal Gupta, an associate professor of data sciences and operations at USC Marshall.

"We want to strategically place them in locations that are both close to where cardiac arrests occur, but also in areas that are difficult to reach by ambulance. The challenge here is that data on ambulance travel times to remote locations is scarce, making it difficult to estimate. Ambulances rarely go to these remote locations, so we don't have a lot of data on travel times," said Gupta, who also holds a courtesy appointment in the Daniel J. Epstein Department of Industrial and Systems Engineering at the USC Viterbi School of Engineering.

The researchers found that for cardiac arrest events in rural areas where ambulance wait times are longer than in urban areas and where there is limited data, their method leads to significantly more effective decisions on when to dispatch the drone and where to place depots compared to conventional approaches.

The AI-driven methodology can be applied to various fields and areas of public policy, including where to place speed bumps to reduce traffic fatalities or the most efficient location for power lines, where the true

construction costs are often unknown and estimates are made based on rough figures.

"We often hear about big data and its potential, but in many cases, data is still scarce, especially in settings where data collection is expensive or limited by privacy concerns," Gupta said. "There are also cases where collection events are rare, which can make it challenging to design systems and make informed decisions. With AI tools, we can address these challenges and make better decisions even in data-limited settings."

More information: Vishal Gupta et al, Debiasing In-Sample Policy Performance for Small-Data, Large-Scale Optimization, *Operations Research* (2022), DOI: 10.1287/opre.2022.2377. pubsonline.informs.org/doi/abs … .1287/opre.2022.2377

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