Caught on camera: Using AI to combat street crime

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According to the Overseas Security Advisory Council (OSAC) Malaysia 2020 Crime and Safety Report, common crimes in Malaysia include snatch thefts and residential or commercial robberies.

More than 2000 snatch thefts or robberies were reported in Malaysia in 2019. The global pandemic and subsequent movement control orders across the country may have reduced street crimes, but they're anticipated to increase again as the nation progresses towards a post-pandemic era.

In an attempt to curb these crimes, city councilors, retailers, commercial and residential management have ramped up the deployment of closed-circuit television (CCTV) cameras across urban areas. Kuala Lumpur has about 1900 CCTVs for traffic management, 100 at flash-flood hotspots, 270 at public parks,130 at rivers, and 309 for security surveillance.

Netizens have regularly witnessed the horrors of snatch thefts or robberies captured by CCTVs, which frequently go viral on social media. The perpetrators are often able to evade apprehension due to the delayed response in alerting authorities.

Researchers at Monash University Malaysia's School of Information Technology embarked on a research and development initiative to transform conventional CCTVs into an autonomously intelligent system to detect street crimes in real time. The project is led by Dr. Vishnu Monn Baskaran and Ph.D. student Marcus Lim Jun Yi, and funded by the Ministry of Higher Education's Fundamental Research Grant Scheme.

The research is motivated by the rapid evolution of artificial intelligence and, in particular, deep neural network algorithms.

"There is a new opportunity to realize a reliable smart video surveillance framework, coupled with significant advancements in high-performance computing technology," says Dr. Baskaran.

A three-stage process

Typically, there are three stages in a smart video surveillance platform.

Stage one involves having AI-based software to process live video surveillance images to detect weapons. In most cases, urban robberies would involve weapons such as guns. Automatically identifying the presence of a weapon from a surveillance camera in real time would increase the software's reliability in assessing a threat within a surveilled area.

Stage two involves formulating a relation between the person wielding the weapon and the weapon itself for aggressive action recognition. Most importantly, the first and second stages are executed autonomously using AI-developed software with minimal manual intervention.

Stage three generates an alert that's relayed to medical crews and law enforcement officers to dispatch them quickly to provide aid to the victim and apprehend the perpetrator.

The significance of a real-time alert and response mechanism could re-envision how AI is used to strengthen law enforcement and to further deter criminal activities.

The Monash University Malaysia team has completed stage one in developing a smart surveillance system that can accurately detect handguns from surveillance cameras in real time.

The team initially focused on automated handgun detection, given that crimes using firearms are more prevalent globally, especially in the Americas and in parts of Southeast Asia.

The outcomes of the research were published in the *Engineering Applications of Artificial Intelligence* journal. The team also won a gold medal for the project, named the Monash Automatic Gun Detection

System (MAGTS), at the 31st International Invention, Innovation and Technology Exhibition 2020 (ITEX 2020).

The researchers are now formulating an accurate human-to-weapon model for classifying aggressive human actions, which represents the second stage in realizing a smart video surveillance platform. They're also fine-tuning the outcomes from stage one of the research to detect knives and machetes, which are more prevalent in robberies carried out in Malaysia.

This research could also be extended to include person re-identification (that is, spotting or tracking a person from one camera to another). Through person re-identification, the location or movement of a perpetrator can be translated into geographical coordinates. These are then relayed to multiple notification modules and plotted on a map, representing a unified urban/city alarm notification system. This, in turn, could further complement efforts in apprehending the law offender.

The research is driven by the Government Transformation Programme (GTP) 1.0 report, which states: "Despite the improvements in the country's crime rate and its continued downward trajectory, public perception of safety is still a challenge as 52.8% of the rakyat [citizens] say they still do not feel safe."

The government recognizes that safety is paramount in sustaining robust economic growth. As such, the proposed outcomes of this research establish the fundamental components of an autonomous surveillance platform.

The platform potentially expands law enforcement's omnipresence program by substantially reducing response time at the point of theft identification. These improvements align with version 2.0 of the GTP to reduce the crime index, which is expected to improve public perception

of urban safety.

In addition, it's envisaged that machine-assisted analysis of human actions in real time will provide additional support for social and scientific domains such as forensic science, criminal deterrence, criminal investigation, medical aid, and psychotherapy.

These solutions can transform the nation's capital into a smart and safe city in line with Transformasi Nasional (TN50), thus paving the way for vibrant economic and societal development.

Provided by Monash University