

AI in Internet of Things (IoT) - Smart City

AI in Smart City (University Internship with Applied-Research with Tools Development) Smart Home/Elderly/Child Safety Monitoring System



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(<https://dslab.saas.hku.hk/cgi-bin/application1.cgi/>)

Home monitoring is one of the critical issues. This project aims to monitor home safety including baby movement, unexpected door open, home fire, etc. In 2020, there were more than 2000 burglary cases in Hong Kong. In order to monitor the risks, video analytics is one of the solutions to monitor home security and safety. There are two steps in video analysis: cropping the video and detecting the object's movement. The challenges of object detection are how to classify the objects, and to identify and locate the objects in the image.

The HKU SAAS Data Science Lab developed a set of libraries and a tool for detecting the risks and the unpredictable events at home. The tool first captures frames from video using OpenCV. There are two methods to detect the object: the two-stage method and one-stage method. The two-stage method (e.g. R-CNN) focuses on object localization and recognition tasks and this method has better detection accuracy rate. The one-stage method (e.g. YOLO) focuses on speed and real time analysis. Since home safety detection requires real time analysis, YOLOv5 was used to train the model in this project. The accuracy rate of the model is 99.88% and 97.63%, 99.25% for door movement detection, fire detection, and baby movement detection, respectively.

The challenges for video analytics are the time and resources in the preparation work of image collection and labelling. A fast GPU server is also required for training the images/videos. Privacy and security concern are some of the major barriers for using the video analytics in home monitoring. To overcome the privacy and security issue, Data Science Lab has been working with a local AI company to deploy the video analytics functions in an **edge computing AI chip**. We run the video analytics in the device itself without transferring the image into cloud server for prediction. It can overcome the privacy and security concern.

"The video analytics techniques in this project can be widely used in home/hotel security monitoring, patient/elderly/child centre risk monitoring, etc.," said Dr Adela Lau, Deputy Director of HKU SAAS Data Science Lab.



Figure 1 Left: Detecting door open or close. Right: Fire alarming

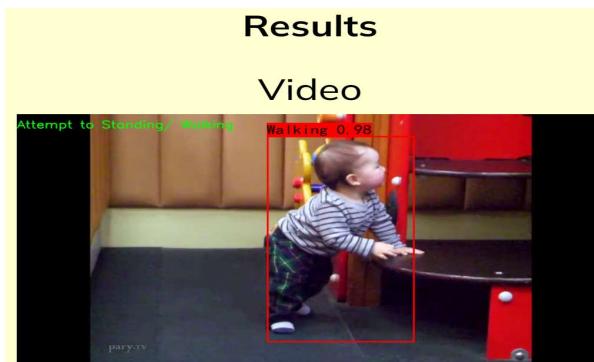


Figure 2 Detecting baby's movement: walking.

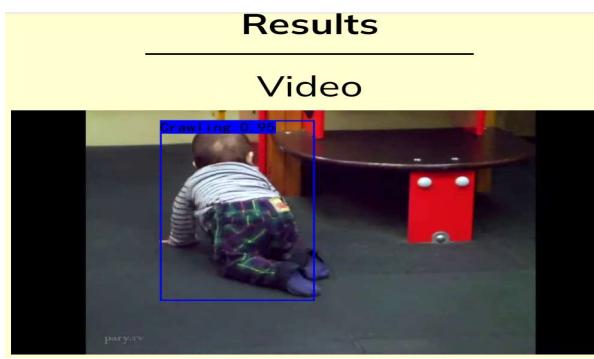


Figure 3 Detecting baby's movement: crawling.

"We welcome companies or manufacturers to collaborate in this project with the Data Science Lab," said Dr Eddy Lam, Director of HKU SAAS Data Science Lab.

"We have introduced this newly invented tool of Data Science Lab to our business partners. This tool, deployed in an edge computing AI chip, has high potential for commercialization and can be widely used in different areas," said Mr Leo Tong, Partner of Vision Real Capital.