AI in Healthcare

AI in HealthTech (Applied-Research Collaboration Project with Joint-Funding Application, Tools Development and Joint-Research Paper Publication)
AI-based Video Analytics for Monitoring Patient Risk: Using YoLov5 for Motion Detection

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

Falls and self-extubations are the most common problems and have caused serious harm to the patients at hospital all over the world. Approximately one fourth patients who self-extubated died in the US, and the death toll due to falls is approximately 650,000 globally each year. It is the second leading cause of unintentional injury deaths worldwide. The existing methods for detecting falls and self-extubation are sensor-based or vision-based approach. The limitations of sensor-based approach are its high cost and wearing device required by patients. Although the vision-based method, which uses machine learning to learn the computer vision, overcomes these problems, the error rate is high and training time is long.

YOLO is a recent method that can train the model and detect the objects fast The Data Science Lab used YOLOv5 deep learning algorithm for object detection and classification. YOLOv5 detects the bounding box (i.e. coordination of the target objects), classifies the objects, and determines whether the objects being in the boundary boxes or not at the same time that improves the accuracy rate and training time for the object detection. In this project, after all the images are labelled with the location and object name, model was trained with the images for object detection. The results showed that the precision for bed, patient and rmTube detection are 99.25%, 91.55% and 93.33% respectively. The recall for bed, patient and rmTube are 99.25%, 99.24% and 100% respectively. The average accuracy for predicting bed, patient and rmTube are 98.69%, 98.59% and 100% respectively. The results can provide a promising object detection for risk alerts.

To better monitor the patient risks and plan the staffing, a dashboard is implemented to measure the time and frequency of the patient risks such as falls, self-extubations, walking out of the bed, etc. It can provide a risk measurement and improve the quality of services of the hospital. To overcome the privacy and security issue, Data Science Lab has been working with a local company to deploy the video analytics functions *into a newly invented edge computing AI chip* that can run the video analytics in the device itself without transferring the image into cloud for analysis.
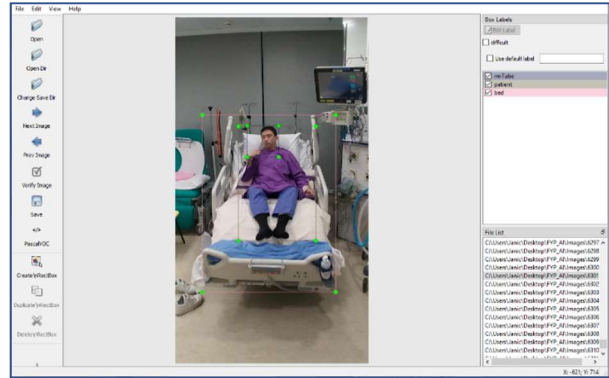

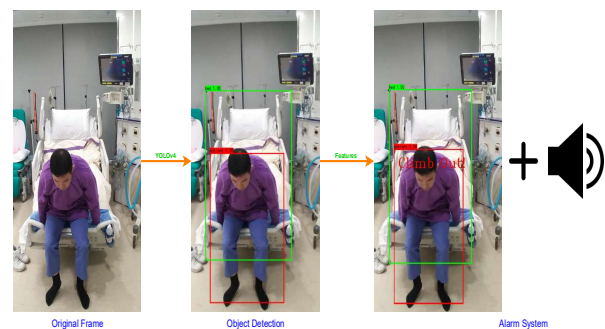Figure 1 Image labelling for model training.
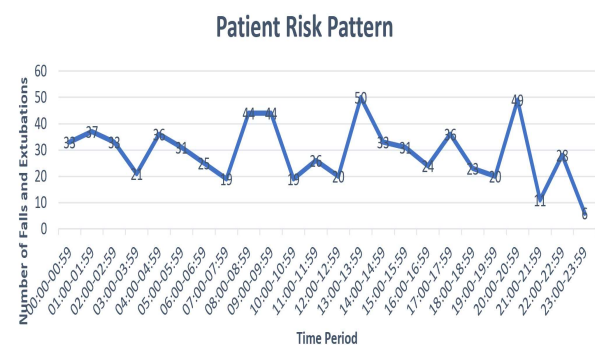

Figure 2 An object detection demo,

Figure 3 Risks Monitoring Dashboard for human resources planning and risk measurement.

"The AI video analytic system has great potential in enhancing patient safety in isolation facilities. In addition, it can protect the nursing/medical staff from directly interacting with the patients during the epidemic period," said Mr Peter Lai, Nursing Consultant (Intensive Care) of the Adult ICU of the Queen Mary Hospital.