Application of computer vision and deep learning models to automatically classify medically important mosquitoes in North Borneo, Malaysia

ABSTRACT

Mosquito-borne diseases have emerged in North Borneo in Malaysia due to rapid changes in the forest landscape, and mosquito surveillance is key to understanding disease transmission. However, surveillance programmes involving sampling and taxonomic identification require well-trained personnel, are time-consuming and labour-intensive. In this study, we aim to use a deep leaning model (DL) to develop an application capable of automatically detecting mosquito vectors collected from urban and suburban areas in North Borneo, Malaysia. Specifically, a DL model called MobileNetV2 was developed using a total of 4880 images of Aedes aegypti, Aedes albopictus and Culex quinquefasciatus mosquitoes, which are widely distributed in Malaysia. More importantly, the model was deployed as an application that can be used in the field. The model was fine-tuned with hyperparameters of learning rate 0.0001, 0.0005, 0.001, 0.01 and the performance of the model was tested for accuracy, precision, recall and F1 score. Inference time was also considered during development to assess the feasibility of the model as an app in the real world. The model showed an accuracy of at least 97%, a precision of 96% and a recall of 97% on the test set. When used as an app in the field to detect mosquitoes with the elements of different background environments, the model was able to achieve an accuracy of 76% with an inference time of 47.33 ms. Our result demonstrates the practicality of computer vision and DL in the real world of vector and pest surveillance programmes. In the future, more image data and robust DL architecture can be explored to improve the prediction result.