PPE-Glove Detection for Construction Safety Enhancement based on Transfer Learning

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ABSTRACT

Current studies combining deep learning techniques and computer vision for the detection of personal protective equipment (PPE) are mainly focused on the detection of hard hats and vests for construction safety management. This study implemented two deep learning-based solutions using You-Only-Look-Once (YOLO) and convolutional neural network (CNN) architectures to detect safety gloves to expand the construction safety applications. In the first case, the customized YOLO-v3 algorithm was applied to directly detect whether a person is wearing gloves or not. In the second case, the customized YOLO-v3 was used to first detect a person's hands from the images, and then a CNN architecture was used to classify it as either 'wearing gloves' or 'not wearing gloves'. A better performance was found in the second case where the customized YOLO-v3 achieved 89.46% mAP (mean average precision), and the CNN network (VGG-19 and ResNet-50) classified 'wearing gloves' or 'not wearing gloves' with an average of 100 % precision. On the other hand, the first case achieved 78.48% mAP in detecting gloves. This study enhances the implementations of computer vision for PPE detection, and the labeled data sets can be used by future research in this area.