Detection of Safety Goggles on Humans in Industrial Environment Using Faster-Region Based on Convolutional Neural Network with Rotated Bounding Box

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Abstract : To successfully deliver our products in the market, the employees need to be in a safe environment, especially in an industrial and manufacturing environment. The consequences of delinquency in wearing safety glasses while working in industrial plants could be high risk to employees, hence the need to develop a real-time automatic detection system which detects the persons (violators) not wearing safety glasses. In this study a convolutional neural network (CNN) algorithm called faster region based CNN (Faster RCNN) with rotated bounding box has been used for detecting safety glasses on persons; the algorithm has an advantage of detecting safety glasses with different orientation angles on the persons. The proposed method of rotational bounding boxes with a convolutional neural network first detects a person from the images, and then the method detects whether the person is wearing safety glasses or not. The video data is captured at the entrance of restricted zones of the industrial environment (manufacturing plant), which is further converted into images at 2 frames per second. In the first step, the CNN with pre-trained weights on COCO dataset is used for person detection where the detections are cropped as images. Then the safety goggles are labelled on the cropped images using the image labelling tool called roLabelImg, which is used to annotate the ground truth values of rotated objects more accurately, and the annotations obtained are further modified to depict four coordinates of the rectangular bounding box. Next, the faster RCNN with rotated bounding box is used to detect safety goggles, which is then compared with traditional bounding box faster RCNN in terms of detection accuracy (average precision), which shows the effectiveness of the proposed method for detection of rotatory objects. The deep learning benchmarking is done on a Dell workstation with a 16GB Nvidia GPU.

Keywords : CNN, deep learning, faster RCNN, roLabelImg rotated bounding box, safety goggle detection
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