Defect Detection of Steel Frame Structure with Image Processing and Artificial Intelligence

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ABSTRACT

Steel Frame Structure Defect Detection is one of the main stages in constructing a building, where most of the times it has been done manually, which leads to no proper inspection, on top of that there isn't any technical device to monitor it, especially in Sri Lanka. The aim of this dissertation is to detect six main defects in welded steel frame structure by using image processing and deep learning algorithms, where the application would aid individuals in construction site to identify defects in said steel frame structures at an early stage of building in order to avoid casualties caused by the defect. An android application incorporated with a classification model was proposed and built. In this research, MobileNet has been used as the classifier algorithm, where Transfer Learning has been implemented on the pretrained model on ImageNet. CNN layers have been customized where GlobalAveragePooling2D layer has been implemented with Rectified Linear Unit being the activation layer and being fed into SoftMax layer. Furthermore, SGD optimizer with Categorical Cross Entropy Loss functionality have been applied. An image preprocessing of data augmentation and image transformation have been done. Viewpoint range is achieved at 10 – 3cm and error free under device rotation circumstances. Robustness and processing performance of the application have been achieved to an optimum level since it runs locally. The mean accuracy level of device has been achieved for 91% for scratch, 78% for patches, 81% pitted surface, 78% for crazing, 73% for rolled in scale and 67% for inclusion defects in welded steel frame structure which sums up with a model mean accuracy being at 78%.

Keywords: - Welded Steel Frame Structure, MobileNet, Transfer Learning, Defect Detection, Data Augmentation, Image Transformation.