

ABSTRACT

Steel is one of the materials widely used in the industry. The use of materials such as ordinary steel will be processed automatically using machines. During the production process, physical damage such as scratches, cracks, and holes cannot be avoided. Defects in the production process reach 47%, which will negatively affect the quality of the produced products.

In the Final Project, a system was designed to detect defects in steel using a Data Augmentation method based on a Convolutional Neural Network (CNN). The CNN model in the system is built using the Cascade R-CNN architecture. The Data Augmentation used in the Final Project includes three types of transformations: random shadow, hue saturation value, and random gamma, which will detect 6 types of defects taken from the NEU-DET dataset, namely rolled-in scale, patches, crazing, pitted surface, inclusion, and scratches. The data consists of digital images obtained from the NEU-DET dataset totaling 1800 images, with each type of defect having 300 images.

The results of the simulation and analysis in this final project show that the system can detect 6 types of defects using CNN-based Data Augmentation. The system tested without using Data Augmentation achieved a mean average precision (mAP) of 76.8% in detecting defects on steel surfaces. Meanwhile, the system tested using 3 Data Augmentation methods achieved the following mean average precision (mAP): Random Shadow at 76.9%, Hue Saturation Value at 76.5%, and Random Gamma at 76.1%. It can be seen that the mean average precision (mAP) value using Data Augmentation achieved the highest result of 76.9%, while without augmentation it was 76.8%. Trials show that although data augmentation can provide a small increase in accuracy, its effectiveness is still limited due to the mismatch of augmentations when used to detect all types of defects on steel surfaces.

Keywords: Data Augmentation, Steel Surface Defects, Convolutional Neural Network (CNN), Digital Image Processing.