World Academy of Science, Engineering and Technology
International Journal of Computer and Systems Engineering
Vol:18, No:06, 2024

Employing Deep Learning for Defect Detection in Antenna Assembly

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Abstract : Assembly processes involve disparate materials that possess dissimilar resiliencies and, therefore, are prone to generating defective products. Manually performed quality inspection of such products is a time-consuming and susceptible to error process. The emerging computer vision techniques in smart manufacturing can alleviate the need for thorough, manually performed quality control. Object detection techniques provide crucial localization abilities, thus helping the operators further validate the identified defect with ease. In this work, several state-of-the-art object detection models are assessed in a real industrial imagery dataset and with the use of transfer learning. EfficientDet D2 is proposed for the identification and localization of antenna defects that are generated during the assembly process. To further enhance the dataset, heavy on-the-fly data augmentation was employed, along with synthetic samples generated with the use of image processing software. The proposed approach utilizing EfficientDet D2 can increase the Average Precision from 0.90 (at IoU 0.5) to 0.97 (at IoU 0.3). The overall performance is further evaluated by applying the F1-Score at each confidence score. For conducting the experiments, the TensorFlow object detection API is employed.

Keywords : defect detection, EfficientDet, deep learning, smart manufacturing, classification
Conference Title : ICAISC 2024 : International Conference on Artificial Intelligence and Soft Computing
Conference Location : Venice, Italy
Conference Dates : June 20-21, 2024