HACETTEPE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

OPTICAL INSPECTION OF ELECTRONIC CIRCUIT BOARDS USING MACHINE LEARNING

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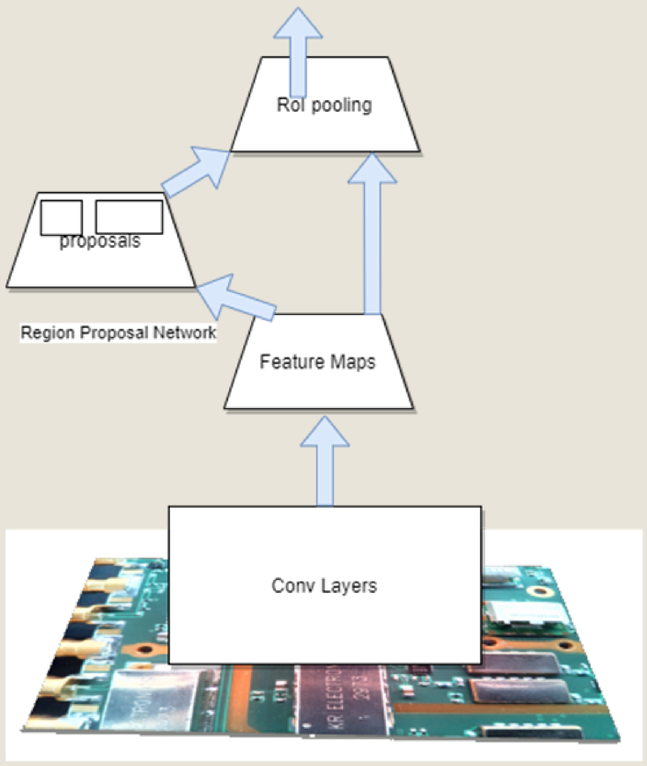
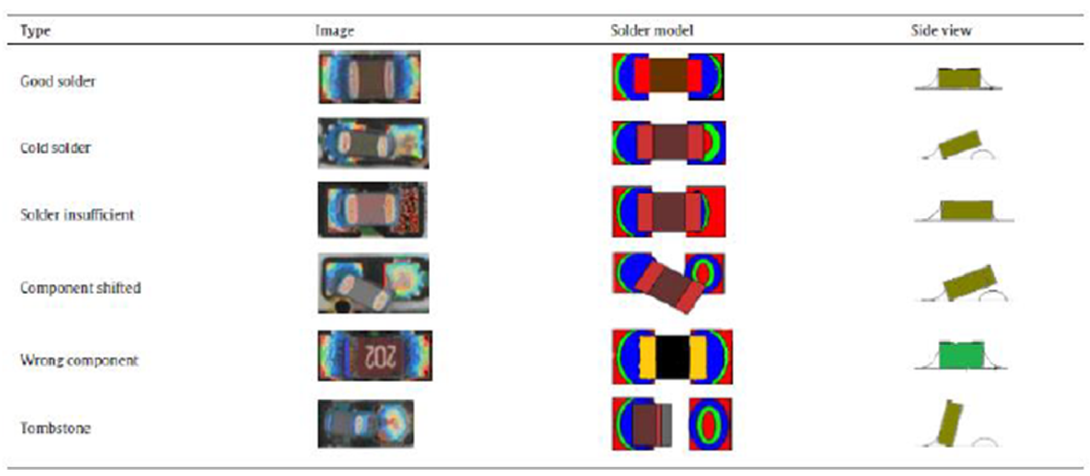
INTRODUCTION

Inspection of solder joints has been a critical process in the electronic manufacturing industry to reduce manufacturing costs, improve yield, and ensure product quality and reliability. The solder joint inspection problem is more challenging than many other visual inspections because of the variability in the appearance of solder joints. Many research works and various techniques have been developed to classify defects in solder joints. These are Solder Bridge, Tompstone Component and Shifted Component.
In this project, it is aimed to detect soldering errors on the PCB by using the object detection method. Three different object detection methods were investigated. These are SSD MobileNet, Faster R-CNN and Mask R-CNN. In this project, Faster R-CNN model has been trained and tested. The reason for using Faster RCNN is that the highest accuracy rate is determined in this model.



OBJECTİVE

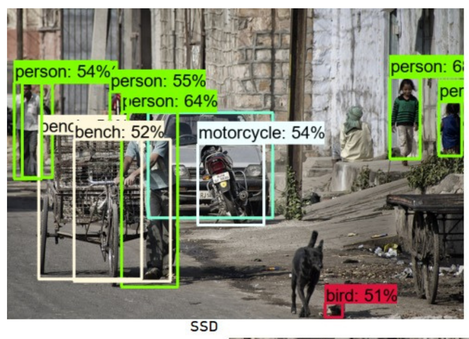
The attachment of electronic components to Printed Circuit Boards (PCBs) has been accomplished generally by solder joining technologies over the past few decades.



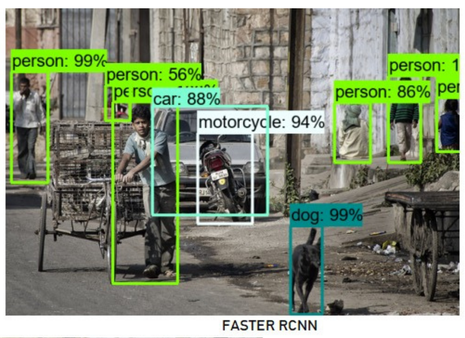
METHODOLOGY

Since the main purpose of this project is to detect problems in circuit boards, the method to be used should be one of the detection algorithms of machine learning.

- SSD METHOD
- FAST R-CNN METHOD
- FASTER R-CNN METHOD
- MASK R-CNN METHOD



SSD

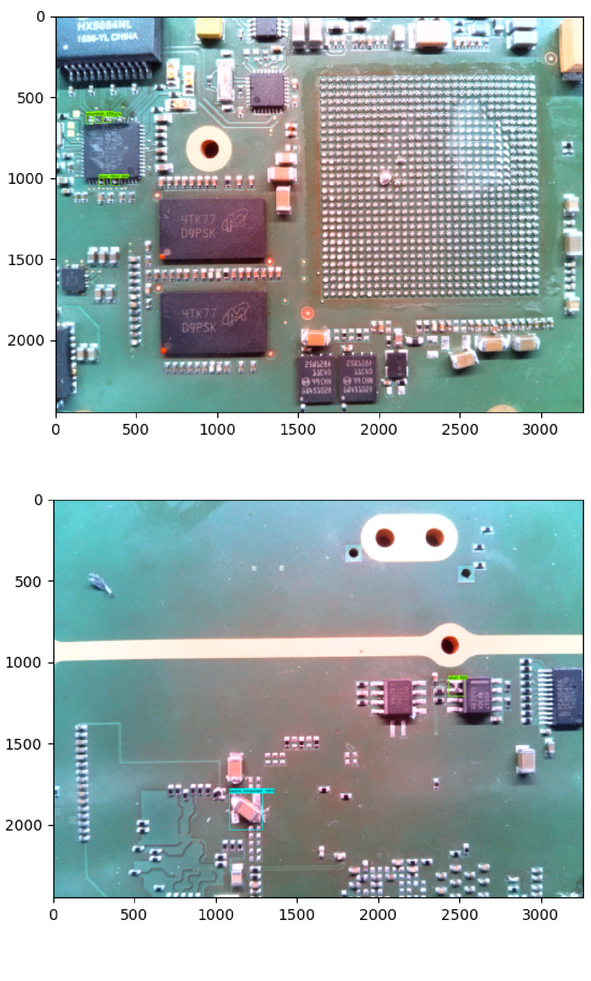


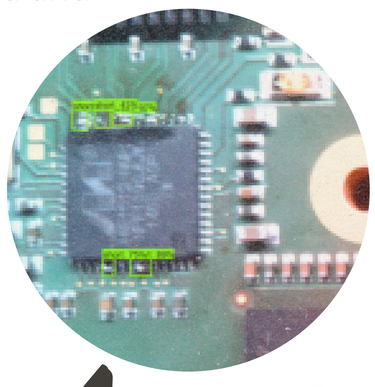
FASTER RCNN

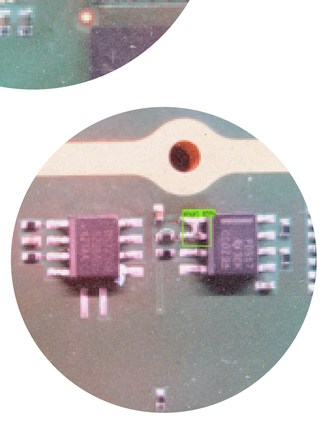

MASK RCNN

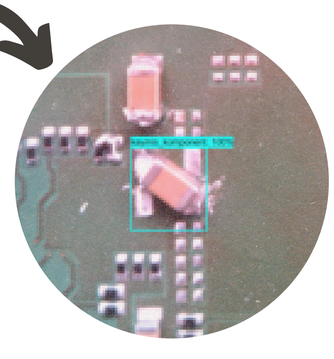
RESULTS

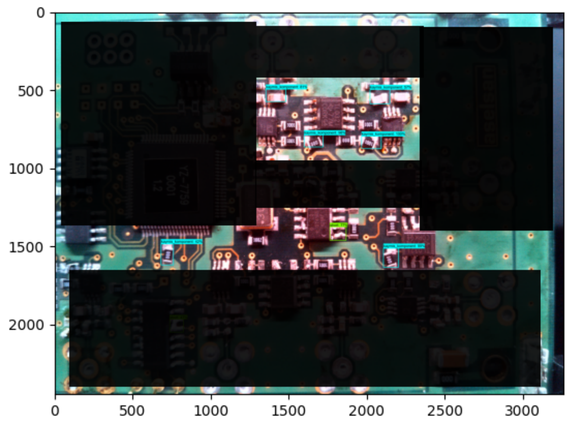
- Faster RCNN Model.
  -The code was run in Anaconda and Pycharm.











CONCLUSİON

3 different models were designed and tested for this research. The differences and similarities are outlined below.
Fast R-CNN, Mask R-CNN and SSD models are faster on average but cannot beat the Faster R-CNN in accuracy if speed is not a concern.
PCBs were tested with the model developed using Faster R-CNN. The total loss was found to be 0.5, although the accuracy rate changed. In general, the project was concluded with success.

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S.Esen YÜKSEL