



## **PCB DEFECT DETECTION USING YOLO V4TINY**

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### **ABSTRACT**

*The main Objective of this project is electronic items have a printed circuit board (PCB) that mechanically supports and connects components along conductive tracks. PCBs are vulnerable to a range of faults that hinder good manufacturing and cost businesses money. Current leakage and open circuits are caused by defects like shorts, spurs, spurious copper, missing holes, mouse bites, and pinholes, which quickly degrade performance or make PCBs worthless. To stay competitive and assure customer satisfaction, PCB makers must endeavour to ship defect-free components. PCB surface inspection is one of the most critical quality control operations since small errors on signal traces can cause major system damage. The goal is to propose a PCB inspectionsystem based on a YOLO V4 TINY network to identify the defects in PCBs and classify them.*

### **I INTRODUCTION**

Printed circuit boards (PCB) as a support for electronic components is becoming more and more sophisticated and delicate. PCB is made of multiple sheet layers made of copper in which electronic components such as electrical resistances or capacitors are placed. Since PCBs are the first step in manufacturing an electronic device, a simple error in them leads to huge flaws in the final product. Different PCB defects can be generated in various production processes, such as missing values, lacking components, mistaken open circuits, and short circuits, causing the yield to drop. PCB defects are one of the critical factors for a high defect rate of electronic equipment. Therefore, defect detection is an important quality control technique for printed circuit boards (PCBs) industry.

### **II LITERATURE REVIEW**

Nowadays the defect images are taken manual and processed with various techniques and the results are produced, and it takes time to produce the results.

Sometimes, inaccurate results are produced through manual counting method and it adds stress to the technician while submitting the report.

### **III EXISTING METHOD**

PCB is placed under the High Resolution Camera to obtain image of PCB. The template image is stored in the database. Then the system finds all the objects in an image and drawing the so-called bounding boxes around them. Then every test image is compared with this template image. Template matching is done using YoLo algorithm .If template image and capture image is same then it display image if defect free otherwise it shows the defect name.



## LIMITATIONS OF EXISTING METHOD

- The performance and generalizability of the CNN model can be improved by collecting more data with a diversity of examples and classes
- The method strongly depends on a carefully designed template.
- In the referential methods, there are several critical practical problems: misalignment, color variation, reflectivity variation, surrounding variations and fuzzy boundary defect segmentation
- Framework can be improved further by utilizing 3 dimensional pictures to recognize blazes, for example, patch joints and thickness of binding

## IV PROPOSED METHOD

In this paper the author studied the effectiveness of using CNN to detect soldering bridge faults in a PCB assembly.

- The paper presents a method for designing an optimized CNN architecture to detect soldering faults in a PCB.
- The proposed CNN architecture is compared with the state-of-the-art object detection architecture, namely YOLO

### Libraries used

a. NumPy NumPy is a Python library used for working with arrays. It also has functions for working in domain of linear algebra, fourier transform, and matrices. NumPy was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely. NumPy stands for Numerical Python. In Python we have lists that serve the purpose of arrays, but they are slow to process. NumPy aims to provide an array object that is up to 50x faster than traditional Python lists. The array object in NumPy is called ndarray, it provides a lot of supporting functions that make working with ndarray very easy. Arrays are very frequently used in data science, where speed and resources are very important..

b. Matplotlib is one of the most popular Python packages used for data visualization. It is a cross platform library for making 2D plots from data in arrays. It provides an object-oriented API that helps in embedding plots in applications using Python GUI toolkits such as PyQt, WxPython or Tkinter. It can be used in Python and IPython shells, Jupyter notebook and web application servers also.

c. PIL Python Imaging Library (expansion of PIL) is the de facto image processing package for Python language. It incorporates lightweight image processing tools that aids in editing, creating and saving images. Support for Python Imaging Library got discontinued in 2011, but a project named pillow forked the original PIL project and added Python3.x support to it. Pillow was announced as a replacement for PIL for future usage. Pillow supports a large number of image file formats including BMP, PNG, JPEG, and TIFF. The library encourages adding support for newer formats in the library by creating new file decoders. This module is not preloaded with Python. So to install it execute the following command in the command-line.

**BLOCK DIAGRAM OF PROPOSED METHOD**

The process flow diagram for the proposed methodology describes the process of data pre processing, and all the actions taking place in the proposed methodology. The process flow diagram is as shown in Fig 5.1 describes various modules like data collection, annotation and model training, and Detection and classification of defects size, shape, structure and connectivity of objects in the image It involves binary erosion, dilation, opening, closing and reconstruction. the erosion plays the role to shrinks and thins objects in image while dilation is used to grow and thicken the objects in image.

Using the closing image transformation with defined Structure Element (SE) unwanted edges, typically generated, are removed. The input to this block is the edge detected image. Morphological operation of filling is applied in the edge detected image.

The output of the morphological filling operation is an image where the objects which was detected by Canny is highlighted with lesser pixel and the background is completely dark which explicitly differentiates the objects that is cells - red blood cells in case of red plane extracted image and White blood cells in case of blue plane extracted image.

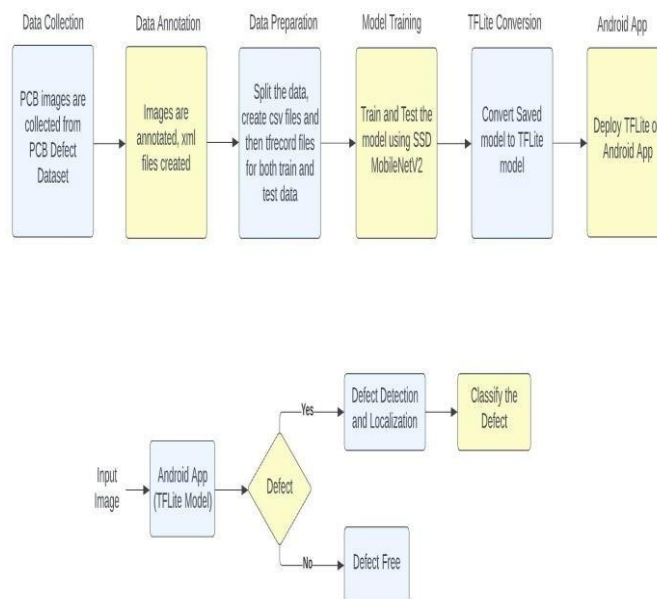


Fig 2: Block Diagram of Proposed Architecture

**SOFTWARE AND HARDWARE REQUIREMENTS SOFTWARE REQUIREMENTS**

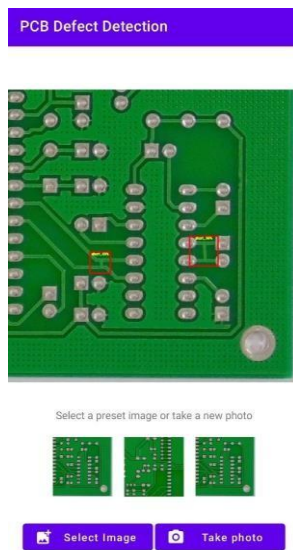
1. Programming Language: Python
2. Operating System: Windows 7(minimum)

### 3. Development Environment: Google Colab

#### HARDWARE REQUIREMENTS

1. RAM: 4 GB (minimum)
2. Hard disk space: 5 GB

#### RESULTS



#### V CONCLUSION

- Printed Circuit Boards (PCBs) are utilized in nearly all electronic devices. The PCBs that are used in these electronic products have a significant impact on their functionality.
- If the PCB is defective, the product will perform poorly regardless of how well it is built. As a result, the most important thing is to design and develop PCBs properly.
- To detect defects in PCB images, the PCB defect dataset was applied in this research. The single shot detector (SSD) algorithm is applied to the dataset.

#### VII REFERENCES

- [1] Akhtar, Muhammad Bilal. "The Use of a Convolutional Neural Network in Detecting Soldering Faults from a Printed Circuit Board Assembly." *HighTech and Innovation Journal* 3.1(2022): 1-14.
- [2] Salunke Purva, A., N. Sherkar Shubhangi, and C. S. Arya. "PCB (Printed Circuit Board) Fault Detection Using Machine Learning." (2021).
- [3] Adibhatla, Venkat Anil, et al. "Defect detection in printed circuit boards using you-only-look-once convolutional neural networks." *Electronics* 9.9 (2020): 1547.
- [4] Mukesh Kumar, Manjesh Kumar. "A Survey on Various Approaches of Automatic Optical Inspection for PCB Defect Detection". A Survey on Various Approaches of Automatic Optical Inspection for PCB Defect



Detection, VOL 7, JUNE2019

- [5] Rehman, Shams Ur, Ka Fei Thang, and Nai Shyan Lai. "Automated PCB identification and defect-detection system (APIDS)." *International Journal of Electrical & Computer Engineering (2088-8708)* 9.1 (2019).
- [6] Weibo Huang, Peng Wei. "A PCB Dataset for Defects Detection and Classification", JOURNAL OF LATEX CLASS FILES, VOL. 14, NO. 8, AUGUST 2018