# Hacettepe University

## ELE402 | Image Processing - Homework 4

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```
I pledge that I have not cheated or given any aid to this homework.
All the work presented below is my own work.
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## YOLO v3 Object Detection on Printed Circuit Board

### Introduction

The last dataset that is used for this assignment was the Roboflow's pcb.

I decided on PCBs in the dataset by using Roboflow. You can download dataset dataset from here.

### Preprocessing

I downloaded pcb PCBs files to Google Drive. Then I unzipped all of them in Google Drive. After that, I changed all the image files in the different folders into images in the single folder.

You can see exact process below step-wise.

**Connect Google Drive with Google Colab**

```
In [ ]: from google.colab import drive
        drive.mount('/content/gdrive')
```

**Download Darknet Via Pjreddie**

Download the zip file from the zip source from **dataset_source** folder to YOLO-v3-PCB-Dataset folder in Google Drive.

```
In [ ]: !wget -nc -q https://pjreddie.com/media/files/darknet.zip
        !unzip -qq -n darknet.zip -d /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset
        !rm -rf darknet.zip
        !cd /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset && ln -s darknet/data/coco.names .
```

**Clone darknet**

```
In [ ]: !cd /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset/
        !ls
```

**Extract Zip Files**

```
In [ ]: !unzip -qq /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset/*.zip -d /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset/
        !cd /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset/
        !ls
```

**Working All Microscope Image to Images Folder**

```
In [ ]: import os
        import shutil
        import glob2 as glob
        import os.path
        from os.path import isfile, isdirectory

        # Change directory to the dataset and the image directory
        %cd /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset/
        # dataset_dir = '/content/gdrive/MyDrive/'
        dataset_dir = '.'
        image_dir = 'images'
        if not os.path.isdir(image_dir):
            os.mkdir(image_dir)
        for dirpath in glob(dataset_dir):
            print(dirpath)
            if dirpath == image_dir:
                continue
            for dirname in os.listdir(dirpath):
                print('  ', dirname)
                if dirname == image_dir:
                    continue
                dirnamepath = os.path.join(dirpath, dirname)
                if isdirectory(dirnamepath):
                    print('    ', dirnamepath, '...')
                    for filename in os.listdir(dirnamepath):
                        filenamepath = os.path.join(dirnamepath, filename)
                        if isfile(filenamepath):
                            print('      ', filenamepath)
                            shutil.copyfile(filenamepath, os.path.join(image_dir, filenamepath.replace('/', '_')))
        print('Copy Done')

        # Delete Other Directories
        for dirpath in glob('*'):
            print(dirpath)
            if dirpath == image_dir:
                continue
            if isdirectory(dirpath):
                print('  Deleting ...')
                shutil.rmtree(dirpath)
        print('Delete Done')

        # Change Image Extension
        %cd /content/gdrive/MyDrive/YOLO-v3-PCB-Dataset/
        !rename -v -n -f -S .jpg .PNG *
        !rename -v -f -S .jpg .PNG *
        !ls -l | wc -l

        file_name = '/content/'+'file.txt'+'/'+'*.PNG'+'/'+'*.jpg'
        !echo $file_name
        !rm -rf /content/file_name.txt
```

### Labelling

Before training anything, model is yet-defined in the darknet. To do that, create some further files in order to merge all annotation into single one. However, I cannot upload those files because of the limitation. I could not even generated annotations in training. Therefore, I found Roboflow to make augment dataset, create annotations, and export annotations for darknet. **Another advantage of using Roboflow is I can do it less time and in any platform.** The dataset has 391 same PCB images with different angles. I generated 3 times of Mosaic augment (Mosaic augment is the same as PCB). With augmentation, I get 1173 images in training set.

**Labelling Examples**

**Issues and Approaches Related to Dataset and Labelling**

First, I tried to find all components. I labelled all the essential components but it was not a good approach because the images must be similar (Mentioned in lecture). Then, I tried **Connectors** (capacitor, **TSM**, resistance for example). **IC**, **TSM**, **Connectors** for example. **IC**, **TSM**, **Connectors** for **Capacitor**, **TSM**, resistance for example. **IC**, **TSM**, **Connectors** for **Resistance**, **TSM**, **Capacitor**, **IC**, **Connectors**.

As it can be seen, it is very time to run yet this objects than to under-presented. Moreover, I tried to train YOLO models by using all objects. But surprisingly, I got worse results.

After that, I tried to use only Connectors, Resistance and TSM. Since with these objects, I can do not predictions clearly. Through Google Colaboratory and Drive that I have input datasets the limited. Furthermore, 3000 iterations and augmentations are too small. Since I have high resolution images, they stream seem or blur. Therefore, I decided to use only Connectors and TSM. Because they are distinctive and well-defined and well-distributed in all pcb's. Finally, I decided to use only Connectors and TSM.

Finally, I decided to use darknet flags parameters. As **I substituted by dividing 32 on the object in the YOLO cfg.**

### Resizing

I resized dataset image proportions due to computational power. Original images 1920x1080 and I'm trying to work on at Colab Pro+. Therefore, I resized images to 416x416 and I could fit all of the offered. By after resizing, I could upload and annotate on all pcb's. Moreover, I could run on all computational datasets.

### Data Augmentation

I augmented dataset using Roboflow augmentation. Listed flip horizontal and vertical, rotation between 0° and 15°, saturation between -25% and +25%, brightness between -25% and +25%.

### Training

Listed flags YOLO-v3 library to train my model.

```
In [ ]: !./obj darknet detector -dontshow -ext_output -map -dumps 1 -clear -i 0 detector -gpus 0,1,2,3 cfg/coco.data cfg/yolov3-obj.cfg backup/yolov3-obj_last.weights
        !cp backup/yolov3-obj.* backup/
        !cp -r backup/ /content/
        !ls backup/
```

**Download darknet and augmented dataset from Roboflow server**

```
In [ ]: !curl -L "https://app.roboflow.com/ds/xxxx
```