

# Configuration Manual

MSc Research Project  
Artificial Intelligence

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**MSc Project Submission Sheet**  
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# Configuration Manual

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## 1 Introduction

Configuration Manual of "Comparison and Analysis of the Three Object Detection Model". You will find this guide as it helps you to compare three object detection models. This guide is intended for any person who intends to know the advantages and disadvantages of these models.

## 2 Prerequisites

1. A Google Drive account with at least 15GB free space to store data and models
2. Access to Google Colab to run Python code and GPU-accelerated workloads
3. Availability of the T4 GPU in Google Colab(Google, n.d.)which greatly speeds up training and evaluation

**To check for T4 GPU availability in Colab:**

1. Open a Colab notebook
2. Click Runtime > Change runtime type
3. Under Hardware accelerator, select GPU and choose T4 if available

With storage, Colab access, and a suitable GPU in place, you'll have the key prerequisites to configure and run your analysis comparing different object detection models.

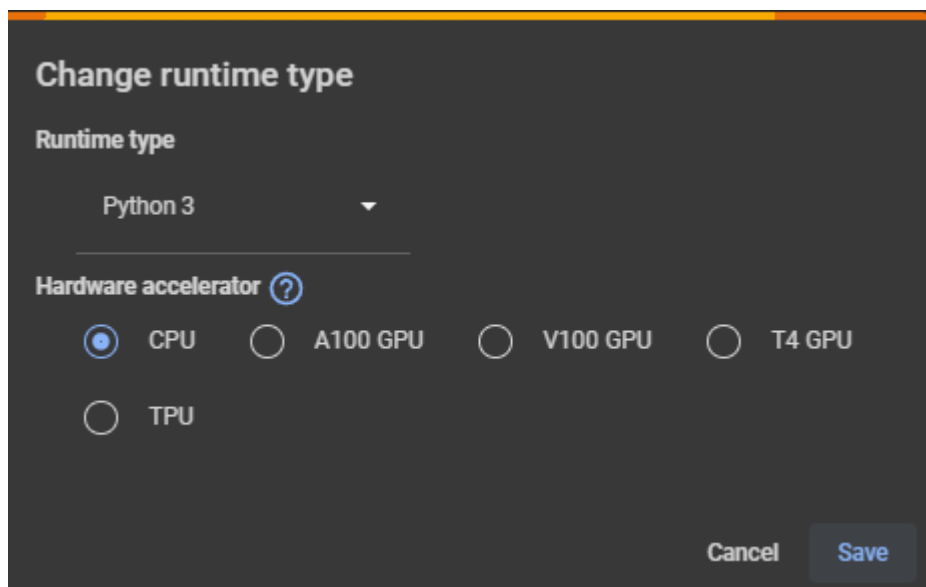


Figure 1 Hardware availability in colab

### 3 Hardware Requirement

- We don't need to set up any hardware on our end because the object detection experiments are being run in Google Colab.
- Google Colab gives you free access to powerful computing resources in the cloud, such as GPUs, for running machine learning workloads. In particular, we chose the T4 GPU option for the Colab runtime.
- The T4 GPU has tensor cores that are specifically designed for deep learning. It works very quickly and well for training neural networks and drawing conclusions from large datasets.
- Because we are using Colab's T4 GPU backend, we don't have to buy GPU servers in-house just for this analysis. Colab takes care of all the hardware infrastructure and setup that is needed to quickly train models.
- We only write and run the Python scripts in Colab notebooks; Google takes care of the GPU-enabled cloud infrastructure that is needed for a fast, responsive runtime.
- We can now focus on modeling and evaluating object detection without having to worry about getting, setting up, and maintaining hardware.

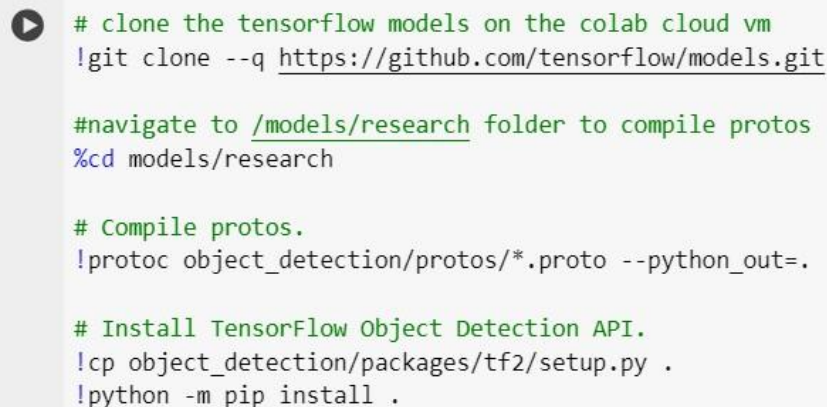
### 4 Setup to Run the Model

#### 4.1 Faster RCNN and CenterNet

##### Step 1: Install Required Libraries

Open a Colab notebook and clone the TensorFlow Models repository(Tensorflow, n.d.)

by running "`!git clone https://github.com/tensorflow/models`". This will give access to the object detection code.



```
# clone the tensorflow models on the colab cloud vm
!git clone --q https://github.com/tensorflow/models.git

#navigate to /models/research folder to compile protos
%cd models/research

# Compile protos.
!protoc object_detection/protos/*.proto --python_out=.

# Install TensorFlow Object Detection API.
!cp object_detection/packages/tf2/setup.py .
!python -m pip install .
```

Figure 2 Tensorflow Model Libray installation

Next, install TensorFlow 2.13 with “! pip install tensorflow==2.13”.

```
!pip install tensorflow==2.13.0

Collecting tensorflow==2.13.0
  Downloading tensorflow-2.13.0-cp310-cp310-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (524.1 MB)
    524.1/524.1 MB 3.0 MB/s eta 0:00:00
Requirement already satisfied: absl-py>=1.0.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0) (1.4
Requirement already satisfied: astunparse>=1.6.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0) (
Requirement already satisfied: flatbuffers>=23.1.21 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0)
Collecting gast<0.4.0,>=0.2.1 (from tensorflow==2.13.0)
  Downloading gast-0.4.0-py3-none-any.whl (9.8 kB)
Requirement already satisfied: google-pasta>=0.1.1 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0)
Requirement already satisfied: h5py>=2.9.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0) (3.9.0)
Collecting keras<2.14,>=2.13.1 (from tensorflow==2.13.0)
  Downloading keras-2.13.1-py3-none-any.whl (1.7 MB)
    1.7/1.7 MB 94.7 MB/s eta 0:00:00
Requirement already satisfied: libclang>=13.0.0 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0) (1
Requirement already satisfied: numba<=1.24.3,>=1.22 in /usr/local/lib/python3.10/dist-packages (from tensorflow==2.13.0)
```

Figure 3 Tensorflow Installation

**Step 2:** Connect Google Drive Run "from google.colab import drive" and "drive.mount('/content/drive')" to mount Google Drive. This will prompt you to authenticate and provide access to Drive where data and models are stored.

### Permit this notebook to access your Google Drive files?

This notebook is requesting access to your Google Drive files. Granting access to Google Drive will permit code executed in the notebook to modify files in your Google Drive. Make sure to review notebook code prior to allowing this access.

No thanks

Connect to Google Drive

Figure 4 Connecting google drive in colab

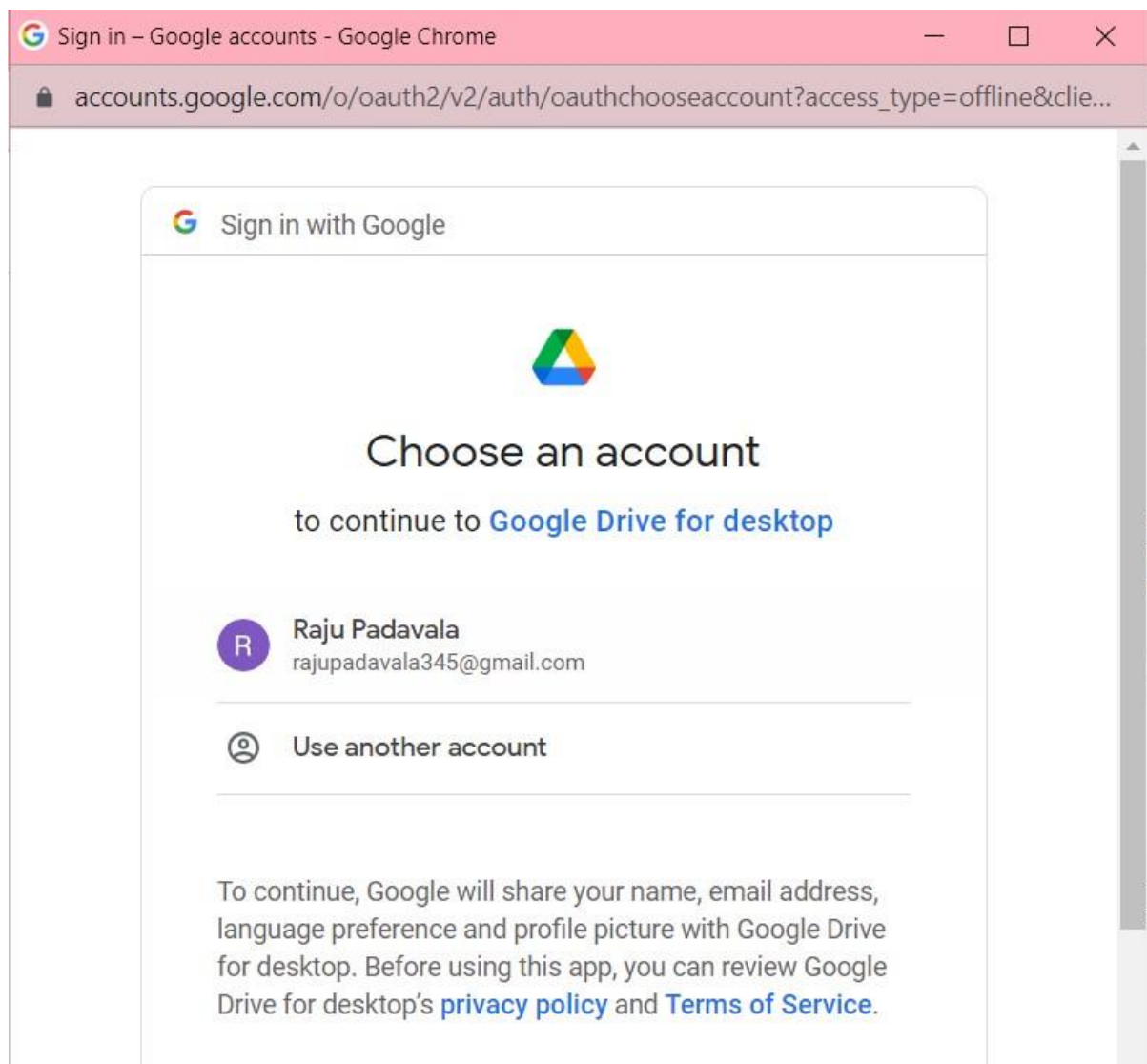


Figure 5 Prompt for Selecting Google Drive Account



Figure 6 Drive Mounted

## Step 2: Load Saved Model

### 2.1 Import all the needed libraries


```
#Loading the saved_model
import tensorflow as tf
import time
import numpy as np
from PIL import Image
from google.colab.patches import cv2_imshow
from object_detection.utils import label_map_util
from object_detection.utils import visualization_utils as viz_utils
```

Figure 7 Importing Required Libraries

2.2 Give the path to the saved model file where it was saved in Google Drive in detection.ipynb file;

2.3 Give the Label map file in detection.ipynb so that the object is correctly labelled

2.4 Give the image path in detection.ipynb to find the object in the picture



The screenshot shows a Jupyter Notebook interface with a code cell. The code is as follows:

```
+ Code + Text
import time
import numpy as np
import warnings
warnings.filterwarnings('ignore')
warnings.filterwarnings("ignore")
import logging

# Set logging level to ERROR to suppress warnings
logging.getLogger('absl').setLevel(logging.ERROR)
from PIL import Image
from google.colab.patches import cv2_imshow
from object_detection.utils import label_map_util
from object_detection.utils import visualization_utils as viz_utils

IMAGE_SIZE = (12, 8) # Output display size as you want
import matplotlib.pyplot as plt
PATH_TO_SAVED_MODEL="/content/drive/MyDrive/ModelFilesToRun/Output Model CenterNet/saved model"
print('Loading model...', end='')

# Load saved model and build the detection function
detect_fn=tf.saved_model.load(PATH_TO_SAVED_MODEL)
print('Done!')

#Loading the label map
category_index=label_map_util.create_category_index_from_labelmap("/content/drive/MyDrive/ModelFilesToRun/label_map.pbtxt",use_display_name=True)
category_index=label_map_util.create_category_index_from_labelmap([path_to_label_map],use_display_name=True)

def load_image_into_numpy_array(path):
    return np.array(Image.open(path))

image_path = "/content/obj0002_frame0000031.jpg.rf.34deacbd001bb98e7b32e9ba7755ffda.jpg"
print('Loading image from %s...' % image_path, end='')

image_np = load_image_into_numpy_array(image_path)

# The input needs to be a tensor, convert it using `tf.convert_to_tensor`.
input_tensor = tf.convert_to_tensor(image_np)
# The model expects a batch of images, so add an axis with `tf.newaxis`.
input_tensor = input_tensor[tf.newaxis, ...]

detections = detect_fn(input_tensor)
```

Annotations in the image:

- Saved Model Path:** Points to the line `PATH_TO_SAVED_MODEL="/content/drive/MyDrive/ModelFilesToRun/Output Model CenterNet/saved model"`.
- Label File Path:** Points to the line `category_index=label_map_util.create_category_index_from_labelmap("/content/drive/MyDrive/ModelFilesToRun/label_map.pbtxt",use_display_name=True)`.
- Image Path:** Points to the line `image_path = "/content/obj0002_frame0000031.jpg.rf.34deacbd001bb98e7b32e9ba7755ffda.jpg"`.

Figure 8 Reference for Providing paths



### 4.3 Outputs of the Faster RCNN and CenterNet Model



Figure 9 Sample output of CenterNet Model





Figure 10 Output from Faster RCNN Model

## 4.4 Loading YOLO V3 Model

### 4.4.1 Libraries Installation

1. Navigate to the content directory: `!%cd /content`. This will set our working directory to the content folder in Colab.
2. Clone the yolov3 repository (Ultralytics, n.d.) from GitHub: `! git clone https://github.com/ultralytics/yolov3.git`. This will download the yolov3 code into a folder called "yolov3".
3. Move into the yolov3 directory: `!%cd yolov3`. Now we are inside the yolov3 folder that was just cloned.

4. Install the required Python packages: "! pip install -r requirements.txt". This will install all the necessary packages to run yolov3 based on the requirements file.

5. Return back to the content directory: "%cd /content/yolov3". So now we're back in the content folder in the yolov3 folder and ready to use the yolov3 code.



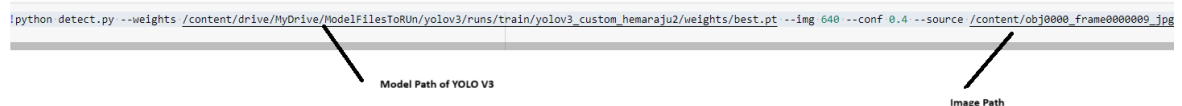
```
%cd /content
!git clone https://github.com/ultralytics/yolov3.git
%cd yolov3
!pip install -r requirements.txt
%cd /content/yolov3

/content
Cloning into 'yolov3'...
remote: Enumerating objects: 11001, done.
remote: Counting objects: 100% (923/923), done.
remote: Compressing objects: 100% (445/445), done.
remote: Total 11001 (delta 631), reused 730 (delta 477), pack-reused 10078
Receiving objects: 100% (11001/11001), 9.88 MiB | 5.83 MiB/s, done.
Resolving deltas: 100% (7430/7430), done.
/content/yolov3
Collecting gitpython>=3.1.30 (from -r requirements.txt (line 5))
  Downloading GitPython-3.1.40-py3-none-any.whl (190 kB)
    190.6/190.6 kB 4.4 MB/s eta 0:00:00
Requirement already satisfied: matplotlib>=3.3 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 6)) (3
Requirement already satisfied: numpy>=1.22.2 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 7)) (1.2
Requirement already satisfied: opencv-python>=4.1.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 8
Collecting Pillow>=10.0.1 (from -r requirements.txt (line 9))
```

**Figure 11 Libraries Installation for YOLOV3**

## 4.4.2 Running YOLO-V3

Step 1: Provide the saved model path and image path after 4.4.1 and run the inference:



```
python detect.py --weights /content/drive/MyDrive/ModelFilesToRun/yolov3/runs/train/yolov3_custom_hemaraju2/weights/best.pt --img 640 --conf 0.4 --source /content/obj0000_frame00000009.jpg
```

Model Path of YOLO V3

Image Path



#### 4.4.3 Output of the YOLO V3

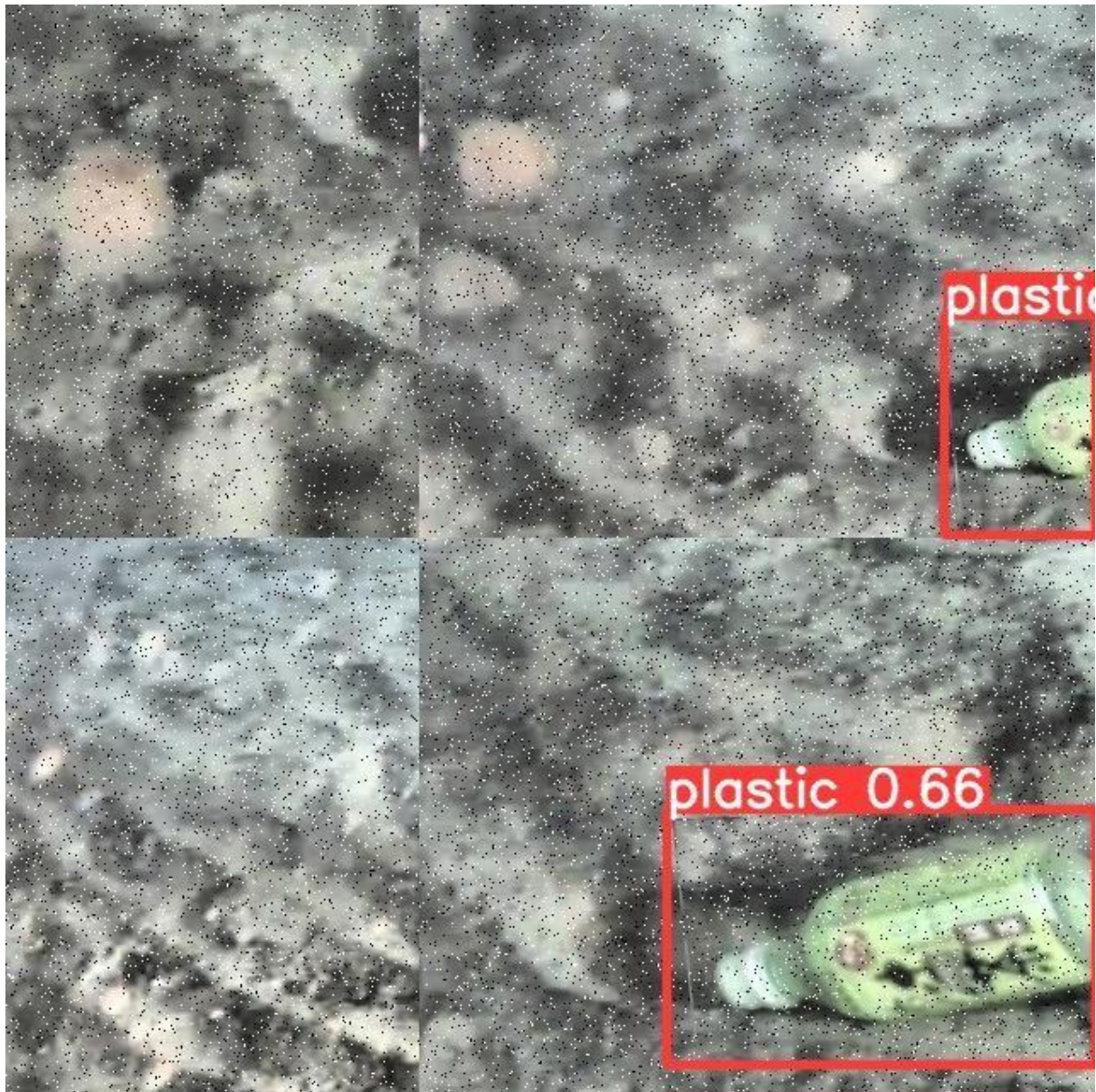


Figure 12 YOLO V3 Sample Output

## References

Google *Colaboratory*. Available from:

[https://colab.research.google.com/?utm\\_source=scs-index](https://colab.research.google.com/?utm_source=scs-index) [Accessed 13/12/23].

Tensorflow *models/research/object\_detection/g3doc/tf2\_detection\_zoo.md at master tensorflow/models*. [Online] GitHub. Available from:  
[https://github.com/tensorflow/models/blob/master/research/object\\_detection/g3doc/tf2\\_detection\\_zoo.md](https://github.com/tensorflow/models/blob/master/research/object_detection/g3doc/tf2_detection_zoo.md) [Accessed 13/12/23].

Ultralytics *YOLOv3* [Online] Ultralytics YOLOv3 Docs. Available from:  
<https://docs.ultralytics.com/models/yolov3/> [Accessed 13/12/23].