OBJECT DETECTION USING OPEN CV AND TENSOR FLOW API

A MINOR PROJECT REPORT

Submitted by

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Vel Tech
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(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

This is to certify that the minor project entitled "**OBJECT DETECTION USING OPENCV AND TENSORFLOW API**" submitted by B.V.Sumanth kumar reddy (16UECS0051), M.Vijay Bhaskar Reddy (16UECD0039) and G.Veera Babu (16UECS0144) in partial fulfillment for the requirements for the award of the degree of Bachelor of Technology in Computer Science and Engineering is an authentic work carried out by them under my supervision and guidance.

To the best of my knowledge, the matter embodied in the project report has not been submitted to any other University/Institute for the award of any Degree or Diploma.

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CERTIFICATE OF EVALUATION

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S. No.	NAME OF THE STUDENT	TITLE OF THE PROJECT	NAME OF THE PROJECT SUPERVISOR
1 2 3	B.V.Sumanth kumar reddy M.Vijay Bhaskar reddy G.Veera Babu	Object Detection using OpenCV and Tensorflow	Dr.N. Partheeban,

The report of the Project submitted by the above students in partial fulfilment for the award of Bachelor of Technology in Computer Science And Engineering of Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology for the viva-voce examination held at Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology on _____, has been evaluated and confirmed to be the report of the work done by the above student(s).

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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We express our deepest gratitude to our respected **Founder Chancellor and President Col. Prof. Dr. R. RANGARAJAN B.E. (EEE), B.E. (MECH), M.S (AUTO). DSc., Chancellor and Foundress President Dr. R. SAGUNTHALA RANGARAJAN M.B.B.S.**, Chairperson Managing Trustee and Vice President.

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ABSTRACT

One of the important fields of Artificial Intelligence is Computer Vision. Computer Vision is the science of computers and software systems that can recognize and understand images and scenes. Computer Vision is also composed of various aspects such as image recognition, object detection, image generation, image super-resolution and more. Object detection is probably the most profound aspect of computer vision due the number practical use cases. In this project, our team will briefly introduce the concept of modern object detection, challenges faced by software developers, the solution my team has provided as well as code tutorials to perform high performance object detection.

Object detection refers to the capability of computer and software systems to locate objects in an image/scene and identify each object. Object detection has been widely used for face detection, vehicle detection, pedestrian counting, web images, security systems and driverless cars. There are many ways object detection can be used as well in many fields of practice. Like every other computer technology, a wide range of creative and amazing uses of object detection will definitely come from the efforts of computer programmers and software developers.

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LIST OF ABBREVIATIONS

ABBREVIATIONS	EXPLANATIONS
AI	Artificial Intelligence
CV	Computer Vision
CNN	Convolutional Neural Network
DL	Deep Learning
ML	Machine Learning
R-CNN	Regional-Convolution Neural Network
SSD	Sinlge Shot Multibox Detector
YOLO	You Only Look Once

CHAPTER 1

INTRODUCTION

1.1 AIM OF THE PROJECT

Getting to use modern object detection methods in applications and systems, as well as building new applications based on these methods is not a straight forward task. Early implementations of object detection involved the use of classical algorithms, like the ones supported in OpenCV, the popular computer vision library. However, the classical algorithms could not achieve enough performance to work under different conditions.

1.2 PROJECT DOMAIN

The breakthrough and rapid adoption of deep learning in 2012 brought into existence modern and highly accurate object detection algorithms and methods such as R-CNN, Fast-RCNN, Faster-RCNN, RetinaNet and fast yet highly accurate ones like SSD and YOLO. Using these methods and algorithms, based on deep learning which is also based on machine learning require lots of mathematical and deep learning frameworks.

1.3 PROBLEM STATEMENT

There are millions of expert computer programmers and software developers that want to integrate and create new products that uses object detection. But the technology is kept out of their reach due to the extra and complicated path to understanding and making practical use of it. My team realized this problem , our team used Image AI , a python library that lets programmers and software developers easily

integrate state-of-the-art computer vision technologies into their existing and new applications, using just few lines of code.

CHAPTER 2
LITERATURE REVIEW

An object detection system finds objects of the real world present either in a digital image or a video, where the object can belong to any class of objects namely humans, cars, etc. In order to detect an object in an image or a video the system needs to have a few components in order to complete the task of detecting an object, they are a model database, a feature detector, a hypothesiser and a hypothesiser verifier. This paper presents a review of the various techniques that are used to detect an object, localise an object, categorise an object, extract features, appearance information, and many more, in images and videos [1]

The object detection based on deep learning is an important application in deep learning technology, which is characterized by its strong capability of feature learning and feature representation compared with the traditional object detection methods. The paper first makes an introduction of the classical methods in object detection, and expounds the relation and difference between the classical methods and the deep learning methods in object detection. Then it introduces the emergence of the object detection methods based on deep learning and elaborates the most typical methods nowadays in the object detection via deep learning [2]

There are numerous applications of unmanned aerial vehicles (UAVs) in the management of civil infrastructure assets. A few examples include routine bridge

inspections, disaster management, power line surveillance and traffic surveying. As UAV applications become widespread, increased levels of autonomy and independent decision-making are necessary to improve the safety, efficiency, and accuracy of the devices. This paper details the procedure and parameters used for the training of convolutional neural networks (CNNs) on a set of aerial images for efficient and automated object recognition.

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Potential application areas in the transportation field are also highlighted.The accuracy and reliablitiy of CNNs , depend on the networks training and the selection of operational parameters [3]

Deep Neural Networks (DNNs) have recently shown outstanding performance on image classification tasks . In this paper we go one step further and address the problem of object detection using DNNs, that is not only classifying but also precisely localizing objects of various classes. We present a simple and yet powerful formulation of object detection as a regression problem to object bounding box masks. We define a multi-scale inference procedure which is able to produce high-resolution object detections at a low cost by a few network applications [4]

Deep learning is an area of machine learning that emerged from the intersection of artificial neural networks , graphical modelling and signal processing. ANN’s are a class of machine learning algorithms which are inspired by structure of brain. The basic building block of brain is neuron. Several layers are composed of many neurons similar to the dataset which we have trained yet. The weights are learned using an algorithm called backpropagation. Deep learning is an significantly developed and improved in the area of computer vision [5]

CHAPTER 3

PROJECT DESCRIPTION

3.1 EXISTING SYSTEM

Without ImageAI library, many software engineers designed interface for object detection and they had used several tools to manage the data set and for input and output sequence, so due to this the object is not accurately determined . One of the best example is IBM Watson Studio , which is an object detection interface designed by tensorflow API by IBM company.

3.2 PROPOSED SYSTEM

By using ImageAI, a python library , programmers and software developers can easily integrate computer vision technologies into their existing and new applications for designing and developing their own accurate object detection interface using tensorflow as backend.

3.3 FEASIBILITY STUDY

To perform object detection using Image AI, all you need to do is

1. Install Python on your computer system or Anaconda (Spyder IDE)
2. Install Image AI and its dependencies

3. Download the Object Detection model file

4. Run the sample codes .

3.4 SYSTEM SPECIFICATIONS

The system should contain the following:

1. 8-GB of RAM
2. NVIDIA GPU’s

3.4.1 Software Specifications

- Anaconda (SpyderIDE for python)
- NumPy
- SciPy
- Matplotlib
- Keras
- Pillow
- H5py
- OpenCV
- Tensorflow
- Retina Net dataset

CHAPTER 4

MODULE DESCRIPTION

4.1 BLOCK DIAGRAM

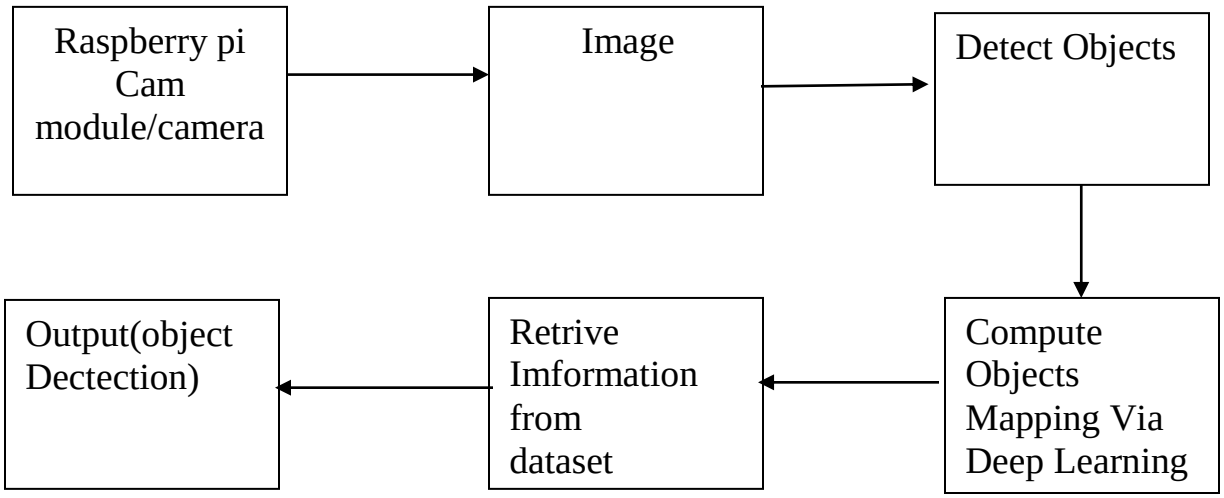

Fig 4.1:Block Diagram

Fig 4.1 shows that the how the system is trained with the help of dataset and how the image is detected with the help of deep learning algorithm and finally it predict the probability.

4.2 DESGIN PHASE

4.2.1 Data flow diagram

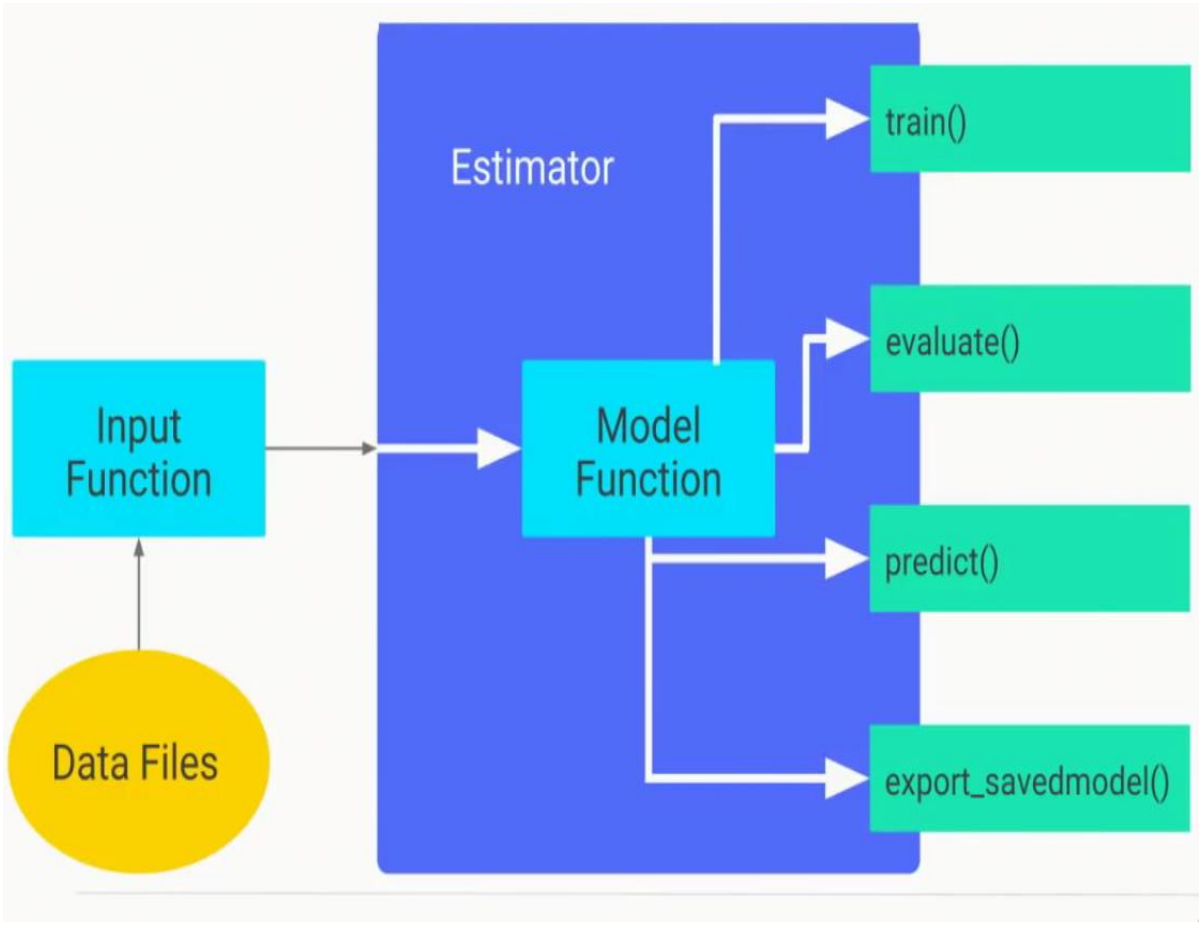

Fig 4.2 : Data Flow Diagram

Fig 4.2 shows that how the dataset is trained by the machine and how it predict the desired output.

4.2.2 Use Case diagram

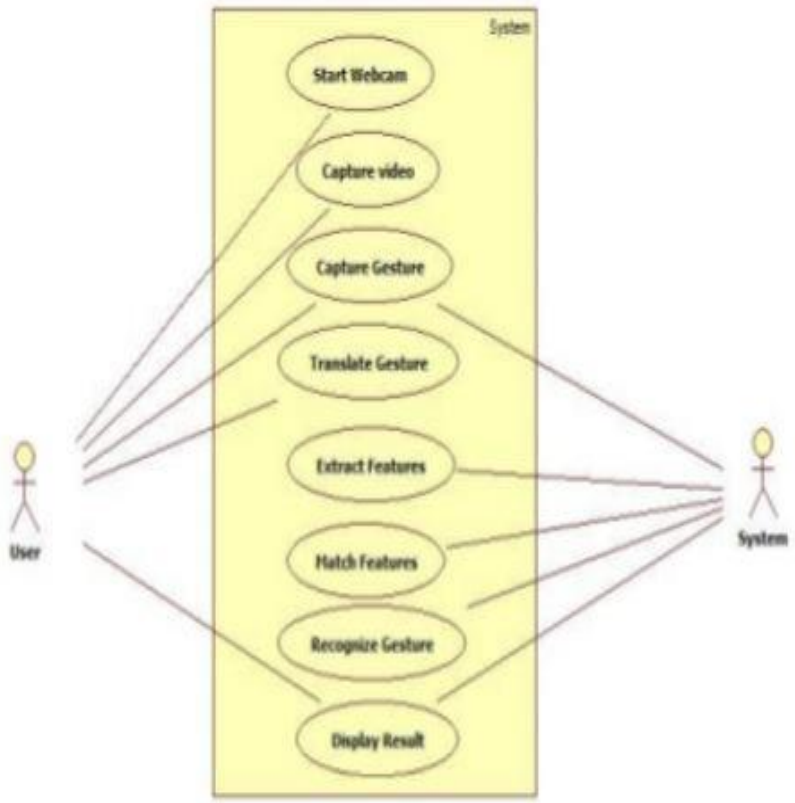

Fig 4.3: Use Case Diagram

4.2.3 Sequence Diagram

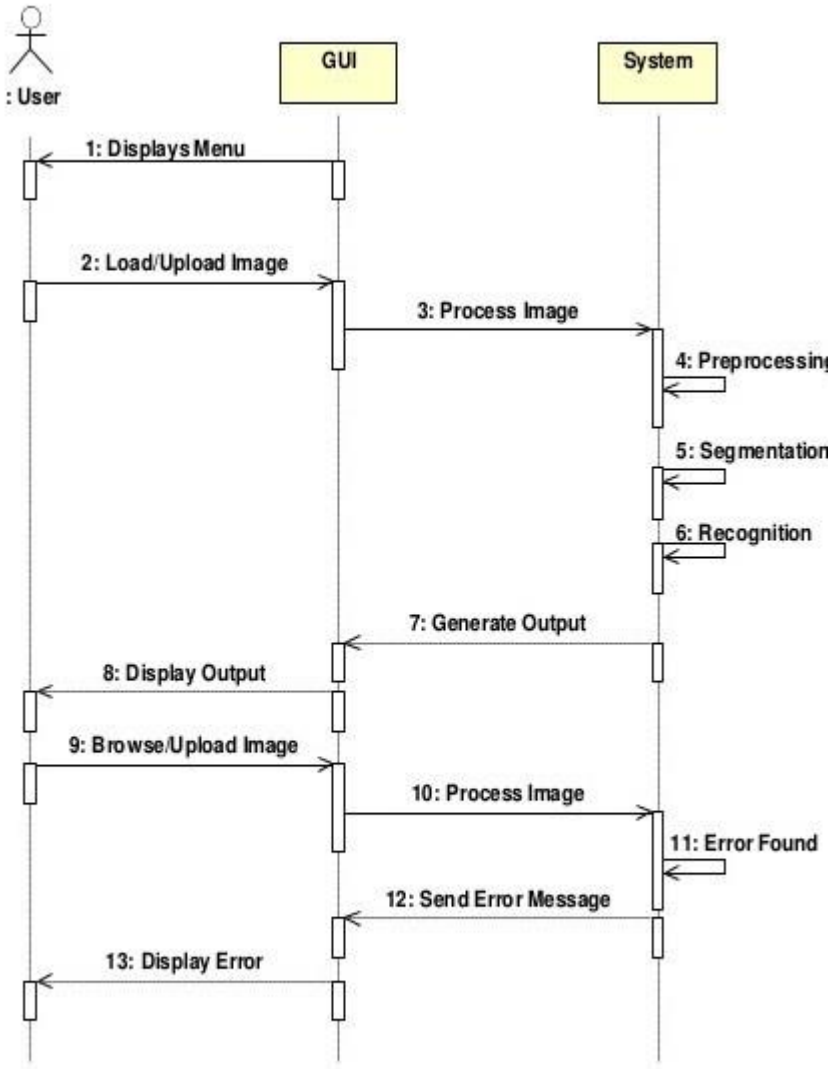

Fig 4.4 : Sequence Diagram

Fig 4.4 shows that the sequence order of dataset training and data acquisition and data prediction.

4.3 RASPBERRY PI CAM MODULE DESCRIPTION

4.3.1Raspberry pi

Fig 4.5 : Raspberry Pi Module

The Raspberry Pi is the go-to microcomputer for all ages and abilities starting out in the wonderful world of programming and electronics.There are three key models of Raspberry Pi on the market today - the Raspberry Pi 3 Model B+, Raspberry Pi Model A+and their tiny sibling the Raspberry Pi Zero.

A Raspberry Pi is a computer.. a really small, really powerful, ‘micro’ computer. The latest Raspberry Pi 3 Model B+includes a 1.4GHz quad-core processor, 1GB of RAM, WiFi, Bluetooth and more!With a highly-active community of forums, blogs, tutorials and learning materials available, learning how to code and make projects has never been easier! It’s also more accessible than ever thanks to the ultra-affordable Raspberry Pi Zero W.

With the ability to use code to control real-world ‘things’ via the Raspberry Pi’s GPIO, there are endless projects to make - LED projects, robots, home automation, AI assistants, remote control cars, displays, camera projects, media centres, servers, cluster computers and much, much more!

4.3.2 Raspberry Pi SD card

Fig 4.6 : SD Card

The micro-SD card is the brain of the Raspberry Pi. Choosing a quality micro-SD card rated at a suitable speed is vital to ensuring your Raspberry Pi runs smoothly.SD cards are one of the first products we sold back in 2012 .Through years of experience and testing, we only trust high-quality SanDisk micro-SD cards – so they’re the only brand we sell. Simple. Raspberry Pi micro-SD cards come in the choice of one of the following operating systems pre-installed for your convenience – Raspbian, KODI or NOOBS.

4.3.3 Pi cam

Fig 4.7 : Pi Cam

Adding a camera to your Raspberry Pi opens up a whole new category of potential Raspberry Pi projects to build, program and enjoy.Popular projects include time-lapse photography, face recognition, DIY CCTV, pet and 3D printer monitors, car cams and more.We now offer a range of different Raspberry Pi camera options, from the tiny ZeroCam to the official Raspberry Pi Camera Module, including NOIR versions for night photography projects.

CHAPTER 5

IMPLEMENTATION

5.1 PROGRAM

```
from imageai.Detection import ObjectDetection
import os
execution_path = os.getcwd()
detector = ObjectDetection()
detector.setModelTypeAsRetinaNet()
detector.setModelPath( os.path.join(execution_path ,
"resnet50_coco_best_v2.0.1.h5"))
detector.loadModel()
detections =
detector.detectObjectsFromImage(input_image=os.path.join(execution_path ,
"image.jpg"), output_image_path=os.path.join(execution_path , "imagenew.jpg"))
for eachObject in detections:
    print(eachObject["name"] , " : " , eachObject["percentage_probability"] )
```

5.2 INPUT

Fig 5.1:Input Image

Fig 5.1 shows the input parsing into the program and the machine reads the image.

5.2 OUTPUT:-

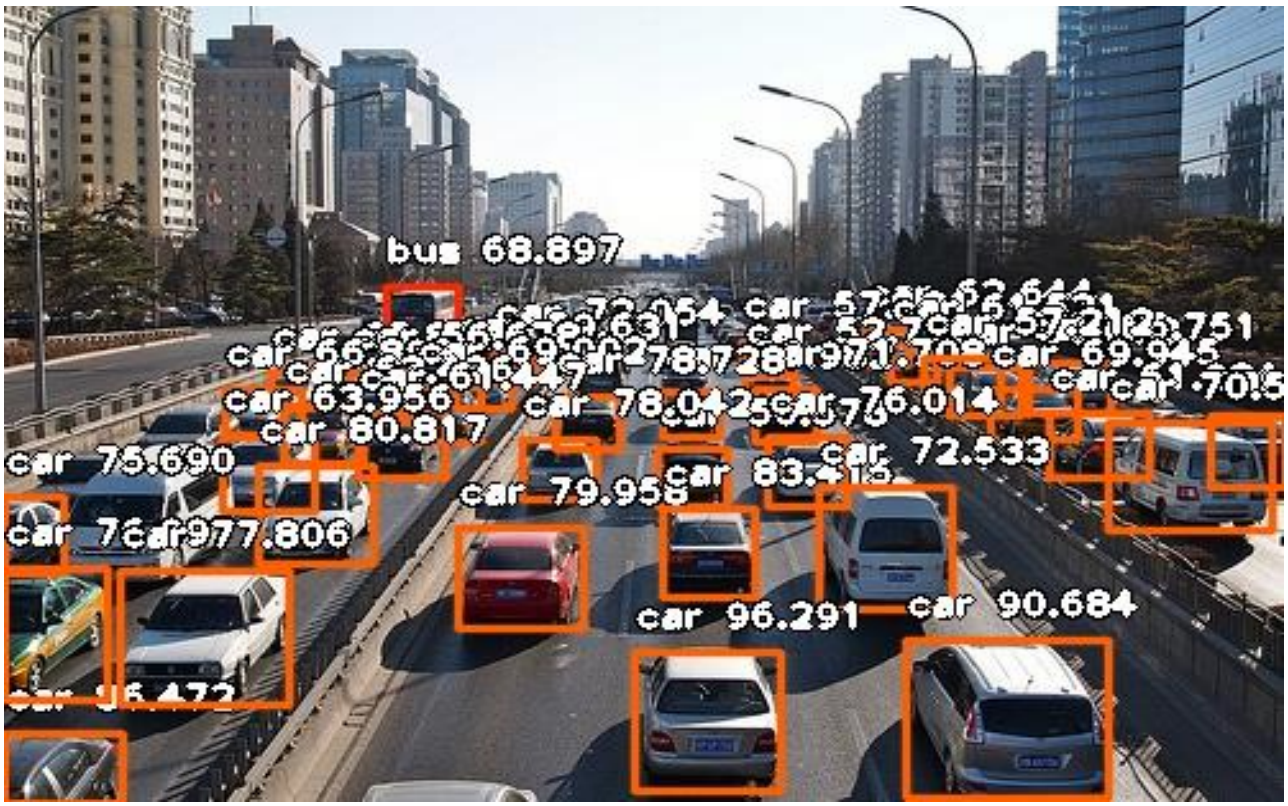

Fig 5.2:Output Image

Fig 5.2 shows that after processing of input image , the output image will be predicted.

5.3 LIMITATIONS

- It detects only objects in an image , but not scenery in the image.
- It detects images based on the training dataset .
- It concentrates mainly on the image resolution while detecting the images .
- It works only on the ImageAI library and Retina dataset.

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CHAPTER 6
RESULTS AND DISCUSSIONS

6.1 EFFICIENCY OF THE PROPOSED SYSTEM

Adjusting Minimum Probability: By default,objects dectected with a probability percentage of less will not be shown or Reported.You can increase this value for high certainty cases or reduce the value for cases where all possible objects are needed to be detected

Custom Objects Dectection: Using provided Custom Object Class,you can tell the dectection class to report dectections on one or a few number of unique Objects.

Dectection Speeds: You Can reduce the time it takes to dectect an image by setting the speed of dectection speed to"faster" and"fastest".

Input Types: You can specify and parse in file path to an image,Numpy array or file stream of an image as the input image.

Output Types: You can specify that the dectectObjectsFromImage function should return the image in the from of a file or Numpy array.

6.2 COMPARING OF EXISTING AND PROPOSED SYSTEM

The existing system no exact detection of objects .T he proposed system there is an exact detection of each and every object and its probability values also. Compared our proposed system with the existing system (IBM Watson Studio), where it performs the poor object detection.

Input image at IBM Watson Studio(existing system)

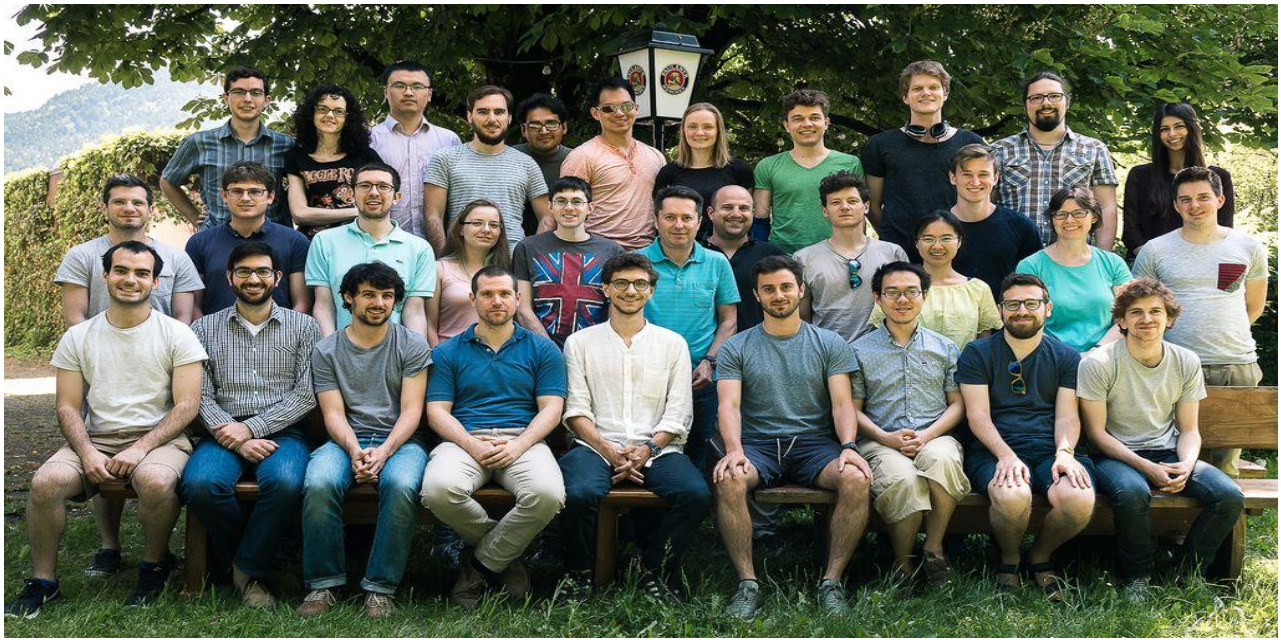

Fig 6.1**:**Input Image IBM Watson

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Output

It detects only 7 faces .

Fig 6.2:Output Image IBM Watson

fig 6.2 shows that the output image of parsed input of IBM Watson studio.

Output of Proposed System

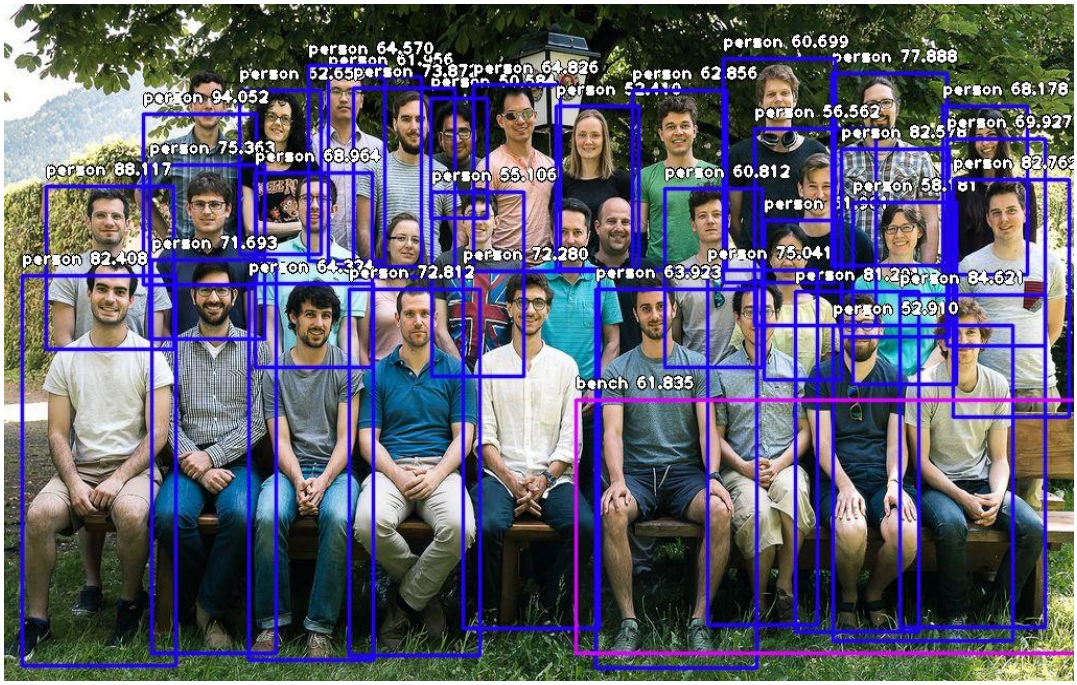

Fig 6.3:Output Of Proposed System

fig 6.3 shows that the output image of proposed system with image AI library

6.3ADVANTAGES OF PROPOSED SYSTEM

- High accuracy: It detects the image very fast with the help of image AI library, compared to other algorithms.

- Faster detection: Through the R-CNN , the machine trained very fast to detect the images .

- Probabilistic determination: The output predicted in the form of probability.

- Understandable UI: It is easily understand by the user for parsing input.

- Detects Low Resolution Objects.

CHAPTER 7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 CONCLUSION

Using the ImageAI , we can easily design our own object detection API's which play a crucial role in self driving cars, security systems and our future enhancement of this project is integrate this technology with raspberry pi and it is easy to integrate with further automobile parts. ImageAI currently supports only state-of-the-art Deep Learning algorithms, which require NVIDIA GPUs to perform real-time recognition and detection tasks. However, we are working on integrating optimized and faster deep learning methods for both image recognition,object detection and video object tracking tasks.

7.2 FUTURE ENHANCEMENTS

To develop this proposed system in order to integrate with the hardware system especially in automobiles to communicate with the surrounding objects for developing the production of self driving cars as well as many applications based on object detection using Open Cv and tensorflow.

Now a days self driving vehicles are usually integrated with object detection technology to communicate with the surrounding parts for best autonomous technology in the future as well as on security systems, pedestrian tracking.With the help of hardware modules , we can integrate the software technology to create the future of autonomous drones, cars etc.

APPENDICES

```
from imageai.Detection import ObjectDetection
import os
execution_path = os.getcwd()
detector = ObjectDetection()
detector.setModelTypeAsRetinaNet()
detector.setModelPath( os.path.join(execution_path ,
"resnet50_coco_best_v2.0.1.h5"))
detector.loadModel()
detections =
detector.detectObjectsFromImage(input_image=os.path.join(execution_path ,
"image.jpg"), output_image_path=os.path.join(execution_path , "imagenew.jpg"))
for eachObject in detections:
    print(eachObject["name"] , " : " , eachObject["percentage_probability"] )
```

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