Report on Project 1

Object Detection using YOLOV5

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Introduction to Computer Science

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Object Detection using YOLOV5

This project aims to show the application of Python in science and computing, more specifically, Machine Learning. By using YOLO (You Only Look Once), we are able to train and detect objects in our daily life. My object of choice is Fire extinguisher

Learning points

Throughout this project, I have learnt several key points including: (1) Understand the basic concept of Machine learning; (2) How to train and use YOLOv5 to detect objects; (3) Understanding the application of Python in Machine learning; (4) Label images for Supervised Machine Learning.

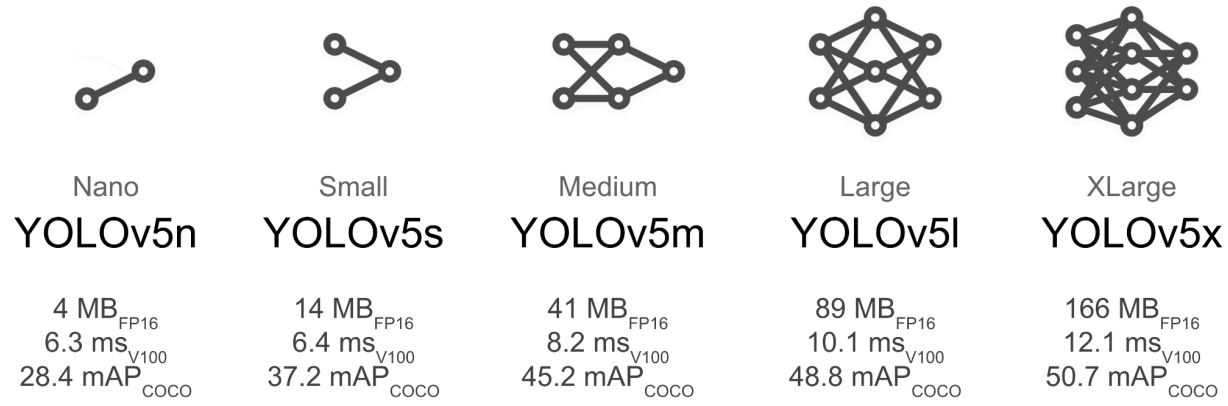
Process

These are the steps that I did to implement this project. This took a week to complete.

Researching on Yolov5

Reading yolov5 documentation

Here are some key highlights from yolov5 documents



The selected model depends on the purpose of our training and dataset. In this case, because of the limited number of images, I used the YOLOv5s model for best use of a small dataset.

The suggested number of images per class is 1500 and the number of instances is about 10000. My implementation only consists of about 500 images (100 of mine and 400 of online data).

There are two ways to start training: (1) Start from a pretrained model or (2) Start from scratch. In my case, I started from a pretrained model, YOLOv5s.pt

Implementing the code

Environment setup

I followed the steps provided in the guidance. After changing the notebook accelerator to GPU, I mounted my Google Drive to the notebook.

I then clone `yolov5.git` on github and install all the requirements for YOLOv5

For this training, I used the YOLOv5s model for faster performance and it works best with a small dataset.

```
[ ]  !git clone https://github.com/ultralytics/yolov5.git
```

```
[ ]  !pip install -r requirements.txt -q
```

```
[3]  !wget https://github.com/ultralytics/yolov5/releases/download/v6.2/yolov5s.pt
```

Data preparation

My chosen object is fire extinguishers. I took 100 pictures of fire extinguishers across VGU New Campus and labeled each picture. In addition, I also searched for dataset online to support the accuracy of my training model, since there is only one type of fire extinguisher in our campus.

I then created a yaml file using code and configured as follows

```
[ ]  import yaml

     dataset_info = {
         'path': 'my_data',
         'train': 'train/images',
         'val': 'val/images',
         'nc': 1,
         'names': ['fire_extinguisher']
     }

     with open('data/my_data.yaml', 'w+') as f :
       doc = yaml.dump(dataset_info,f,default_flow_style=None,sort_keys=False)
```

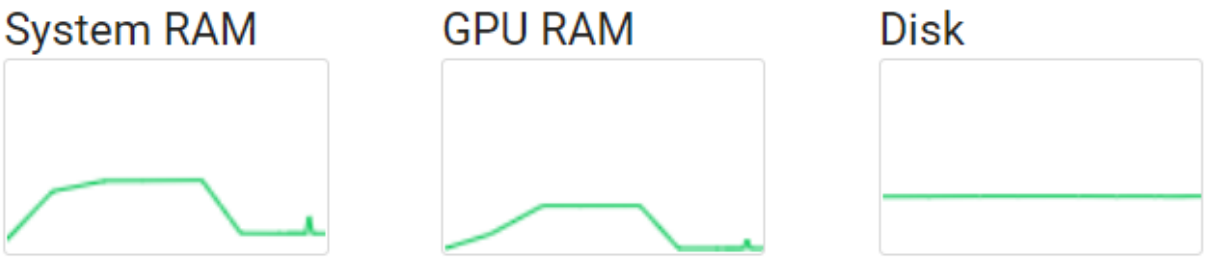
Training process

I used the configuration as follows

```
!python train.py --img 640 --batch 8 --epochs 50 --data my_data.yaml --weights yolov5s.pt --cache
```

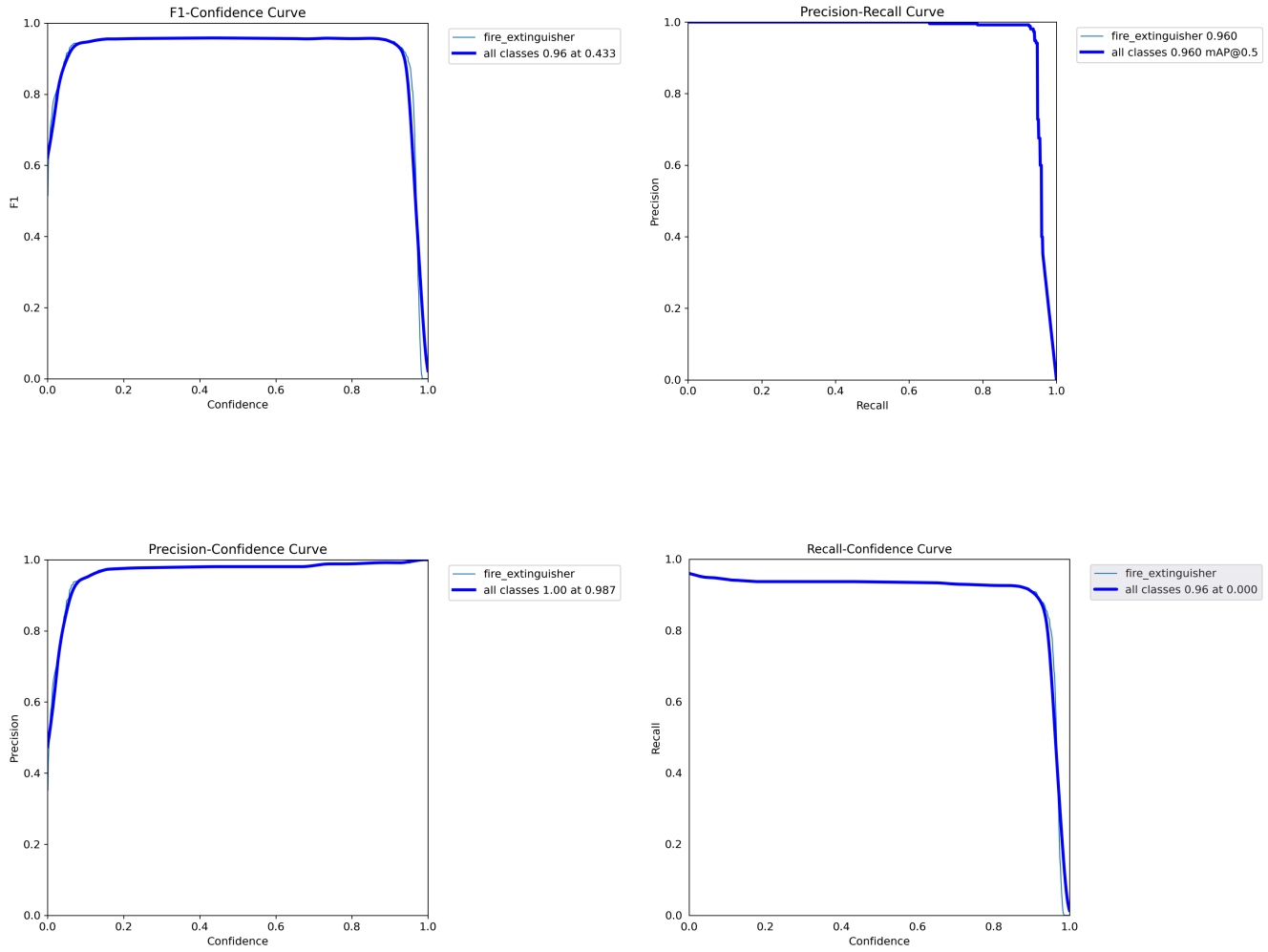
```
batch 8

epochs 50
```



For each pouch, it required 2.39 Gigabyte GPU RAM, the free account is capable of running this training up to 12 hours with a user supervised on the running code.

Validation process



Result

Here are the results on the first model using best.pt to detect.

Figure 1: A picture of a fire extinguisher is detected with confidence 0.95.

Figure 2: A video of two fire extinguishers - link

Figure 3: A video of fire extinguisher in CSE Class - link

Conclusion

Although this model is still having flaws (mistaken for a person with a fire extinguisher, randomly detecting objects as fire extinguishers), the implementation of this helped expand the knowledge on Machine Learning and Python in a fun, realistic and informative way. With the help of Guidance on YOLOv5 provided, this process is much easier and more enjoyable.