

Configuration Manual

MSc Research Project MSc. in Data Analytics

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Configuration Manual

Sudharsan Ramesh

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1 Introduction

This is the configuration manual of the project "Improvements in Aerial Object Detection: Comparing YOLOv7 with YOLOv5 for Fine Drone and Bird Detection in Volatile Environments". This setup documentation contains all of the relevant data, including the equipment I utilized, software and hardware specifications, crucial code screenshots, and reproducibility requirements. The specifications are detailed in Section 2, which includes the Software Standard and Hardware Specifications.

2 Specifications

The following chapters go through the software and hardware requirements for this proposed study.

2.1 Software Configurations

As we can see in Table 1, the summary of the software configurations that have been employed during this investigation. Figure 2 demonstrates the hardware and operating system performance.

Software	Configuration
Operational System	Windows 10 Home Single Language
Online IDE	Google Colab notebooks
Coding Language	Python
Coding Language Version	Python 3.7
Additional Tools Used	LabelImg, Google Colab

Table 1: Software

2.2 Hardware Configurations

Table 2 illustrates the hardware configurations used in this investigation.

Table 2: Hardware

Hardware	Configuration
System	Intel(R) Core(TM) 4210U
Operation System	Windows 10 Home Single Language

RAM	6.00 GB
Storage	1 TB
Libraries	cv2, os, torch, tensorflow, yaml, utils
Graphic Card	Intel (R) HD Graphics Family

Item	Value
OS Name	Microsoft Windows 10 Pro
Version	10.0.19045 Build 19045
Other OS Description	Not Available
OS Manufacturer	Microsoft Corporation
System Name	DESKTOP-BFK0U5B
System Manufacturer	LENOVO
System Model	20AMS1XB00
System Type	x64-based PC
System SKU	LENOVO_MT_20AM_BU_Think_FM_ThinkPad X240
Processor	Intel(R) Core(TM) i5-4300U CPU @ 1.90GHz, 2494 Mhz, 2 Core(s), 4 Logical Pr
BIOS Version/Date	LENOVO GIET98WW (2.48), 08-08-2019
SMBIOS Version	2.7
Embedded Controller Version	1.18
BIOS Mode	UEFI
BaseBoard Manufacturer	LENOVO
BaseBoard Product	20AMS1XB00
BaseBoard Version	0B98401 WIN
Platform Role	Mobile
Secure Boot State	Off
PCR7 Configuration	Elevation Required to View
Windows Directory	C:\Windows
System Directory	C:\Windows\system32
Boot Device	\Device\HarddiskVolume1
Locale	United Kingdom

Figure 1: Device and Windows Specifications

3 Integrated Development Environment

To conduct the research and run the code, Google Colab's was utilized, and Figure 2 below shows how it appears once I start it.

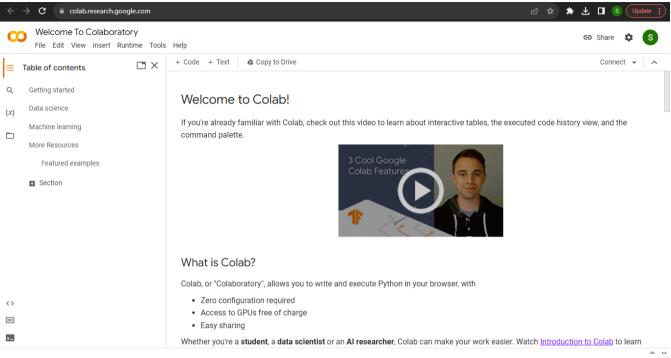


Figure 2: Google Colab launched

4 LabelImg

Download

4.1 Download Labelimg

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Labeling Graphical image annotation tool and label object bounding boxes									
	Labelimg project, hosted at <u>htt</u> r	os://github.com/tzutalin/labelImg	3. SourceForge is not affiliated	l with LabelImg. For m	nore information, see <u>the Source</u>	Forge Open			
Source Mirror Directory.									
Add a Review		Downloads: 229 T	his Week		Last Update: 202	21-05-05			

Figure 3: Downloading Software

4.2 Open LabelImg



Figure 4: LabelImg Application

4.3 Select Directory to open and save images

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IVEXT LINGGE	h Music	Semester 3	14-08-2023 00:09	File folder	
	Pictures	Shiva yolov5	10-05-2023 21:32 16-06-2023 10:19	File folder File folder	
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Figure 5: LabelImg Directory Selection

4.4 Draw and Save Annotations

When we select and save, the photograph is stored to the place we have specified previously. Afterwards we just click on the next photograph and repeat the process for each picture.

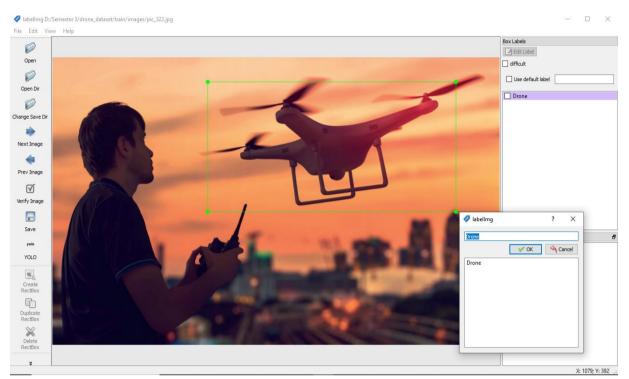
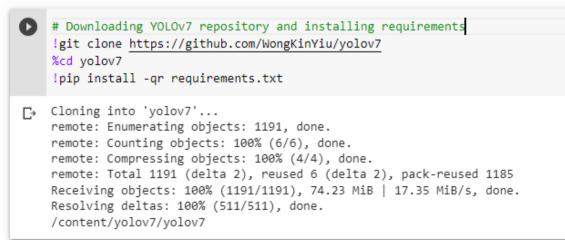


Figure 6: Image labeling

5 YOLOv7 Training Phase

5.1 Installing the YOLOv7 Environment

To get started with YOLOv7, we'll download the repository and apply the requirements. This will prepare our development platform so that object identification training and interpretation instructions can be executed.



After that, we can look at our Google Colab setup and begin installing requirements. We will be able to reduce training time by using the GPU, Torch is preconfigured on Colab, and it is a beneficial characteristic. As we do not attempt to run this code locally, there are no additional setups to be followed for YOLOv7.

5.2 Download Correctly Formatted Custom Dataset

Loading into this notebook our data

```
!unzip /content/Drone.zip -d /content/yolov7/
   Archive: /content/Drone.zip
E≯.
       creating: /content/yolov7/train/images/
      inflating: /content/yolov7/train/images/0080.jpg
      inflating: /content/yolov7/train/images/0081.jpg
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      inflating: /content/yolov7/train/images/0096.jpg
      inflating: /content/yolov7/train/images/0097.jpg
      inflating: /content/yolov7/train/images/0101.jpg
      inflating: /content/yolov7/train/images/1.png
      inflating: /content/yolov7/train/images/100.png
      inflating: /content/yolov7/train/images/101.png
                   Figure 8: Import Dataset
```

5.3 Model Architecture

We can use the pre-created yaml file because it specifies our model's characteristics, such as the number of classes, anchors, and layers.

! data.yaml ×
D: > Semester 3 > drone_dataset > Drone > ! data.yaml
1 train: /content/yolov7/train/images
<pre>2 val: /content/yolov7/valid/images</pre>
3 nc: 2
4 names: [drone, bird]
5

Figure 9: Yaml data

```
# define number of classes based on YAML
import yaml
with open("/content/data.yaml", 'r') as stream:
    num_classes = str(yaml.safe_load(stream)['nc'])
```

```
[ ] num_classes
```

'2'

Figure 10: Importing Yaml file

5.4 Train the Model

Based on the information we have Yolov7 is now ready to train with our yaml files on hand. To start training, execute the training instruction with the following parameters:

_ . . _ _ .

Table 3: Train model				
Image	416 x 416			
Size of the batch	16			
Epoch	300			
Data location	/content/data.yaml			
Weights	yolov7.pt			
Name	Yolov7_result			

. .

And run the training command:

```
#customize iPython writefile so we can write variables
from IPython.core.magic import register_line_cell_magic
@register_line_cell_magic
def writetemplate(line, cell):
    with open(line, 'w') as f:
       f.write(cell.format(**globals()))
```

To emable the following instructions: XX2 XX212F FM, in other operations, rebuild FensorFlow with the supportiset compiler flags 2023-08-12 215:06.08053: W tensorFloW compiler /f2tensorFluX [sty]. Namespace(weights='yolov7,tr', cfg-'', data-'/content/data.yml', hyp-data/hyp.scratch.ps.yml', epochs-300, batch_size-16, ing_si tensorband: Start with 'tensorFloW compiler /f2tensorFloW is ittm://lcabside.def hyperparameters: Ir00-01, Irfe-1, momentum-0.93, weight_decaye0.0005, warmug_epochs-3.0, warmug_momentum-0.8, warmug_blas_lr=0.1 wadd: Install weights & blasses for YOLOB logio with 'pip install wandb' (recommended) Overriding model.yml /rc-20 with nc-2 from n params module arguments e 1 1 928 models.common.Comv [3, 32, 3, 1] 1 -1 1 10500 models.common.Comv [64, 64, 3, 1] 2 -1 1 2020 models.common.Comv [64, 64, 3, 1] 5 -2 1 0 2000 models.common.Comv [64, 64, 3, 1] 5 -2 1 0 2000 models.common.Comv [64, 64, 3, 1] 5 -2 1 0 2000 models.common.Comv [64, 64, 3, 1] 6 -1 1 30902 models.common.Comv [64, 64, 3, 1] 7 -1 1 30902 models.common.Comv [64, 64, 3, 1] 8 -1 1 30902 models.common.Comv [64, 64, 3, 1] 7 -1 1 30902 models.common.Comv [64, 64, 3, 1] 7 -1 1 30902 models.common.Comv [64, 64, 3, 1] 8 -1 1 30902 models.common.Comv [64, 64, 3, 1] 9 -1 1 30902 models.common.Comv [64, 64, 3, 1] 9 -1 1 30902 models.common.Comv [64, 64, 3, 1] 9 -1 1 30902 models.common.Comv [64, 64, 3, 1] 10 [-1, -3, -5, -6] 1 0 models.common.Comv [64, 64, 3, 1] 11 [-1, -3, -5, -6] 1 0 models.common.Comv [64, 64, 3, 1] 12 -2 130 0.8050 0.112 40 416(10000, 1.235/it] 13 -2 130 0.8050 0.113 0.8240 0.80364 Epoch gpu_mem box obj cls total labels img_size 12 -2 13 0.8084 0.8025 Epoch gpu_mem box obj cls total labels img_size 12 -2 13 0.8092 0.90927 0.80157 0.80996 13 416: 1008X 52/52 [00:11:00:00, 2.24it/5] 13 1 125 139 0.229 0.33 416: 1008X 52/52 [00:11:00:00, 2.24it/5] 24 1				00 epochs				
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<pre>7 -1 1 36992 models.common.Conv [64, 64, 3, 1] 8 -1 1 36992 models.common.Conv [64, 64, 3, 1] 9 -1 1 36992 models.common.Conv [64, 64, 3, 1] 9 -1 1 36992 models.common.Conv [64, 64, 3, 1] 9 models.common.Conv [64] % cd /content/yolov7/ python train.pyimg 416batch 16epochs 300data '/content/data.yaml'weights 'yolov7.pt'name yolov7_resultsc Epoch gpu_mem box obj cls total labels img_size 1/299 1.316 0.08471 0.088546 0.01979 0.1112 40 416: 100% 25/25 [00:11<00:00, 1.23s/it] all 125 139 0.0586 0.113 0.0240 0.00304 Epoch gpu_mem box obj cls total labels img_size 1/299 5.666 0.087564 0.088919 0.01452 0.09907 38 416: 100% 25/25 [00:11<00:00, 2.241t/s] all 125 139 0.039 0.193 0.0304 0.00026 Epoch gpu_mem box obj cls total labels img_size 2/299 6.66 0.06017 0.01061 0.009287 0.01157 0.08996 19 416: 100% 25/25 [00:11<00:00, 2.091t/s] all 125 139 0.129 0.343 0.12 0.0338 Epoch gpu_mem box obj cls total labels img_size 3/299 6.66 0.06107 0.01061 0.009287 0.01157 0.08996 19 416: 100% 25/25 [00:11<00:00, 2.091t/s] all 125 139 0.233 0.297 0.256 0.0846</pre>							-	-
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Epoch gpu_mem box obj cls total labels img_size 3/299 6.6G 0.06107 0.01001 0.008984 0.08007 40 416: 100% 25/25 [00:12<00:00, 2.05it/s] Class Images Labels P R mAP@.5: n95: 100% 4/4 [00:01<00:00, 3.96it/s] all 125 139 0.233 0.297 0.256 0.0846	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0	16epochs 300 obj cls 008546 0.01797 Labels 139 obj cls 008919 0.01452 Labels 139 obj cls 009287 0.01157	total 0.1112 P 0.0585 total 0.039 0.039 total 0.08996	labels 40 R 0.113 labels 38 R 0.193 labels 19	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416:</pre>	<pre>100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 100% 25/25 [00:11<00:00, 2.09it/s]</pre>
3/299 6.6G 0.060107 0.01001 0.0808984 0.08007 40 416: 100% 25/25 [00:12<00:00, 2.05it/s] Class Images Labels P R mAP@.5: .95: 100% 4/4 [00:01<00:00, 3.96it/s]	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class	e g 416batch box 0.08471 0.(Images 125 box 0.07564 0.(Images 125 box 0.0691 0.(Images	16epochs 300 obj cls 008546 0.01797 Labels 139 obj cls 008919 0.01452 Labels 139 obj cls 009287 0.01157 Labels	total 0.1112 P 0.0585 total 0.039 0.039 total 0.08996 P	labels 40 R 0.113 labels 38 R 0.193 labels 19 R	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5</pre>	<pre>100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s]</pre>
3/299 6.6G 0.06017 0.01001 0.080894 0.08007 40 416: 100% 25/25 [00:12<00:00, 2.05it/s] Class Images Labels P R mAP@.5: .95: 100% 4/4 [00:01<00:00, 3.96it/s]	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class	e g 416batch box 0.08471 0.(Images 125 box 0.07564 0.(Images 125 box 0.0691 0.(Images	16epochs 300 obj cls 008546 0.01797 Labels 139 obj cls 008919 0.01452 Labels 139 obj cls 009287 0.01157 Labels	total 0.1112 P 0.0585 total 0.039 0.039 total 0.08996 P	labels 40 R 0.113 labels 38 R 0.193 labels 19 R	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5</pre>	<pre>100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s]</pre>
Class Images Labels P R mAP@.5 mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.96it/s] all 125 139 0.233 0.297 0.256 0.0846	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125	16epochs 300 obj cls 008546 0.01797 Labels 139 obj cls 008919 0.01452 Labels 139 obj cls 009287 0.01157 Labels 139	total 0.1112 p 0.0585 total 0.039 0.039 total 0.08996 p 0.129	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12</pre>	<pre>100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s]</pre>
all 125 139 0.233 0.297 0.256 0.0846	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all gpu_mem	e g 416batch 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125 box	16epochs 300 obj cls 008546 0.01797 Labels 139 obj cls 008919 0.01452 Labels 139 obj cls 009287 0.01157 Labels 139 obj cls	total 0.1112 p 0.0585 total 0.09907 p 0.039 total 0.08996 p 0.129 total	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343 labels	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12 img_size</pre>	<pre>100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s] 0.0338</pre>
	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all gpu_mem 6.6G	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125 box 0.0691 0.0	16epochs 300 obj cls 308546 0.01797 Labels 139 obj cls 308919 0.01452 Labels 139 obj cls 309287 0.01157 Labels 139 obj cls .01001 0.008984	total 0.1112 p 0.0585 total 0.09907 p 0.039 total 0.08996 p 0.129 total 0.08096	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343 labels 40	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12 img_size 416:</pre>	<pre>100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s] 0.0338 100% 25/25 [00:12<00:00, 2.05it/s]</pre>
	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all gpu_mem 6.6G Class	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125 box 0.06107 0. Images	16epochs 300 obj cls 200546 0.01797 Labels 139 obj cls 200919 0.01452 Labels 139 obj cls 2009287 0.01157 Labels 139 obj cls .01001 0.008984 Labels	total 0.1112 p 0.0585 total 0.09907 p 0.039 total 0.08996 p 0.129 total 0.08007 p	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343 labels 40 R	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12 img_size 416: mAP@.5</pre>	<pre>: 100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 : 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 : 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s] 0.0338 : 100% 25/25 [00:12<00:00, 2.05it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.96it/s]</pre>
Epoch gpu_mem box obj cls total labels img_size	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all gpu_mem 6.6G Class	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125 box 0.06107 0. Images	16epochs 300 obj cls 200546 0.01797 Labels 139 obj cls 200919 0.01452 Labels 139 obj cls 2009287 0.01157 Labels 139 obj cls .01001 0.008984 Labels	total 0.1112 p 0.0585 total 0.09907 p 0.039 total 0.08996 p 0.129 total 0.08007 p	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343 labels 40 R	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12 img_size 416: mAP@.5</pre>	<pre>: 100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 : 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 : 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s] 0.0338 : 100% 25/25 [00:12<00:00, 2.05it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.96it/s]</pre>
	%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299 Epoch 3/299	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all gpu_mem 6.6G Class all	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125 box 0.06107 0 Images 125	16epochs 300 obj cls 308546 0.01797 Labels 139 obj cls 308919 0.01452 Labels 139 obj cls 309287 0.01157 Labels 139 obj cls .01001 0.008984 Labels 139	total 0.1112 p 0.0585 total 0.09907 p 0.039 total 0.08996 p 0.129 total 0.08007 p 0.233	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343 labels 40 R 0.297	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12 img_size 416: mAP@.5 0.12</pre>	<pre>: 100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 : 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 : 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s] 0.0338 : 100% 25/25 [00:12<00:00, 2.05it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.96it/s]</pre>
	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all gpu_mem 6.6G Class all	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125 box 0.06107 0 Images 125 box	16epochs 300 obj cls 308546 0.01797 Labels 139 obj cls 308919 0.01452 Labels 139 obj cls 309287 0.01157 Labels 139 obj cls .01001 0.008984 Labels 139 obj cls	total 0.1112 p 0.0585 total 0.09907 p 0.039 total 0.08996 p 0.129 total 0.08007 p 0.233 total	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343 labels 40 R 0.297 labels	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12 img_size 416: mAP@.5 0.256 img_size </pre>	<pre>: 100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 : 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 : 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s] 0.0338 : 100% 25/25 [00:12<00:00, 2.05it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.96it/s]</pre>
	<pre>%%time %cd /conten !python tra Epoch 0/299 Epoch 1/299 Epoch 2/299 Epoch 3/299 Epoch</pre>	t/yolov7/ in.pyim gpu_mem 1.31G Class all gpu_mem 5.66G Class all gpu_mem 6.6G Class all gpu_mem 6.6G Class all gpu_mem 6.6G	e g 416batch box 0.08471 0.0 Images 125 box 0.07564 0.0 Images 125 box 0.0691 0.0 Images 125 box 0.06107 0 Images 125 box	16epochs 300 obj cls 308546 0.01797 Labels 139 obj cls 308919 0.01452 Labels 139 obj cls 309287 0.01157 Labels 139 obj cls .01001 0.008984 Labels 139 obj cls	total 0.1112 p 0.0585 total 0.09907 p 0.039 total 0.08996 p 0.129 total 0.08007 p 0.233 total	labels 40 R 0.113 labels 8 0.193 labels 19 R 0.343 labels 40 R 0.297 labels	<pre>img_size 416: mAP@.5 0.0249 img_size 416: mAP@.5 0.0304 img_size 416: mAP@.5 0.12 img_size 416: mAP@.5 0.256 img_size </pre>	<pre>100% 25/25 [00:30<00:00, 1.23s/it] mAP@.5:.95: 100% 4/4 [00:06<00:00, 1.73s/it] 0.00364 100% 25/25 [00:11<00:00, 2.24it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.05it/s] 0.00626 100% 25/25 [00:11<00:00, 2.09it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.64it/s] 0.0338 100% 25/25 [00:12<00:00, 2.05it/s] mAP@.5:.95: 100% 4/4 [00:01<00:00, 3.96it/s] 0.0846</pre>

Figure 11: Training the YOLOv7

5.5 Evaluate Custom YOLOv7 Detector Performance



```
# trained weights are saved by default in our weights folder
     %ls runs/
     train/
[ ] %ls runs/train/yolov7_results/weights
     best_278.pt
                   epoch_049.pt
                                  epoch_149.pt
                                                 epoch_249.pt
                                                                epoch_297.pt last.pt
     best.pt
                   epoch_074.pt
                                  epoch_174.pt
                                                 epoch_274.pt
                                                                epoch_298.pt
     epoch_000.pt epoch_099.pt
                                  epoch_199.pt
                                                 epoch_295.pt
                                                                epoch_299.pt
     epoch_024.pt epoch_124.pt epoch_224.pt
                                                 epoch_296.pt
                                                                init.pt
[ ] # when we ran this, we saw .007 second inference time. That is 140 FPS on a TESLA P100!
     # use the best weights!
     %cd /content/yolov7/
     python detect.py --weights /content/yolov7/runs/train/yolov7_results/weights/best.pt --img 416 --conf 0.1
     /content/yolov7
     Namespace (weights=['/content/yolov7/runs/train/yolov7_results/weights/best.pt'], source='/content/yolov7/v
     YOLOR 🚀 v0.1-126-g84932d7 torch 2.0.1+cu118 CUDA:0 (Tesla T4, 15101.8125MB)
     Fusing layers...
     RepConv.fuse_repvgg_block
     RepConv.fuse_repvgg_block
     RepConv.fuse_repvgg_block
     /usr/local/lib/python3.10/dist-packages/torch/functional.py:504: UserWarning: torch.meshgrid: in an upcomi
return _VF.meshgrid(tensors, **kwargs) # type: ignore[attr-defined]
     Model Summary: 306 layers, 36485311 parameters, 6194944 gradients, 103.2 GFLOPS
      Convert model to Traced-model..
      traced_script_module saved!
      model is traced!
```

Figure 13: Detecting the class after YOLOv7

5.7 Export Trained Weights for Future Inference

```
from google.colab import drive
drive.mount('/content/drive')
Mounted at /content/drive
```

5.8 Detecting Drone and Bird Images

```
O
   import os
    import random
    import matplotlib.pyplot as plt
    from PIL import Image
    # Path to the directory containing the images
    image_dir = '/content/yolov7/runs/detect/exp'
    # Get a list of image file names in the directory
    image_files = [f for f in os.listdir(image_dir) if f.lower().endswith(('.jpg', '.jpeg', '.png', '.gif', '.bmp'))]
    # Randomly select 20 images
    random_images = random.sample(image_files, 20)
    # Create a 4x5 grid for the collage
    num rows = 4
    num cols = 5
   # Set up the figure
   fig, axes = plt.subplots(num_rows, num_cols, figsize=(15, 12))
    plt.subplots_adjust(wspace=0.2, hspace=0.4)
    # Loop through the axes and display images
    for i, ax in enumerate(axes.flat):
        img_path = os.path.join(image_dir, random_images[i])
        img = Image.open(img_path)
       ax.imshow(img)
        ax.axis('off')
        ax.set_title(random_images[i])
    plt.show()
```

Figure 14: Show the detected Image

5.9 Final Output

