Ref:27/2/2022_GalaxyDetML

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Detection of Galaxy Shapes Using Machine Learning

Project Description:
a)Detetction of Galaxy Shape Types Using Machine Learning with Python is a Machine Learning Project Through which we will be Able to identify the different shapes of galaxies from their Pictures as input data.

b)This Project we will be using Image Classification with Python to Understand and Classify Different Shapes of the Galaxies.

c) Through this project we will be able to link Astrophysics and MachineLearning.

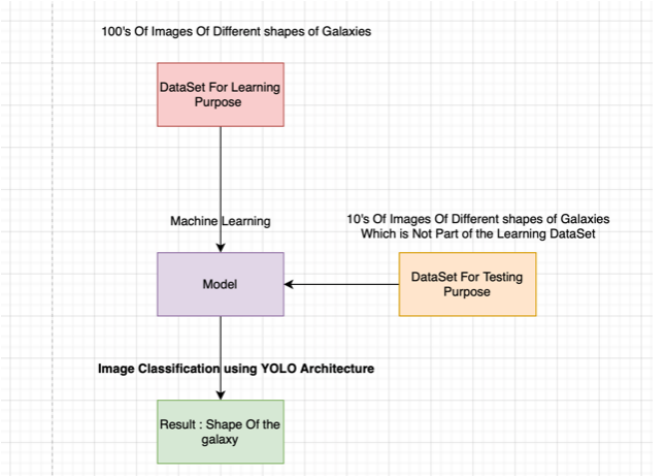
Methodology:
a)The Project is Fed with 100's of Images of Different Images of Different Types of Galaxies such as
a) Elliptical b) Irregular c)Spiral d) Peculiar
For Machine Learning Purposes.

b)The project then Use Python Programming and YOLO Architecture to Train the dataset.

c)After Learring Process , The Project is Checked with Random Images to see if it Identifies the Shape of the Galaxy Correctly

d)If Not , To Improve the Accuracy the First three Steps are Performed again with Higher Number Of Images.

Schematic Diagram:



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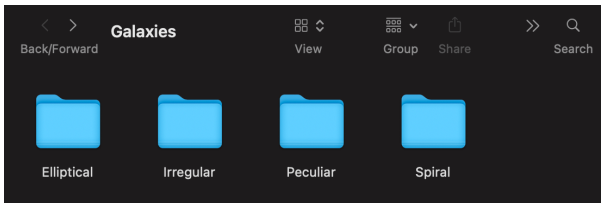
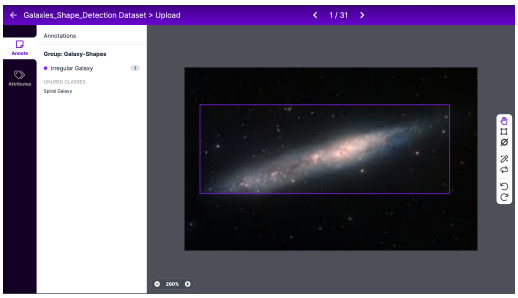
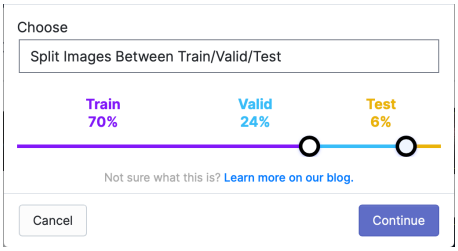
Documentation Of The Work:



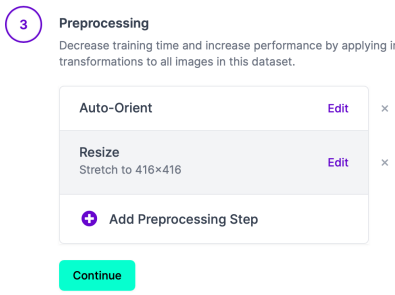
Step 0: Gather Images of Different types of Galaxies



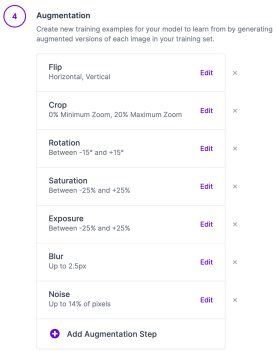
Step 1: Labeling of Images



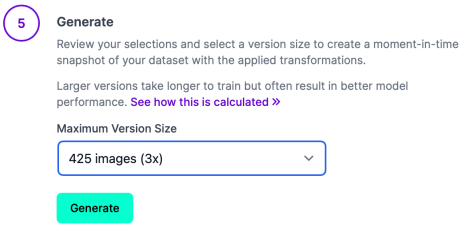
Step 2: Splitting Images B/W Train-Valid-Test



Step 3: Preprocessing The Images



Step 4: Augmentation of Images



Step 5: Generate Augmented Images

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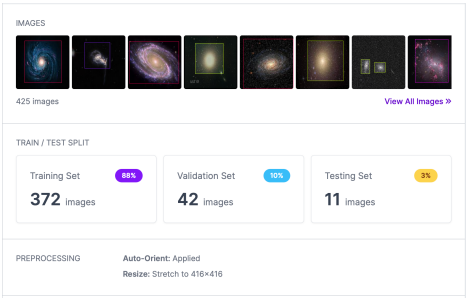
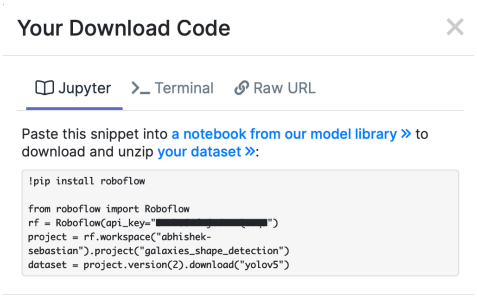


Step 6: Verify Images Split



Step 7: Copy Export Code

Step 8: Open Google Colab Link and Create Own Copy:

https://colab.research.google.com/github/roboflow-ai/yolov5-custom-training-tutorial/blob/main/yolov5-custom-training.ipynb

Run Certain Predefined Codes:

1)

Step 1: Install Requirements

```
#clone YOLOv5 and
!git clone https://github.com/ultralytics/yolov5  # clone repo
%cd yolov5
%pip install -qr requirements.txt # install dependencies
%pip install -q roboflow

import torch
import os
from IPython.display import Image, clear_output  # to display images

print(f"Setup complete. Using torch {torch.__version__} ({torch.cuda.get_device_properties(0).name if torch.cuda.is_available() else 'CPU'})")
```

2) Run The Exported Piece of Code Already Copied Earlier.

3) Run The Machine learning Code .

```
!python train.py --img 416 --batch 16 --epochs 150 --data {dataset.location}/data.yaml --weights yolov5s.pt --cache
```

4) The Model Starts to learn From The training set , The Number of Epochs,Batches Can be Changed accordingly

5) After 150 Epochs are Mentioned in The Code , the learning process is Completed.

```
      Epoch    gpu_mem       box       obj       cls    labels  img_size
    144/149      1.52G   0.02572   0.01558  0.001527        42       416: 100% 8/8 [00:01<00:00,  6.91it/s]
                 Class     Images     Labels          P          R     mAP@.5 mAP@.5:.95: 100% 1/1 [00:00<00:00, 29.34it/s]
                   all          5         14      0.988          1      0.995      0.736

      Epoch    gpu_mem       box       obj       cls    labels  img_size
    145/149      1.52G   0.02154   0.01217   0.00125        32       416: 100% 8/8 [00:01<00:00,  7.12it/s]
                 Class     Images     Labels          P          R     mAP@.5 mAP@.5:.95: 100% 1/1 [00:00<00:00, 29.42it/s]
                   all          5         14       0.99          1      0.995       0.71
```

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6) Check Inference with Trained Weights

Run Inference With Trained Weights

Run inference with a pretrained checkpoint on contents of `test/images` folder downloaded from Roboflow.

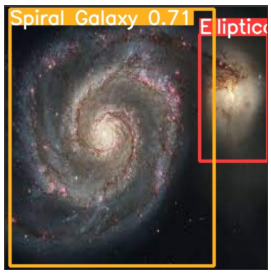
```
!python detect.py --weights runs/train/exp/weights/best.pt --img 416 --conf 0.1 --source {dataset.location}/test/images
```

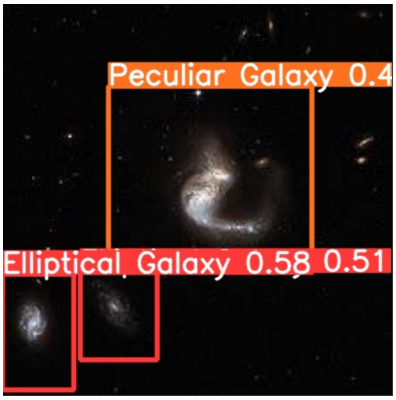
```
#display inference on ALL test images

import glob
from IPython.display import Image, display

for imageName in glob.glob('/content/yolov5/runs/detect/exp/*.jpg'): #assuming JPG
    display(Image(filename=imageName))
    print("\n")
```

7) Results from The Testing Set





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Application For This Project:
With Wide usage of Artificial intelligence and machine leanring in different fields, it is evident if we use the same in astrophysics we will be able to easily detect and identify the shape of the galaxies from Telescopic Images .

Reference
[1] González, R. E., Munoz, R. P., & Hernández, C. A. (2018). Galaxy detection and identification using deep learning and data augmentation. Astronomy and computing, 25, 103-109.
[2] Liu, J., & Wang, X. (2020). Tomato diseases and pests detection based on improved Yolo V3 convolutional neural network. Frontiers in plant science, 11, 898.

Thanks to : YOLOv5 + Roboflow Custom Training Tutorial from RoboFlow
https://www.youtube.com/watch?v=x0ThXHbtqCQ

Github:https://github.com/abby1712

Linkedin:https://www.linkedin.com/in/abhisheksebastian/