Realtime Traffic Sign Detection

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Team name: -

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**Introduction:**

Traffic signs convey vital information such as speed limits, lane changes, pedestrian crossings, and potential hazards. With the ever-increasing volume of vehicles on the roads, accurately detecting and interpreting traffic signs is essential for assisting drivers in making informed decisions and complying with traffic regulations. It also plays a vital role in providing critical information to autonomous vehicles, allowing them to understand road regulations, make informed decisions, and navigate complex traffic scenarios. In this article, we will explore the traffic signs recognition project, which employs traffic sign recognition using CNN to improve road safety through effective traffic sign classification. Discover how deep learning enhances accuracy and efficiency in recognizing vital road signs.

**Model’s Working:**

The presented model has trained on the YOLO(Version5) object detection algorithm, which was released by Ultralytics in June 2020 and currently being state of the art among other algorithms. YOLO (You only look once) is a creative convolutional neural network (CNN) for doing object detection in real-time with high accuracy of 97.4 %. This algorithm applies a single neural network to the full image, and then divides the image in to regions and predicts bounding boxes and probabilities for each part. The predicted probabilities weight these bounding boxes. The algorithm “you only look once” at the image in the sense that it requires only one forward propagation pass through the neural network to make predictions. After non-max suppression (which makes sure that the object detection algorithm only detects each object once), it then outputs recognized objects.

**Capabilities:**

1. Real-Time detection and classification up to 45 fps

2. Accuracy as high as 98%

3. Robust model - detects in all weather conditions

4. Trained on 61 classes

5. Able to detect a wide variety of signs (for ex. Indian, European, American traffic signs)

Speed limit (20km/h), Speed limit (30km/h), Speed limit (50km/h), Speed limit (60km/h), Speed limit (70km/h), Speed limit (80km/h), End of speed limit (80km/h), Speed limit (100km/h), Speed limit (120km/h), No passing, No passing for vehicles over 3.5 metric tons, Right-of-way at the next intersection, Priority road, Yield, Stop, No vehicles, Vehicles over 3.5 metric tons prohibited, No entry, General caution, Dangerous curve to the left, Dangerous curve to the right, Double curve, Bumpy road, Slippery road, Road narrows on the right, Road work, Traffic signals, Pedestrians crossing, Children crossing, Bicycles crossing, Beware of ice/snow, Wild animals crossing, End of all speed and passing limits, Turn right ahead, Turn left ahead, Ahead only, Go straight or right, Go straight or left, Keep right, Keep left, Roundabout mandatory, End of no passing, End of no passing by vehicles over 3.5 metric tons.

**Specifications:**

YOLOv5 is released in four different versions namely -YOLOv5s, YOLOv5m, YOLOv5l, YOLOv5x.

We have implemented our model using YOLOv5s algorithm because its fast as well accurate enough

to perform real time classification. We have collected our dataset from sources like Kaggle (GTRSB: German Traffic Sign Recognition Benchmark), it comprises a total of 2796 images which includes about 43 classes for image classification, with some classes having many images and others just a few. 2269 of these images are used for training purposes and the remaining 527 images are used for testing and validation purposes.

Firstly, all the images are converted into 640x640x3pixels (3 represents the RGB channels) and after

performing some normalization and pre-processing tasks these images are fed into the model for

training. Model is trained for 800 epochs and achieves mAP of 0.5(Mean Average Precision) equal to 91.75% and mAP of 0.5:0.95 equal to 74.08%.

**Directions to Run the Code:**

1. Go to the project directory

2) Firstly, install all the required dependencies using the requirements.txt file-

If you are using windows machine:

Type - pip install -r requirements.txt in your cmd.

Or if you are using anaconda prompt-

Type - conda install --file requirements.txt

3) Then go to the directory named Codes using the command-

Type - cd Codes

4) Before running the next command, put your test file in the directory named Test.

Type - python detect.py --source ../Test/{name of your file}

NB: If we are wants to test on image but not in real time

e.g.- If your image name is test.jpg, then put your image in the directory named Test and then run

python detect.py --source ../Test/test.jpg

5) Above same step can also be used to test the model on video files.

6) For running on Webcam run python detect.py --source 0

7) A pop-up window appears, showing the bounding boxes of all Traffic signs present in that frame with their label and accuracy score. FPS for each frame is also shown in the top-left corner of that window.

**References:**

1) GitHub link to the Ultralytics repository- <https://github.com/ultralytics/yolov5>

2) Kaggle link for some images of the dataset- https://www.kaggle.com/datasets/meowmeowmeowmeowmeow/gtsrb-german-traffic-sign

3) YOLO Documentation: https://docs.ultralytics.com/