EXPLORATORY PROJECT ON

SELF DRIVING CAR

(Using deep learning)

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Contents

Aim:

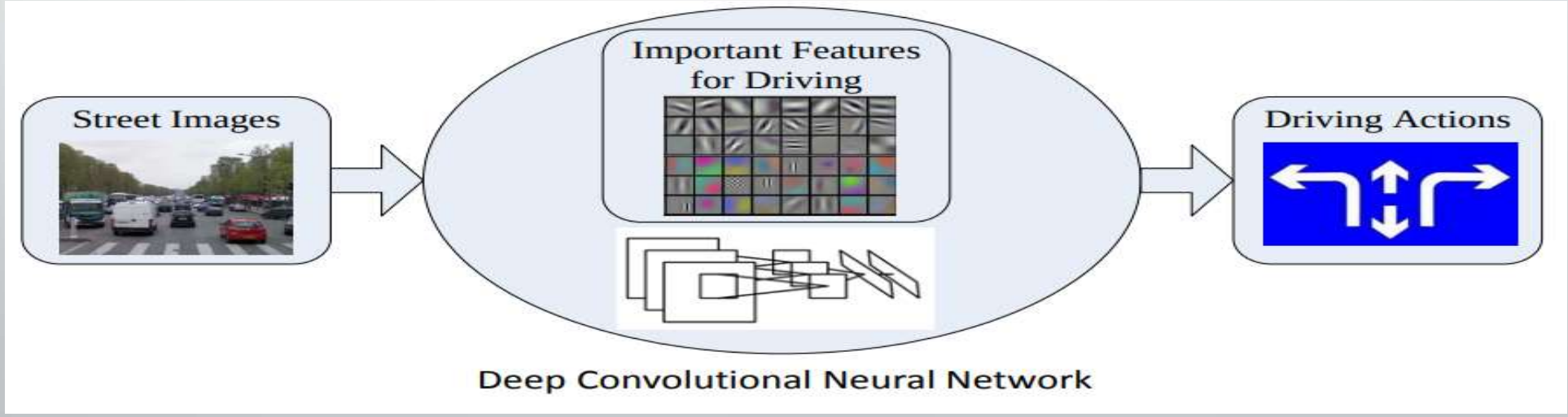
Detection of Lane, objects, and traffic signals during autonomous driving.

Abstract :

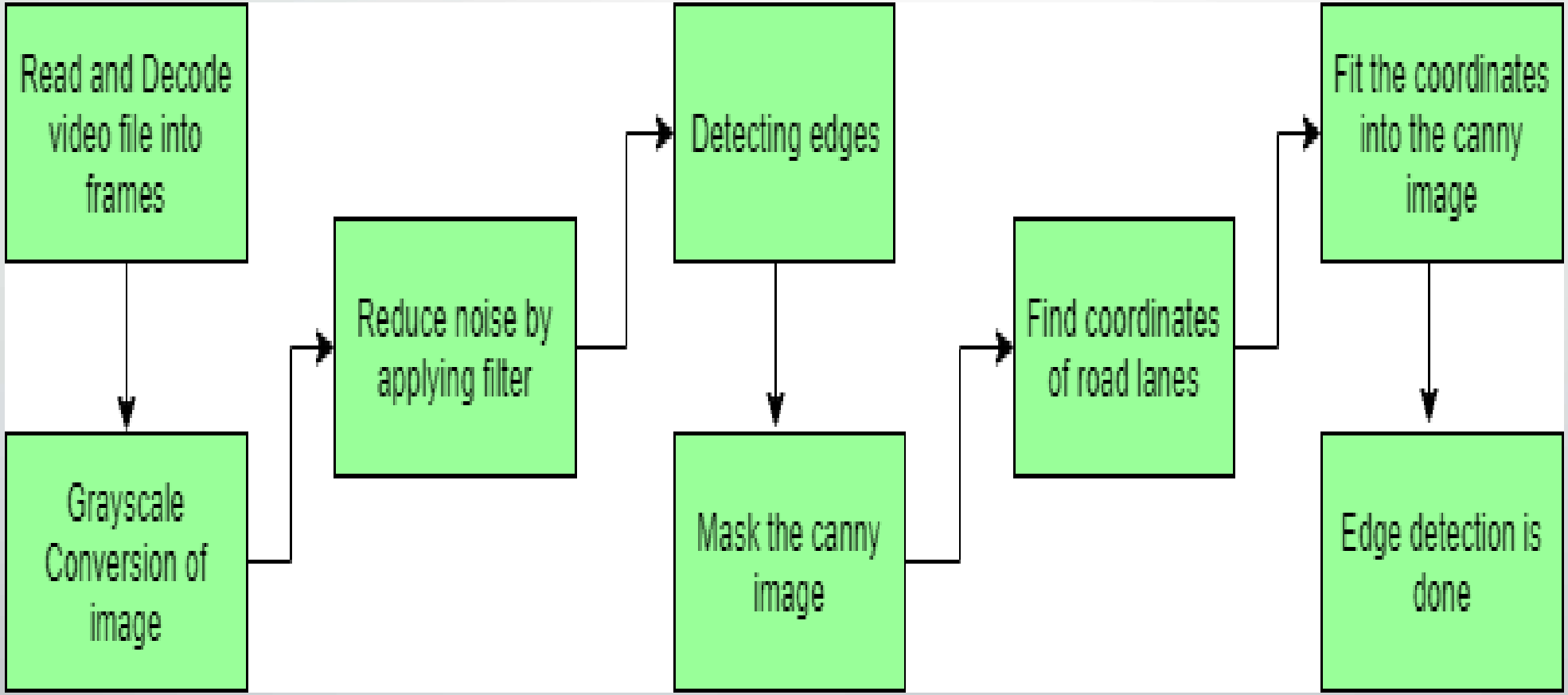
- A self-driving car, also known as an autonomous car or driverless car, is a vehicle that can travel between destinations without the need of any human effort.
- They can process streams of data from different sensors such as cameras, LiDAR, RADAR, GPS, or inertia sensors.
- This data is then modeled using deep learning algorithms, which then make decisions relevant to the environment the car is in.

Why deep learning?

- Salient features can be automatically detected and processed by deep learning algorithm
- A mapping between features and actions is established during training
- While ImageNet Classification Challenge there are many categories, training images , validation images and testing images
- low error rate of deep learning: ~15.3%

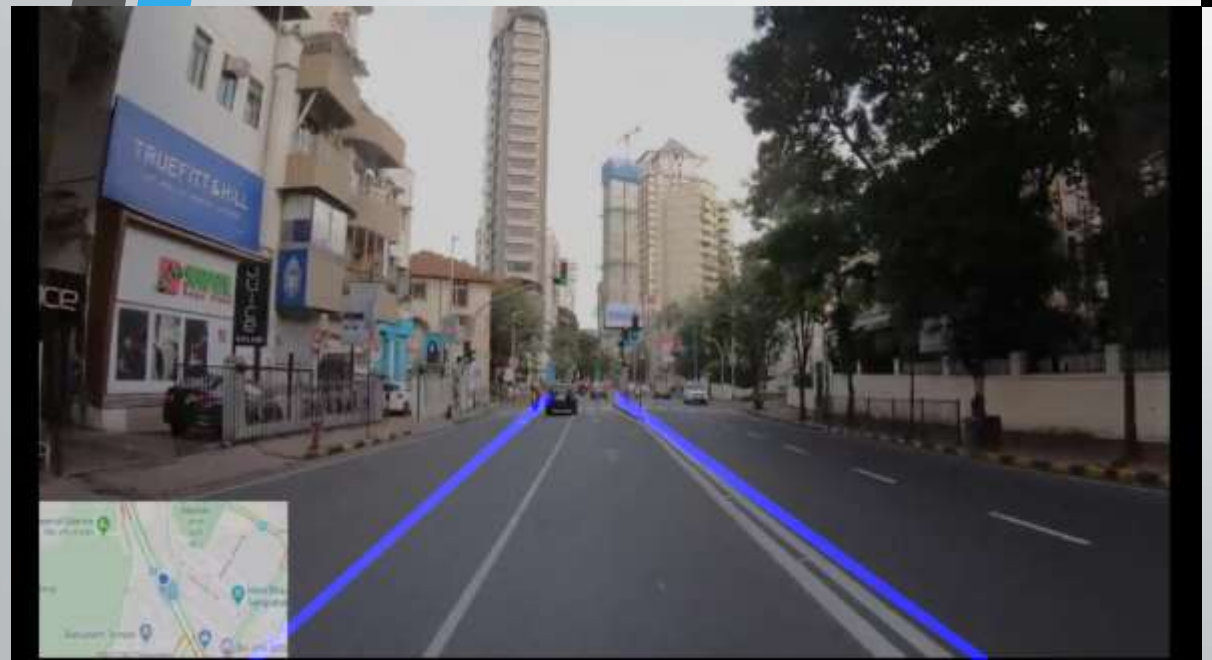


Lane detection



Example:

Input



Output

YOLO (You Only Look Once)

- The YOLO algorithm consists of various variants. Some of the common ones include tiny YOLO and YOLOv3.

- YOLO uses the following techniques
  - Residual blocks
  - Bounding box regression
  - Intersection Over Union (IOU)

- Yolo has high Speed, High accuracy and Learning capabilities

Object detection

- Object Detection is done by Yolo algorithm
- YOLO detects and recognizes various objects in a picture (in realtime).
- Object detection in YOLO is done as a regression problem and provides the class probabilities of the detected images.
- The algorithm requires only a single forward propagation through a neural network to detect objects.
- Prediction in the entire image is done in a single algorithm run, the CNN is used to predict various class probabilities and bounding boxes simultaneously.

Example:

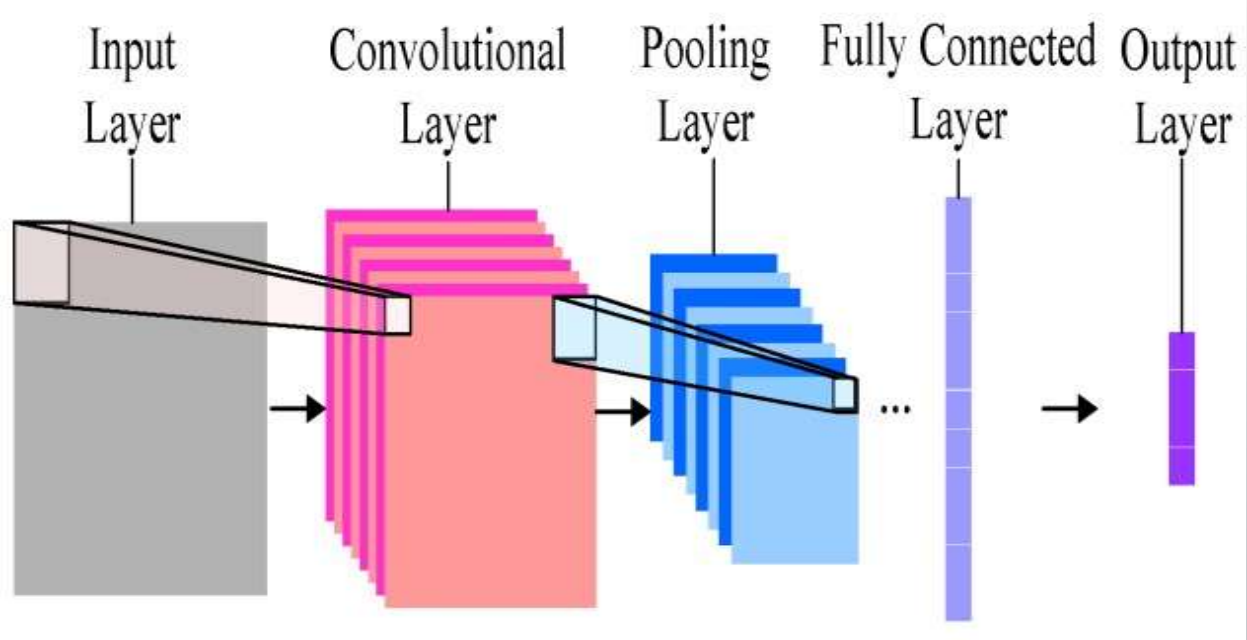
Input

Output

CNN (Convolutional Neural Network)

A convolutional neural network (CNN) is a type of artificial neural network used in image recognition and processing that is specifically designed to process pixel data.

- **Working of CNN**



Traffic sign detection and recognition

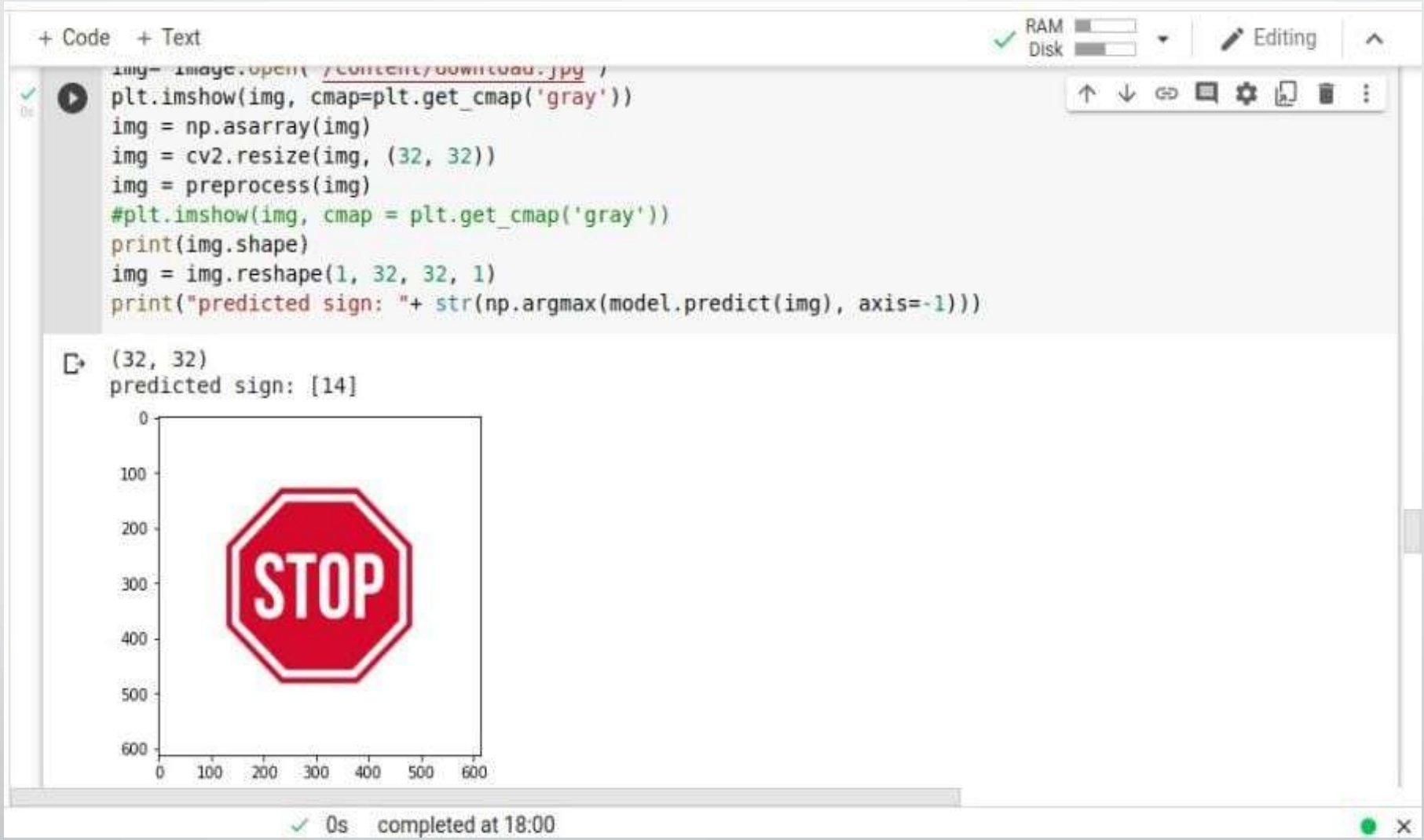
Detection:

- Image obtained from the camera in the car is preprocessed before detection starts.
- It involve converting the obtained RGB image into an HSV image.
- Once the HSV image is obtained, the following steps would be to detect objects based on their color, determine their shape, and validate the object to be a traffic sign.

RECOGNITION:

- Can be implemented with the help of TensorFlow and CNN .
- Used the German Traffic Sign Benchmark data set for training and testing
- All the layers of the proposed CNN have Rectified Linear Unit (ReLu) activation
- After every two convolutional layers, a max-pooling layer is added to improve processing speed.
- The loss of the model is set to categorical cross-entropy, and adam is used as an optimizer. The metric used is accuracy. Epochs with a backward pass are used to increase the accuracy of the prediction.
- Converted the image into the dimension of shape (1, 30, 30, 3) then it predicts the class, and the model.predict_classes(image) returns us a number between (0-42) representing the class it belongs to.

Example:


+ Code
+ Text
RAM
Disk
Editing
plt.imshow(img, cmap=plt.get_cmap('gray'))
img = np.asarray(img)
img = cv2.resize(img, (32, 32))
img = preprocess(img)
#plt.imshow(img, cmap = plt.get_cmap('gray'))
print(img.shape)
img = img.reshape(1, 32, 32, 1)
print("predicted sign: "+ str(np.argmax(model.predict(img), axis=-1)))
(32, 32)
predicted sign: [14]
0
100
200
300
400
500
600
STOP
0s completed at 18:00

Results and conclusion

- Lanes were detected properly using computer vision.
- Yolov3 algorithm which was used for object detection has high speed, accuracy and learning capabilities.
- However, the yolo algorithm couldn't detect small objects and low resolution objects.
- The yolov3 trained model may not be ideal when large datasets are hard to obtain.
- Accuracy of 98.9% was achieved using the CNN trained model for traffic sign detection.
- Drawback of the model is that it cannot be trained on a different dimension of images.
- Another limitation is that due to a large number of classes it was not able to predict a few traffic signs correctly.
- Hence, Autonomous vehicle technology is not yet mature enough. Still, it needs rigorous exposure to a wide range of traffic, landscape, and natural conditions in which the autonomous vehicles can be trained to perform as expected in actual traffic conditions.
- **Drive link:**

https://drive.google.com/drive/u/1/folders/191GBkms1knTJpZ2rqzKU5X2LVCSn733Y

Bibliography

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