

# Finding Lane Lines on the Road

## Pipelines

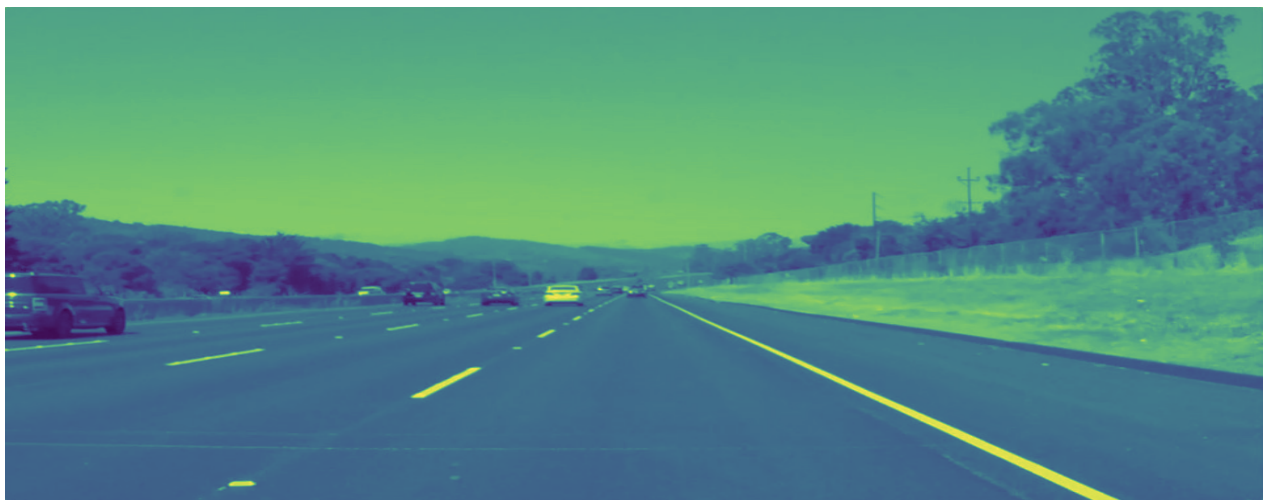
Original Image -



Following are the steps of pipelines -

1. Convert Original Image to grayscale Image. This is done in order to avoid complexity in image processing tasks and also It has been found that Image processing algorithms produces better result with Gray Scale on object detection or edge detection task as compared to RGB image.

Below is gray image of the original image.



2. Remove the noise of image using Gaussian filter. We have used Kernel of 5 for gaussian filtering as it produced better result. Below image is image after applying Gaussian filtering.



3. Road Lanes has high intensity than actual road, It means there is big change in intensity of road and lanes. This intensity change helps to find edges of lanes. Edges in the images is generated through gradient of image using canny edge function. We tried different threshold of for canny edges. It has been found that low\_threshold = 50 and high\_threshold=150 produces better result. It has also been found that 1:3 ratio of low\_threshold:high\_threshold was better than other ration. Below is the edge image.



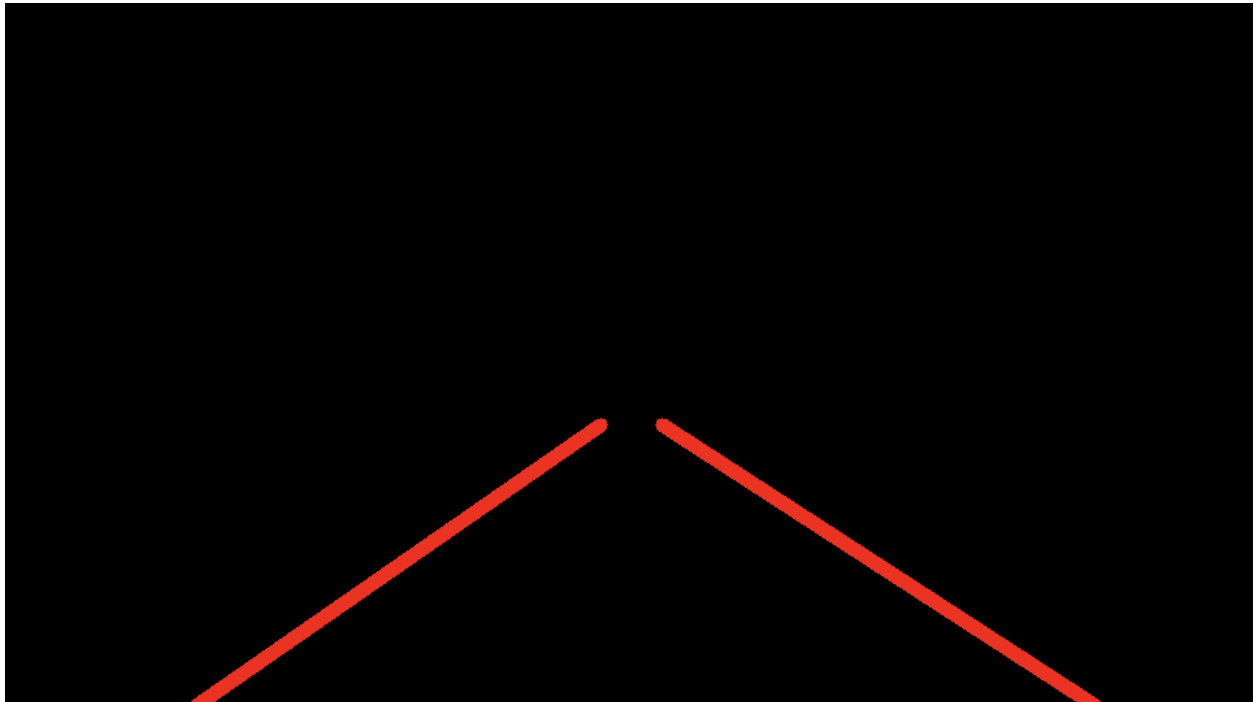
4. Area of interest image is generated by filtering area of polygon which of not interest.



5. Edge of the image is connected and line segment is generated using Hough transform. And finally all line segments are connected by draw\_line function.

Following are things incorporated in draw\_line function -

- a. Average slope of line segments of left lane and right lane is being calculated. That becomes the slope of line of left lane and right lane.
- b. Intercept of left lane and right lane is generated by picking the left top points for line segment and right top for right lane segment.
- c. Once we have line equation for left lane and right lane, line is extrapolated from  $y = y_{\text{max}}$  line as base.



6. Final output image is generated by applying step5 image on original image.



### **Potential short comings -**

1. Current system is highly dependent on left-top line segment for left lane and right-top line segment for right lane. If these line segment will have high error, it will directly be reflected in extrapolated line. It might not work in curve line as extrapolated line is always linear but actual lane is curve.
2. Area of interest in currently static polygon. If the image will be taken from some different angle of camera mounted on car, it might not work. For example - It might not work in curve line in few of the cases.

### **Possible Improvements -**

1. In place of drawing straight line, curve generated by combining small segments would be robust and will not rely on correctness of any particular line segments.
2. Area of interests can be generated dynamically by finding the appropriate polygon of interest from gradient image.