ENPM673 - Project2 - Group34

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1 Problem

Solution:

- **Developing an improved quality video :** Initially, we converted the video to frames and used image segmentation by blurring, converting the image to HSV and used the CLAHE function for better enhancement. By varying the threshold of the ciplimit we can observe the expected output at a particular threshold.

2 Problem

Solution : Steps involved in Lane Detection

- **Creating Video from image files :** A video file is created using the images provided in the data set-1. The video file is evaluated at each individual frame and the output is displayed after the analysis is complete. It is possible to change the video file being evaluated by changing the file path, video file name, and camera parameter value file in lines 23 and 24 of the code.
  Function used :

Figure 1: Initial frame

- **Undistortion of the Image** The video file frames are subjected to undistortion so as to get the upright view of image. This is performed using values read from the provided camera parameters.
  Function used :

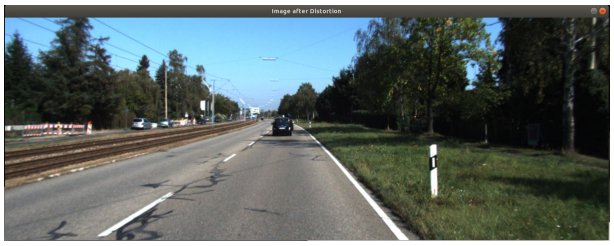

Figure 2: Undistorted Image

- **Denoising the image** The individual frame is subjected to de-noising to get a clear view of elements for further processing. This mostly eliminates noise of road textures and textures of the environment.
  Functions used : cv2.denoise

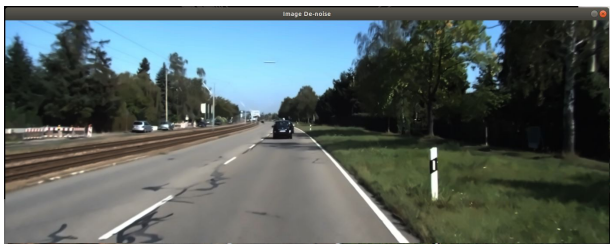

Figure 3: Denoised Frame

- **Edge Detection of Image and Masking the Image** The frames are later converted into binary images to allow the program to evaluate the line colors in comparison to the surroundings. Sobel edge detection method is used to find the edges in the binary images. As not all edges found using the Sobel are useful, it is necessary to mask out the unnecessary details. Fig-5 represents the frame after the above operations as the distant environment is masked out as black color and only the near field lines remain. This leaves distinct near field lines for evaluation.
  Functions used :
- **Applying Hough Transform** Next, the Hough Transform is applied to the image. As a result, the Hough Lines and Hough Peaks are generated on the edges detected. This results

in several Hough lines generated for the left and right side lines. The surrounding lines that do not meet the criteria are ignored. This leaves two distinct groupings of Hough lines that represent approximations of the left and right lane lines.
Functions used :

- **Polynomial Fitting** A first order polynomial function is calculated for each line group based on an averaging of the detected Hough lines. The result of this operation is a representative line for the left and right lane lines. The slope and constants obtained are used to obtain final points for the given initial points which are further plotted on the image. These lines project to infinity and reference the upper left origin of the image. It was necessary to convert the lines to reference specific intersect points at the base of the image and project along the lanes detected. This allowed the generation of the rectangle seen in the projected lane.

- **Turn Prediction** Turn prediction is performed by evaluating the slope of the left and right lane lines from the previous step. By determining a differential of the two, it is possible to determine if the lines are extending to the left, right, or straight (a threshold value can tune the determination of striaght vs. turning). In this case, a positive resulting slope indicates a left turn, negative slope indicates a right turn, and a (near) zero slope indicates a straight road. This threshold value is obtained using trial and error method.

  Lane position is determined by the intersect of the lane center (pictured in green in Figure 7) to the center of the image. This provides an indication of the position of the vehicle within the lane.

  The angle of the road turn and lane position are displayed in the cmd window.
  Functions used :

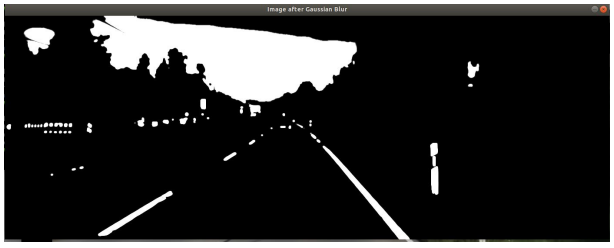

Figure 4: Binary Image

Figure 5: Edge Detection

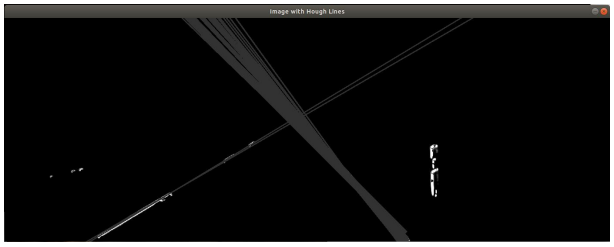

Figure 6: Hough Lines

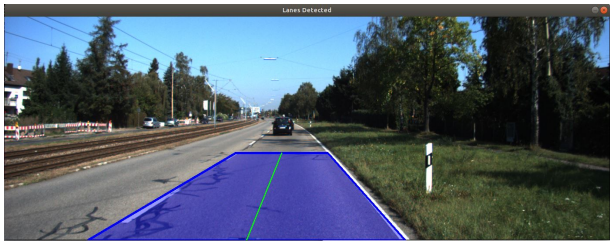

Figure 7: Projected lane detection

```
acf@acf-VirtualBox:~/Documents/ENPM673/Project 2/Code$ python Project2_P2V6_Grou
p34.py
Predicted Road Bend:
Road is turning Left at a predicted angle of  15.34  Degrees ahead


Lane Position:
Vehicle is to the Right of lane center
```

Figure 8: Printout of predicted turn angle and lane position