BBM 418 - Computer Vision Laboratory

HACETTEPE UNIVERSITY
Department of Computer Engineering

Programming Assignment 1
Spring 2022-2023
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Due Date: 23:59 pm on Wednesday, April 5th, 2023

Lane Detection Using Hough Transform

In this assignment, you will get familiar with edge detection methods and Hough Transform. First of all, you will extract and obtain the edge points from an image simply by using an edge detection method. Then, you will use these edge points to detect lanes by giving the map including edge points as an input for the Hough Transform (See Figure 1). As a dataset, you will use a subset of CULane dataset [1].

Figure 1: Hough Transform

Edge Detection and Hough Transform

Edge Detection: We can define edges as a sudden changes of brightness values in the image pixels. These sudden level of transition determines how the candidate pixel groups have potential to construct an edge. Generally several different edge detection methods are utilized to extract horizontal, vertical and diagonal edge information by constructing an edge map of an image (See Figure 2). Edge detection is a critical process because of that most of the shape information is intrinsically encoded in edges.

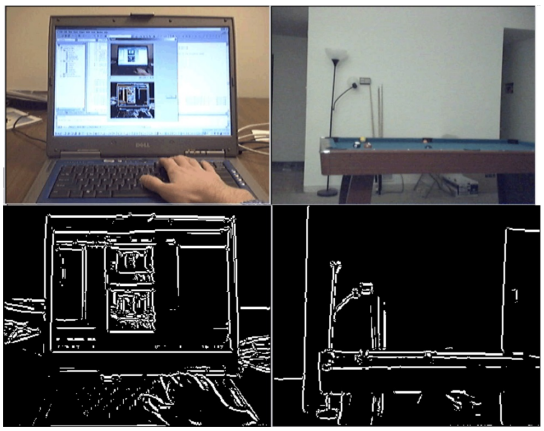

Figure 2: Example images and their corresponding edge images obtained by an edge detection methods

Hough Transform: Hough Transform is a voting method which developed to solve these issues:

1. Detection of a potential line object with respect to the given points
2. Determining the count of the potential line objects
3. Assigning the given points to the one of the potential line objects detected.

Hough Transform proposes to save vote for each potential line on which each edge point exists and search for the lines gotten.

Dataset

Dataset [1] consists of sample images including lanes (See Figure 3).

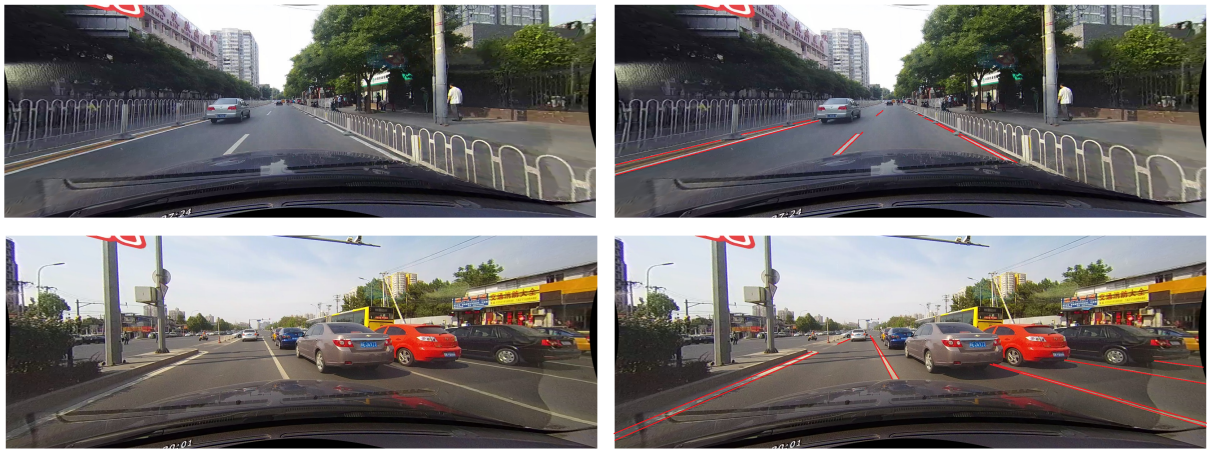

Figure 3: Sample images and the ground lanes from the dataset

The Implementation Details

1. Firstly, you are expected to implement Sobel Edge Detector and Canny Edge Detector given in the python notebook under the resources of Piazza.
2. Then, you are expected to utilize Hough Transform on obtained edge map from Sobel and Canny edge detectors to detect possible lanes within the image. **You must implement your own Sobel edge detector, Canny edge detector and Hough Transform method.**
3. You should also plot your detected lanes on the original image and segmentation map of the corresponding input image to measure visually how good your method's performance is.
4. You should compare the results of hough transforms used Sobel and Canny edge detectors with respect to their visual performance.
5. You should write your code to related code area, as well as answer the questions in the notebook.
6. Your code should read all images from a folder named "dataset" and write results.
7. You should use Python 3 for the assignment.

The Report

You will not write a report for this assignment. You will fill the code parts and answer the questions in the notebook. In addition, you will run the code cells to show the results of your codes.

What to Hand In

Your submission format will be:

- b<studentNumber>.ipynb (Python notebook you will fill)

Archieve this folder as **b<studentNumber>.zip** and send via Piazza Private Post.

Grading

The assignment will be graded out of 100:

- CODE: 0 (no implementation), 50 (a partial solution– only edge detections), 75 (a partially correct solution - edge detections and partially correct Hough Transform), 100 (a correct solution).

Academic Integrity

All work on assignments must be done individually unless stated otherwise. You are encouraged to discuss with your classmates about the given assignments, but these discussions should be carried out in an abstract way. That is, discussions related to a particular solution to a specific problem (either in actual code or in the pseudocode) will not be tolerated. In short, turning in someone else's work, in whole or in part, as your own will be considered as a violation of academic integrity. Please note that the former condition also holds for the material found on the web as everything on the web has been written by someone else.

References

[1] `https://xingangpan.github.io/projects/CULane.html`