Cyclist Detection Project Report

Abstract

In the past year, a new bike lane on both sides of the road, in front of the house was constructed. Looking at the build plans, there was hope that it would be modified, due to the bike lane taking up valuable parking spaces. Unfortunately, these plans were not modified, which is how this project idea was born. The current office space is in the front of the house, with a clear view to the road and the bike lanes. For the past 1.5-2 years, before the bike lane construction, it was observed that there were very few people cycling along this route. With this project, it can be verified if the estimate of there being between 5-10 bike lane users is accurate.

Implementation

What was tried

In the first iteration of this system, the plan was to have a constant feed of the Region of Interest (ROI) and to use an Ultraltytics yolov8 nano model. After testing the model, it was decided that it would need to be trained on specific images of cyclists and e-scooter users. Due to the limited number of cyclists using the lane, the model was tested on a video of cyclists. While it did recognise the cyclists, it was slow, and not very accurate, as it would lose track of the cyclists as they were moving on the, in the videos case, road. It would either stop detecting them, or detect something else entirely, or detect the same cyclist at the later stage in the video, thus skewing the value of the number of cyclists. As such,a conclusion was reached that it would be too labour intensive to run the system and constantly, as well too inaccurate.

From this point on, it was decided to pivot, instead of having a constant live feed to check for cyclists, the system would work via motion detection. Once it detected motion in the ROI, it would take a snapshot and then check the photo for cyclists. This took some trial and error in adjusting thresholds to make the motion detection less sensitive, at the start it was being triggered by trees and bushes swaying in the wind.

As mentioned previously, the goal is for motion to be detected in the ROI. The bike lane is a reddish brown colour, and as such the idea was to identify it via colour. Upper and lower hsv values were provided to the system in the hopes that it would be able to detect the lane in both sunlight and shade. A mask was applied to the image as well, however this was short levied, as the changes in sunlight made it very difficult to identify, making the previously provided hsv values essentially obsolete. The masking also was not possible, unfortunately.

All of these attempts had their own separate code, such as getting and testing the hsv values, getting the coordinates, just testing the model, with no ROI.

What is currently implemented

Based on the experience from the previous attempts, as mentioned above, it was decided to define the ROI with coordinates, and to create a rectangle around the lane. This method will not be affected by changes in light, however, unfortunately, it is not very robust, as moving the webcam will of course move the ROI. Masking is no longer needed, and thus not performed. The collected data is stored in a table in SQLite.

Future ideas

As mentioned above, defining the ROI does not lend to the robustness of the system, a potential future fix for this would be to identify the lane with distinguishing features, such as a drawing of a bike, or perhaps the line in the middle splitting it for pedestrians and cyclists. In the case for this lane, the only distinguishing features are the colour, which as mentioned above is not viable for any changes in lighting, and the white lines on either side.

To prevent potentially counting the same cyclist twice, if for example they were detected going to school in the morning, and then returning in the afternoon, some sort of ID's could be assigned to the cyclists. This way the count will not be skewed, but there will be some additional data that the cyclists used the same route. However, if they are wearing school uniforms that may pose an issue, some specific feature must be used to identify the lane users, perhaps the colour of the bike, maybe the helmet being used. Unfortunately bikes do not have registration numbers, otherwise identifying them would be much too easy.

Perhaps in future iterations, both bike lanes could be monitored, instead of just the one in front of the house, to get more accurate data.