Ahmedabad
University

CSE623 Machine Learning

Weekly Report 1

Section 1

Submitted to Faculty: <u>Prof. Mehul Raval</u>

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Work Done This Week

During the first week of this project, our team focused primarily on understanding the purpose of this project, what is expected of us and what all ways could we train our model to get our desired output. We evaluated the dataset provided to get an idea about its structure and how suitable it is for the intended tasks. The dataset given has drone-captured aerial images of traffic intersections and their locality, along with text files with data about the OBB (Oriented Bounding Box), the vehicle classes and their heading angles. A large part of our effort this week went into the analyses of this data.

We started by extensively examining the data to determine its nature. Through this, we observed that the dataset has 2 main components- the drone-based aerial images and the corresponding text files containing annotation information, immediately highlighting the need for preprocessing and data remodelling to successfully use it. We discussed the different ways of preprocessing the text files into machine-readable files like CSV to use them in data analysis tools.

While exploring the dataset and ways to use it for the project, we encountered a number of issues. One of our concerns was the presence of augmented images where images of cropped vehicles have been fused onto the original image to address class imbalance. Although this method of image augmentation adds an effective sample size, the images were often in unrealistic places. Some examples for this are vehicles pasted on the road divider, the walls on the side or even the bushes. Along with this, we noticed that some of the images, generally the augmented ones, were blurry, which could further complicate the object detection and feature extraction from the final videos. This led us to discuss the need for data cleaning before we could preprocess the data.

Another issue we had was the size of the dataset. Over 20,000 images and their corresponding text files are in the dataset. Converting all of these into a standardized table would require an automated conversion pipeline that would differentiate between the vehicle type, the OBB coordinates and the heading angles for each image.

In our project, we need to distinguish a vehicle performing a hard stop and one that is performing a momentary stop, and for that, we need to identify and analyse the trajectory of each vehicle along with its velocity and change in orientation over a fixed period of time. However, the

dataset only contains images, rather than videos. Moreover, neither the images nor the text files contain any time stamps to get an idea about the time frame and the nomenclature doesn't follow any particular pattern or order either. The dataset is also randomly organized. The lack of temporal metadata makes it difficult to correctly determine the time interval between images and any assumptions made on our end can introduce a bias in the model.

Finally, we discussed the broader consequences of the difference between the given data and its application. When our final goal with the model is using it on video sequences to identify the vehicle hard and momentary stops, training the model using static images raises concerns with the model generalization. These meetings allowed us to understand the magnitude of the project and the key challenges we would face during it.

Overall, we dedicated this week to understanding the project definition, exploring the dataset and identifying the key challenges to find ways around them.

Work Planned for the Coming Week

Our main goal next week is to ensure that the issue of lack of temporal data is resolved. We plan to coordinate a meeting with the TA in order to elicit proper use of the dataset along with determining the presence of temporal elements. This discussion will play a critical role in establishing the path we take for the project, especially on the analysis of vehicle trajectories.

Along with this, we will perform an analysis of the referenced articles and videos attached to the original dataset. This is to determine the manner in which other researchers handled similar issues and whether their methodology also relies on temporal information. This will allow us to decide another strategy of attack.

Once we have the full picture and a solid course of action, we will shift our attention to the data preprocessing with conversion the text files in CSV files. Additionally, we are planning on learning more about Ultralytics and YOLO in regards to OBB.

We are expecting to have a clear working plan and a start on the preprocessing of text files by the end of the following week.