Local Vehicle Detection

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ABSTRACT

Vehicle detection is a very essential application for driver assistance system and autonomous self guided vehicles . In Bangladesh, there are various kinds of local vehicles like- rickshaw, CNG, leguna which we can see everyday on the road .For this project, a new high definition local vehicle dataset, containing 25,000 images is made on perspective of Bangladesh .This research work propose a video based vehicle detection. Experimental results using video collected from real world scenarios are provided, showing that the proposed method possesses accuracy and it can detect vehicle targets successfully in real life environment. The focus of the paper is to solve the problem of feature extraction and classification for detecting local vehicles . Thus, we propose using Histogram of Oriented Gradient(HOG) for feature extraction and Support Vector Machine(SVMs) for vehicle detection .The goal of this study is to identify the local vehicles individually and find the accuracy. We have also discussed general challenges and future work scopes and plans.

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Chapter 1

Introduction

In today's world, the intelligent transportation system plays a crucial role in the field traffic management to provide an efficient and reliable transportation system. One of the applications of the intelligent transportation system is to detect vehicles . Smart detection systems require the collection of processed data from respective procedures for regulation of classifying. In this regard, surveillance cameras have been installed in monitoring and control of traffic in the last few years. Image processing algorithms had been widely developed to monitor the motion of vehicles, humans or any other objects. Video processing of a traffic data obtained through prerecorded video is an instance of applications for advance cautioning or data extraction for real-time analysis of vehicles. However, the traditional vehicle systems may be declined and not recognized well due to the vehicles are occluded by other vehicles or by background obstacles such as road signals, trees, weather conditions and the performance of these systems depend on a good traffic image analysis approaches to detect and classify the vehicles. Here we have studied and analyzed previous works done on this area, identified research scope, understand the process, methods used and finally propose a model that might help us in vehicle detection with great accuracy. Vehicle detection and classifying them is not something new , but using it on data set, enrich with local vehicles is something not so common thing .

Chapter 2

Literature Reviews

2.1 Overview

This chapter depicts the works that are related to our works.We have studied several literature on our current work which is on vehicle detection. As we used machine learning models we also studied different machine learning approaches. In section 2.2 these literature were briefly described.

2.2 Related Works

There are so many studies in the field of vehicle detection using different types of methods . There are lots of article , journals on the topic of how we can use image processing and machine learning in detecting objects . Some papers are ,

2.2.1 Comparative Study of Computational Time that HOG-based Features Used for Vehicle Detection [1]

This paper studied the processes that HOG-based features were generated, selected, and used in vehicle detection and find one that takes the shortest time.The experimental results showed that process which VHOG preceded ELM provided a little less accurate than HOG preceded SVM did.

2.2.2 Pedestrian Crossing Detection Based on HOG and SVM[6]

This paper proposes a pedestrian cross-border detection method based on HOG and SVM . This method extracts the moving target through the GMM (Gaussian Mixture Model) background modeling and then extracts the characteristics of the moving target through gradient HOG. Finally, it uses SVM training to distinguish pedestrians from non pedestrians, completes the detection of pedestrians, and labels the targets.

2.2.3 Vehicle Detection with HOG and Linear SVM[7]

In this paper, they presented a vehicle detection system by employing Histogram of Oriented Gradients (HOG) for feature extraction and linear SVM for classification. They studied the influence of the color space on the performance of the detector, concluding that decorrelated and perceptual color spaces give the best results.

2.2.4 A Comparative Study On Machine Learning Algorithms Using Hog Features For Vehicle Tracking And Detection[8]

The main aim of this project is to use Histogram of oriented gradients (HOG) feature extraction algorithm to identify multiple vehicles in images and then classify them using various classification techniques.

Chapter 3

Data Collection & Processing

Here , we are using our own dataset containing more than 25,000 images where approximate 20,000 images are vehicles and 5,000 images are non vehicles .

3.1 Data Collection

We have taken videos using our own device of a busy street. and from those videos , we splited the videos into images into different frame and into different size . We also split one image into many pixels to enrich the dataset . We have introduced total 4 types of vehicles

- Car
- CNG
- Leguna
- Rickshaw

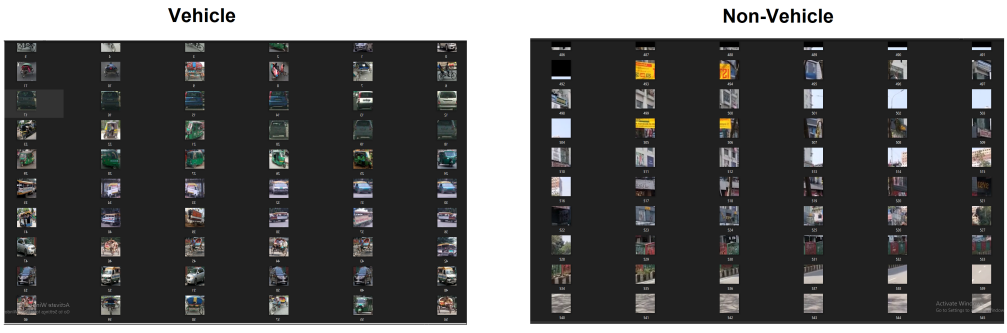

Figure 3.1: Dataset

3.2 Data Processing

In data processing , we have done some steps , as its our own dataset and we are making the dataset through videos

- we have taken video of roads and vehicles . Then split those videos into different frames apart from 4 seconds.
- Then cropped those images into different frames according to the vehicle .
- Resizing these cropped picture into 64*64 pixel
- Making all the images into .png file .

After collecting all these pictures of vehicle , for differentiating a vehicle to a non vehicle , we used road ,trees, length divider frames as non vehicle .

After collecting all the pictures of vehicle and non vehicle , there are approximately 25,000 pictures in where 20,000 are vehicle's and rest are non vehicle's .

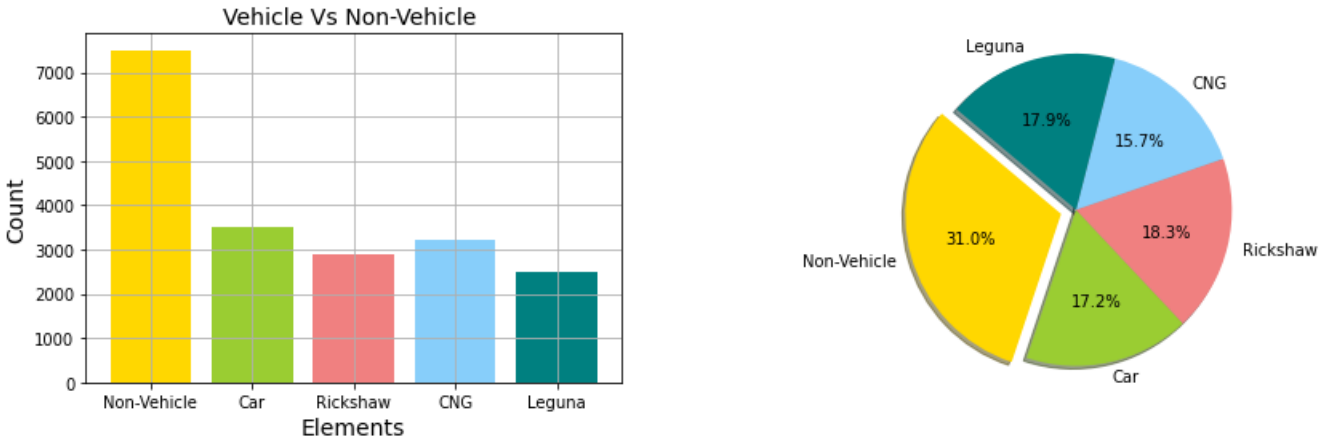

Figure 3.2: Approximate vehicle in Data set

Chapter 4

Methodology

4.1 Feature Extraction

4.1.1 Histogram of Oriented Gradient(HOG)

Histogram of Oriented Gradient (HOG) was first proposed by Dalal and Triggs for human body detection but it is now one of the successful and popular used descriptors in computer vision and pattern recognition. HOG counts occurrences of gradient orientation in part of an image. HOG divides the input image into small square cells (here we used 16*16) and then computes the histogram of gradient directions or edge directions based on the central differences. For improve accuracy, the local histograms have been normalized based on the contrast and this is the reason that HOG is stable on illumination variation. It is a fast descriptor in compare to the SIFT and LBP due to the simple computations, it has been also shown that HOG features are successful descriptor for detection.

After the preprocessing stage, feature extraction is performed by computing the HOG descriptors of every preprocessed image from the labeled dataset. These descriptors are used to train and test a linear SVM.

4.2 Model

4.2.1 Support Vector Machine(SVM)

SVM is a two-category model. The learning algorithm of SVM is the optimal algorithm for solving convex quadratic programming. The basic idea of SVM learning is to solve the

separation hyperplane that can correctly divide the training data set and have the largest geometric interval. For a linearly separable data set, there are infinitely many such hyperplanes, but the separating hyperplane with the largest geometric interval is unique .

4.2.2 Heat Map

A heat map is a two-dimensional representation of data in which values are represented by colors. A simple heat map provides an immediate visual summary of information.

There are so many ways to introduce heatmaps , but one thing is common is using the color. Using different colors , we apply heatmaps to visualize everything smoothly . It also very useful to more complicated datasets .

Chapter 5

Experiments and Results

5.1 Applying HOG

After processing the data set , feature extraction process is started . As before mentioned , we use Histogram of Oriented Gradient(HOG) fore extracting feature as it works best with [7] . We use different types of parameters to run the HOG smoothly(Table :5.1) . And we applied HOG in all the pictures of our dataset and extracted the features

Parameter	Value
Color space	YCrCb
Detection window size	64×64
Block size	16×16
Block stride	8×8
Cell size	8×8
Bins	9
Discrete derivative mask size	1
Gaussian smoothing window parameter	-1 (means no smoothing)
Block normalization type	L2-Hys
L2-Hys threshold	0.2
Gamma correction	False
Signed gradient	False
Nu	0.09

Table 5.1: Parameters Testing Values

5.2 Train Model

For Model as we mentioned before , we used Support Vector Machine classifier to detect vehicles . For this purpose we use the Function LinearSVM imported from sklearn.svm library . After applying SVM ,it returns labelled image and bounding box around the vehicle [Figure 5.1].

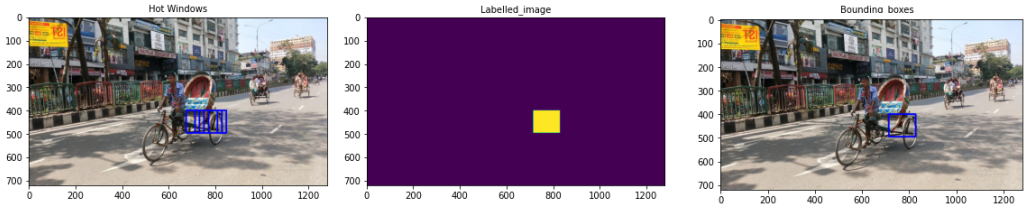

Figure 5.1: Applying SVM

5.3 Accuracy

After applying SVM classifier into the test images the accuracy is **99%** .

5.4 Applying Heat Map

After applying SVM and detecting the vehicles , for visualizing and to help detecting vehicles from videos , we use Heat Map . After heat map , it created a visualizing image with black and white , where white portion is the vehicle and black is non vehicle [figure 5.2]

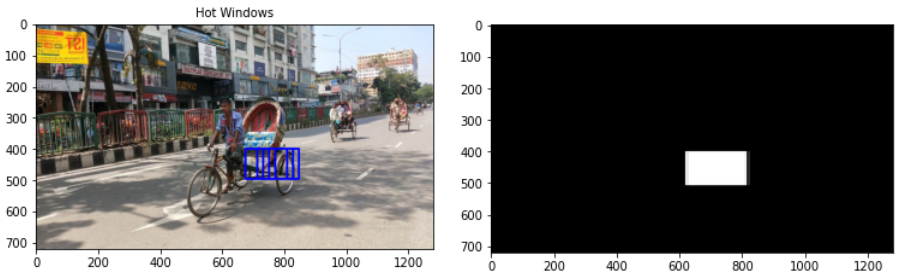

Figure 5.2: Applying Heat Map

5.5 Detecting On Video

After detecting vehicles from images with HOG, SVM and heat map, we applied this training to detect vehicles from videos . After applying the training on the video , it detect all the vehicles that is trained, along with every window [figure5.3]

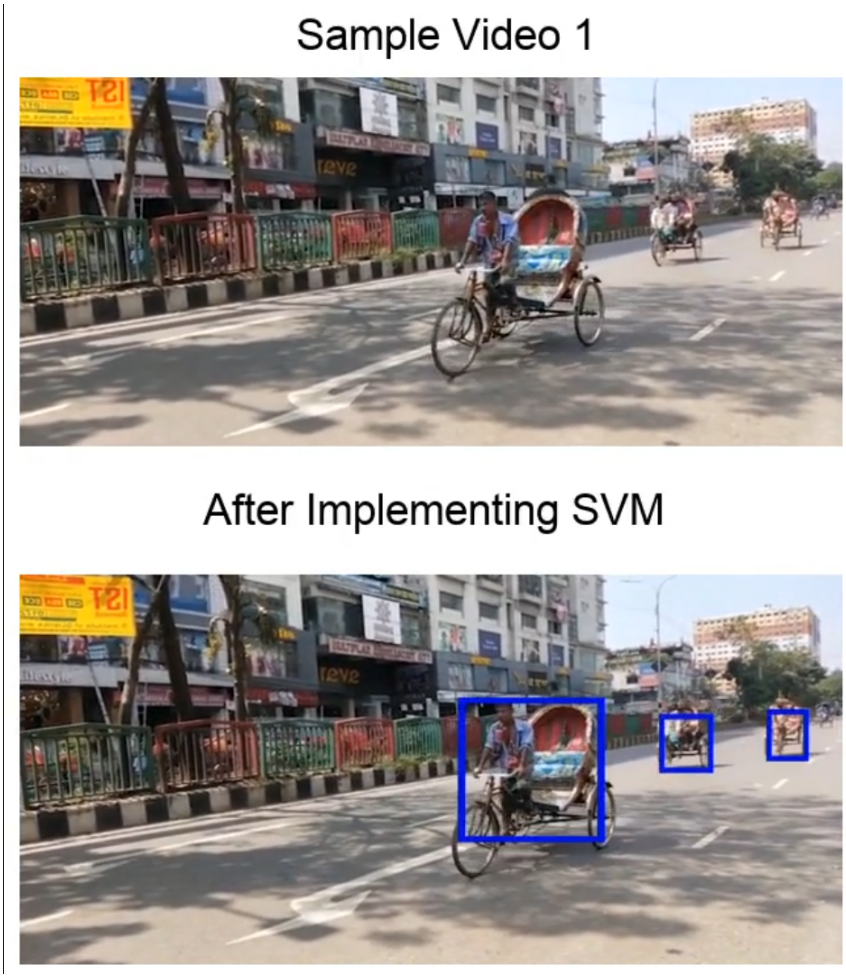

Figure 5.3: Applying SVM in Video

Chapter 6

Future Work and Conclusion

6.1 Challenges

As we move forward in the model , we faced so many challenges , the main challenge is to pre-process our data as this data is customized by our self. In creating bound box in sliding window also is a challenge for ours .

6.2 Conclusion

Vehicle detection is a very popular technology , real time video based vehicle detection is so popular now . There are so many new models like YOLO(You Only Look Once), CNN , RNN , these are so popular models that are being used in vehicle detecting . Support Vector Machine using HOG (Histogram of Oriented Gradient) is also a very popular process to detect vehicles . But the main difference here is our data , there are so many data set is available , but the data we used is made by us as we wanted to detect our local vehicles . So , we enrich our dataset with local vehicles so that after running the model we can detect our own local vehicles in any videos .

6.3 Future Work

As we wanted to detect our local vehicles , but for time consuming , we are detecting only four local vehicles . So we will enrich our data with all the local vehicles , so that after applying HOG and SVM classifier , the model can detect every local vehicles . We will also try to apply more models as there are so many new models , in future we will apply that to detecting local vehicles .

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