Night Time Headlight Detection Using CNN Based Object Tracking

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Abstract

Due to bad visibility many accidents take place at night time. High beams used by oncoming vehicles produce glare and pose discomfort to people, thereby contributing to a big portion of these accidents. Our main goal is to detect and track the oncoming vehicle's headlights from the images extracted from a camera by using a trained CNN model and switch the lighting of the vehicle from high beam to low beam. When there is no oncoming vehicle, the lighting automatically switches to high beam. This will reduce the discomfort caused to the oncoming vehicle's driver and improve visibility for both the vehicles greatly, thereby reducing the risk of an accident.

Keywords : Frames extraction, labeling, TF object detection API

I. INTRODUCTION

On the road, a large part of the reaction of drivers depends on their visibility of the road ahead. At night, the visibility of the road is very limited. When the driver of an oncoming vehicle does not bother to use low beam, this visibility further decreases and makes driving at night very dangerous. It normally takes 3 to 8 seconds for a driver's vision to come back to normal after being hit by the headlight beam of an oncoming vehicle. The system proposed in this paper is capable of detecting the headlights of vehicles coming ahead by processing the frames from a camera. It is important for this system to differentiate between headlights and other light sources at night like tail lights, streetlights etc. Preprocessing, training, and inference are the main steps of the proposed method. This system is implemented using Python.

II. METHODOLOGY

A. Extracting Frames From the Video Feed

First, we take the video signal given by the camera using open Cv library. The frames are extracted and saved in a separate directory to continue with labeling. While saving the frames we resize them to a resolution of 64X64 for better performance during real-time detection.

B. Labeling the Headlights

Using the tool LableImg, each of the frames extracted are to be labeled for headlights. The tool generates an XML file for each frame. These XML files contain information about the image like the resolution and name, and also the coordinates of the boxes bounding the headlights.

C. Converting XML to CSV

After labeling all the data, the XML files have to be converted to a CSV file. By using Python code we take each XML file. In the XML, we take the values of each attribute and add it to a Data Frame created by using Pandas Library. We then export this Data Fame as a CSV for further use.

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D. Converting CSV to TFRecords

In this paper we will use Tensorflow's Object Detection API to train our model for detecting the headlights. To use this API we need to feed the data as TFRecords. For this purpose, we need to convert the CSV into TFRecords. We take each row from the CSV ad convert it into corresponding TFRecord using Python code.

E. Training the Model

The data we prepared is now used for training the model. The model we use is Faster-Region-Convolutional Neural Network (RCNN). We use this model because it is fast and can be implemented in real-time scenarios like the one we are dealing with. This model runs the image through a CNN to get a Feature Map. It then runs Activation Map on Region Proposal Network which outputs interesting boxes. These interesting boxes use many dense layers to output the class and the bounding boxes coordinates. We use a pre trained RCNN model called faster RCNN inception. To train it, we need to make a configuration(.config) file with all the required parameters for training. We also need to create a label map for the model to use while training.

F. Using the Model

Once the model is trained, we import the inference graph generated during the training of the model. We then use a camera to feed the input. Then extract the frame and resize it to 64X64 to pass it to the model for detection. If we detect the headlight we can use a signal to use dipper.

III. RESULT

The results of this trained model are satisfactory with a mean squared loss of less than 0.03. It performs very well in low light conditions and detects the headlights with multiple sources of lights in a frame.

Fig. 1. Detection of Headlights With Background Lights

Fig. 2. Detection of Headlights With Background Noise

Fig. 3. Detection of Headlights Ignoring Tail Lights

IV. CONCLUSION

The results being satisfactory and fast processing time, the proposed technique is suitable for use in real time scenarios. This system can help contribute to a safer journey during the night and help reduce the number of accidents that take place during the night due to poor visibility caused by improper lighting.

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Vemuri Rani Mounika takes interest in learning new things that interest her. This has set her down this path of learning Artificial Intelligence. She is working with Accenture as a Software Engineer and has attended the Certified Artificial Intelligence Specialist program from Edvancer during the weekends. She is a B.Tech graduate in Information Technology from Lakkireddy Balireddy Engineering College.