Driver Drowsiness and Fog Monitoring System using Deep Learning

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Abstract: The drowsiness of the driver and Due to Fog the rash driving are the major causes of road accidents, which result in loss of valuable life, and deteriorate the safety in the road traffic. The Reliable and precise driver drowsiness systems and Fog Monitoring System are required to prevent road accidents and to improve road traffic safety. Various driver drowsiness detection systems have been designed with different technologies which have an affinity towards the unique parameter of detecting the drowsiness of the driver. This paper proposes a novel model of multi-level distribution of detecting the driver drowsiness using the Convolution Neural Networks (CNN) followed by the emotion analysis. The facial pattern of the driver is treated with images Convolution Neural Network (CNN) to detect and capture the behavior and driver's emotion. The proposed model is implemented using images and the experimental results prove that the proposed model detects the driver's emotion and drowsiness more effectively than the existing technologies.

Keywords Drowsiness · Driver · Convolutional Neural Networks · Fog Monitoring · Safety

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Introduction

According to published reports from the World Health Organization (WHO), traffic accidents are one of the top 10 causes that lead to death in the world. The reports demonstrate that the first cause of such crashes are drivers. Therefore, the detection of driver drowsiness could be a suitable methodology to prevent accidents. It also improves the performance of the Advanced Driver Assistance Systems (ADAS) and Driver Monitoring System (DMS); as a result, road safety.

Generally, the methods to detect drowsy drivers and Fog Monitoring system are classified in three types; vehicle based, behavioral based and physiological based. In vehicle based method, a number of metrics like steering wheel movement, accelerator or brake pattern, vehicle speed, lateral acceleration, deviations from lane position etc. are monitored continuously. Detection of any abnormal change in these values is considered as driver drowsiness and fog detection with prediction.

A driver drowsiness detection system based on Convolution Neural Network (CNN), for detecting the fatigue of the driver and the acceleration system of the vehicle.

A Fog Monitoring detected system based on the same Convolution Neural Network (CNN), for detecting the fog In front of the vehicle.

Problem Statement

Driver inattention may be caused by a lack of alertness while driving as a result of driver drowsiness and fogginess distraction. When an object or event draws a person's attention away from the driving task, this is referred to as driver distraction. Driver drowsiness, unlike driver distraction, does not have a triggering event and is instead characterized by a gradual withdrawal of attention from the road and traffic demands. Driver drowsiness and distraction, on the other hand, may have the same effects, namely decreased driving performance, longer reaction time, and an increased risk of crash involvement.

Related Work

According to the maker Esra, they have used AI to data mine certified human lead during drowsiness scenes. Customized classifiers for 30 facial exercises from the Facial Action Coding structure were made using AI on an alternate informational index of unconstrained verbalizations. These facial exercises fuse glimmering and yawn developments, similarly as different other facial turns of events. Additionally, head development was accumulated through modified eye following and an accelerometer. The effect on sluggishness on different looks have not been thought totally. This method for managing drowsiness area basically makes pre-notions about the significant direct, focusing in on glimmer rate, eye end and yawning.

Deep Learning Model for A Driver Assistance System to Increase Visibility on A Foggy Roads: This project the foggy infront of the car by capturing with the front camera and increases the visibility that will be display on the interior screen monitoring system.

Use Case Diagram:

Proposed Work

In this project,We added CNN layers for sequential model to perform training on data set. Binary-cross entropy as loss function because we need to predict two classes I.e foggy and drowsy nature of the Driver.The optimizer RMSprop is used to control the weight upgradation with Learning rate 0.001.Sigmoid activation function is appropriate for binary classes.Flask web Framework is used to integrate the saved model with web application.

1.1 Datasets

One dataset examined for this research. The mixture data set of Drowsy and the Foggy dataset from Kaggle. The details of eachdescribed in the following.

FOG-DROWSY Data set

The data set consists of mixed images of fog on car and driver feeling drowsy while driving on road.There are total 730 drowsy and 600 foggy images with 300*300 each pixel size.The images are with high quality .They have capturing of yawning positions of driver while driving i.e mouth-open,eyes-closed,hand raised,feeling dizziness .The foggy data images also have 300*300 pixel size .They contains the fog on glass .There are high and low foggy images in the data set.

Fig 1: Driver yawning image while driving

Fig 2: Foggy image

Preprocessing of the model

Preprocessing refers to all the transformations on the raw data before it is fed to the machine learning or deep learning algorithm. For instance, training a convolutional neural network on raw images will probably lead to bad classification performances.To train a network and make predictions on new data, your images must match the input size of the network. If you need to adjust the size of your images to match the network, then you can rescale or crop your data to the required size.

You can effectively increase the amount of training data by applying randomized augmentation to your data. Augmentation also enables you to train networks to be invariant to distortions in image data. For example, you can add randomized rotations to input images so that a network is invariant to the presence of rotation in input images. An augmented Image Datastore provides a convenient way to apply a limited set of augmentations to 2-D images for classification problems.

For more advanced preprocessing operations, to preprocess images for regression problems, or to preprocess 3-D volumetric images, you can start with a built-in datastore. You can also preprocess images according to your own pipeline by using the transform and combine functions.

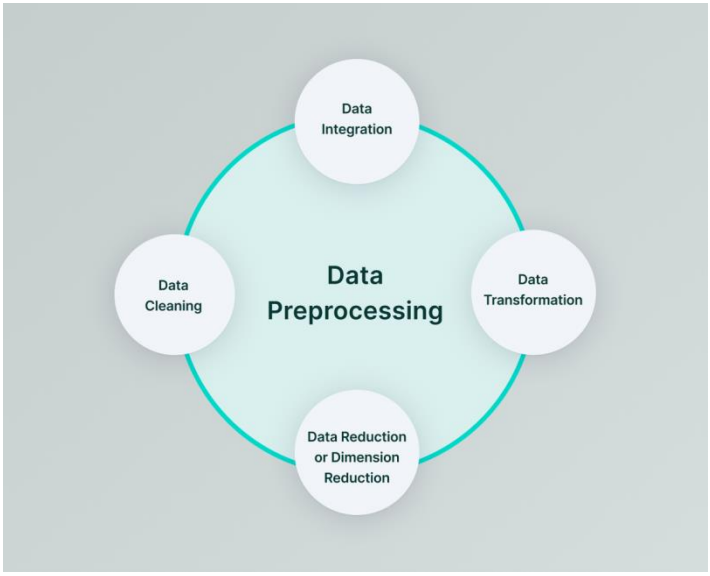


Fig 3: Data Preprocessing methods

There are different ways to Preprocess the data .The very common techniques are represented in the above Fig 3.The explanation to each one of them are as follows.

Data Cleaning :The process of detecting and correcting (or removing) corrupt or inaccurate records from a record set, table, or database is known as data cleansing. It refers to identifying incomplete, incorrect, inaccurate, or irrelevant parts of the data and then replacing, modifying, or deleting the dirty or coarse data.

Data Dimensionality Reduction: Image dimension should be reduced because space required to store the data is reduced as the number of dimensions comes down. Less dimensions lead to less

computation/training time. Some algorithms do not perform well when we have a large dimensions.

Data Transformation: Data transformation is the process of changing the format, structure, or values of data.For this project convolutional layers are used to reduce dimensions of data and transforms the images for training .

Data Integration: Data integration is the practice of consolidating data from disparate sources into a single dataset with the ultimate goal of providing users with consistent access and delivery of data across the spectrum of subjects and structure types, and to meet the information needs of all applications and business processes.

Model-Architecture:

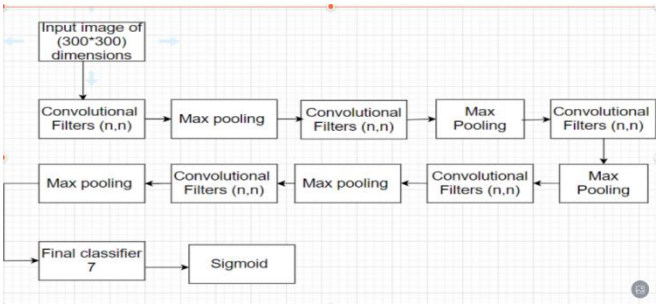


Fig 4: Model-Architecture Diagram

Model Architecture consists of input image of 300*300 pixel for both driver drowsiness and fogginess images.First we apply convolutional layer for the sequential model and Max Pooling with size (2,2).Five convolutions are added to the model followed by max pooling with size (2,2).Finally the flatten layer is added to dense with Sigmoid activation function.

Convolution layers=5
Max-Pooling=5 with size(2,2)
Input-shape=(300,300,3)

Post processing:

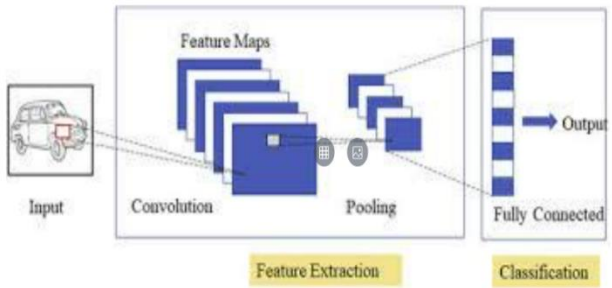


Fig 4: Post processing methods

The post processing techniques normally consists of model compilation,fitting and evaluation.

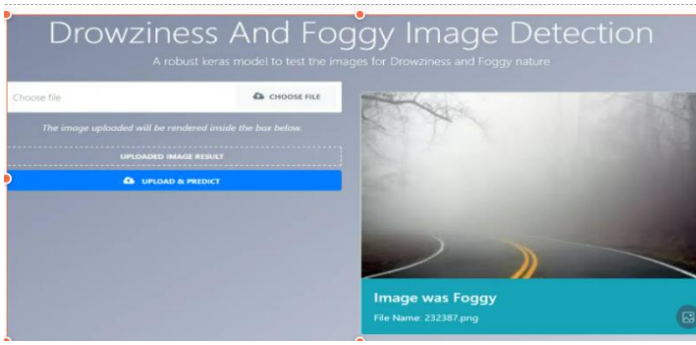
Model.Compile():The compilation is the final step in creating a model. Once the compilation is done, we can move on to training phase.It consists of three parameters.

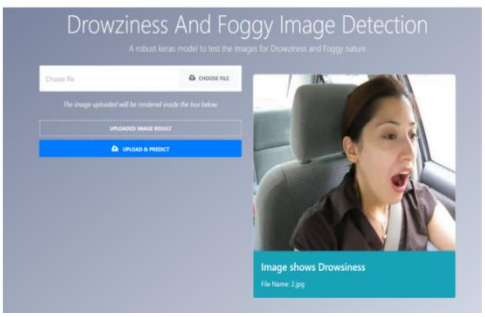
Loss Function:Loss function is used to find error or deviation in the learning process. Keras requires loss function during model compilation process.In our project we used binary_cross entropy because we have 2 classes to predict I.e drowsiness and fogginess images. Binary cross entropy compares each of the predicted probabilities to actual class output which can be either 0 or 1. It then calculates the score that penalizes the probabilities based on the distance from the expected value. That means how close or far from the actual value.

Optimizer :RMSprop is the optimizer used for our model .RMSprop is a gradient-based optimization technique used in training neural networks. This normalization balances the step size (momentum), decreasing the step for large gradients to avoid exploding and increasing the step for small gradients to avoid vanishing.

Accuracy: Accuracy is the quintessential classification metric. It is pretty easy to understand. And easily suited for binary as well as a multiclass classification problem. Accuracy is the proportion of true results among the total number of cases examined.

Results:





Conclusion:

In this project, A low-cost and A real-time driver drowsiness and Fog monitoring system has been proposed based on visual behavior and images captured using machine learning. An adaptive thresholding technique has been developed to detect driver drowsiness in real time. The developed system works accurately with the generated synthetic data. Subsequently, the feature values are stored and machine learning algorithms have been used for classification.
Here the system can detect the both images at a time and provide the results whether it was drowsiness or fog and, in the background, the predict the accuracy and loss of the images. We have used the CNN(Convolutional Neural Network),Multi-level Distribution in this project.

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