AN EFFICIENT TRANSFER LEARNING BASED APPROACH FOR DRIVER DROWSINESS DETECTION

A PROJECT REPORT

Submitted by

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ABSTRACT

The developments in technology over the years bring the support to drivers using smart vehicle systems,there has been substantial increase in road accidents too. The most significant reasons for the same is drowsiness.“Drowsiness” is defined as brief and involuntary intrusions of sleep that can occur at any time due to fatigue or a prolonged conscious effort.In a vehicle safety technology, driver drowsiness detection is major possible area to prevent a large number of sleep induced road accidents.This work, propose an efficient methods of deep learning techniques with adaptive deep neural networks based on MobileNet-V2 .It analyzes the videos and detects driver’s activities in every frame to learn features automatically and leverage the advantage of the transfer learning technique to train the proposed networks on our training dataset.. Empirical results demonstrate that the proposed method achieves a high accuracy of 95%. As they are very good feature extractors,and can capture and learn relevant features of drowsiness from an image or video at different levels similar to a human brain also instead of focusing on the two regions of the eyes and mouth, the proposed deep neural networks analyze the videos and detect the driver’s activities in every frame to automatically learn all features of drowsiness such as head orientation, yawning, eyelid opening, eye blinking, pupil diameter etc. Experiments were conducted on dataset collected with Haar cascade frontal face detector method and after training the session with transfer learning ,in the testing face deep neural network model called Caffe model for capturing the drivers face and analyzing the awake and drowsy state. By placing a particular count and if the person feel drowsy, by giving alarm alerting the driver. The effectiveness of the proposed method in accuracy and reliability. As transfer learning used it solves the problem of small training datasets, training time, and keeps the advantage of the deep neural networks.

OBJECTIVE

In recent years, building an intelligent systems for drowsy driver detection has become a necessity to prevent road accidents. Therefore, it requires a lot of research to design robust alert methods to recognize the level of sleepiness while driving,to suggest an efficient way.

• To detect the early symptoms of drowsiness before the driver has fully lost all attentiveness.

• To detect blinks and yawns based on appropriate thresholds for each driver.

• To analyzes the videos and detects driver’s activities in every frame to learn all features automatically.

• To leverage the advantage of the transfer learning technique to train the proposed networks on our training dataset.

FUNCTIONAL REQUIRMENTS

Hardware Requirements

Processor :Any Processor above 500 HZ

RAM :4 GB

Hard disk :4 GB or 8 GB reccomended

Input device :Standard Keyboard, High Resolution Camera and Mouse

Output device :VGA, High Resolution MonitorandS peaker

Software requirements

Operating System :Windows7 or above

Working Platform: AnacondaNavigator

Front end Framework :Qtdesigner, Pyqt5

Language Used :Python

SYSTEM MODULES

Data Set Collection

I had collected around 1000 drowsy and non drowsy image using haar cascade frontal face detection model.The repository has the models stored in XML files, and can be read with the OpenCV methods.Haar Cascade is a feature-based object detection algorithm to detect objects from images. A cascade function is trained on lots of positive and negative images for detection.Haar cascade uses the cascade function and cascading window. It tries to calculate features for every window and classify positive and negative. If the window could be a part of an object, then positive, else, negative.

Preprocessing

A real-world data generally contains noises, missing values, and maybe in an unusable format that cannot be directly used for machine learning models. Data pre-processing is a required task for cleaning the data and making it suitable for a machine learning model which also increases the accuracy and efficiency of a machine learning model.Identifying duplicates in the dataset and removing them is also done in this step.In these method precisely estimates the positions of facial landmarks using a training set of labeled facial landmarks on images. This method can be used for real-time detection to identify the facial features after detecting faces on an image.In this step, we extract video frames from input videos. The rate of selecting images from videos is 50 frames per seconds.

Training

Loading dataset and data augmentation.

Firstly loading the dataset by defining the path and categories. preprocessing the collected raw data into an understandable format.The main aim of this step is to study and understand the nature of data that was acquired in the previous step

and also to know the quality of data.As the dataset is of images which saved in the two folder awake and drowsy collected using haar cascades, loading them into proper size of 224*224 and format.Also in these step based on existing images in dataset, to improve dataset new images are creating by applying some augmentation steps like orientation ,horizontal flips,zooming shearing etc.

Splitting dataset and Training through transfer learning model

In order to extract features and train, the training dataset is passed through deep neural networks (DNNs). MobileNet-v2, is using and by making improvements in some layers of these networks to adapt the drowsiness detection to our model.Constructing an adaptive network by adding layers such as Flatten,Dense (Relu), Dropout, Dense (Softmax) and by suppressing the AveragePooling 2D layer of the MobileNet-v2 network. It aims at solving the problem of overfitting and helps the model to converge faster.

Transfer learning

Transfer learning refers to the situation where what has been learned in one setting is exploited to improve generalization in another setting. First train a base network on a base dataset and task, and then we repurpose the learned features, or transfer them, to a second target network to be trained on a target dataset and task. Taking advantage of the transfer learning approach, the proposed networks are pretrained on datasets of Bing Search API, Kaggle, and RMFD. We use the pre-trained weights and re-train them on our training dataset to fine-tune the parameters of these networks. This leads to faster learning, a shorter training time, and no requirement for large training datasets. During the training process, we decide to stop the training phase when the Lossvalue is not reduced.

Architecture of Mobilenet V2

MobileNetV2 is a convolutional neural network architecture that seeks to perform well on mobile devices. It is based on an inverted residual structure where the residual connections are between the bottleneck layers. The intermediate expansion layer uses lightweight depthwise convolutions to filter features as a source of non-linearity. As a whole, the architecture of MobileNetV2 contains the initial fully convolution layer with 32 filters, followed by 19 residual bottleneck layers.In MobileNetV2, a better module is introduced with inverted residual structure. Non-linearities in narrow layers are removed this time.With MobileNetV2 as backbone for feature extraction, state-of-the-art performances are also achieved for object detection and semantic segmentation.In MobileNetV2.

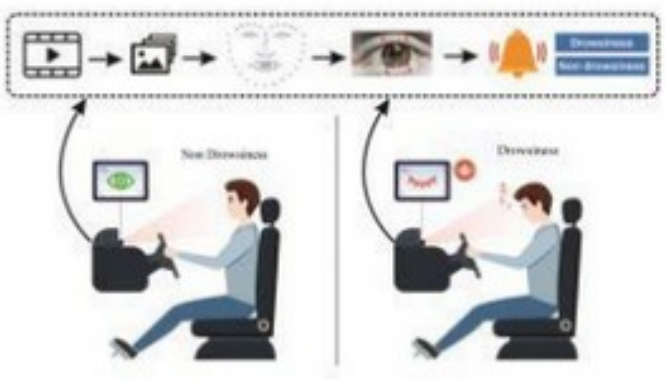
Testing

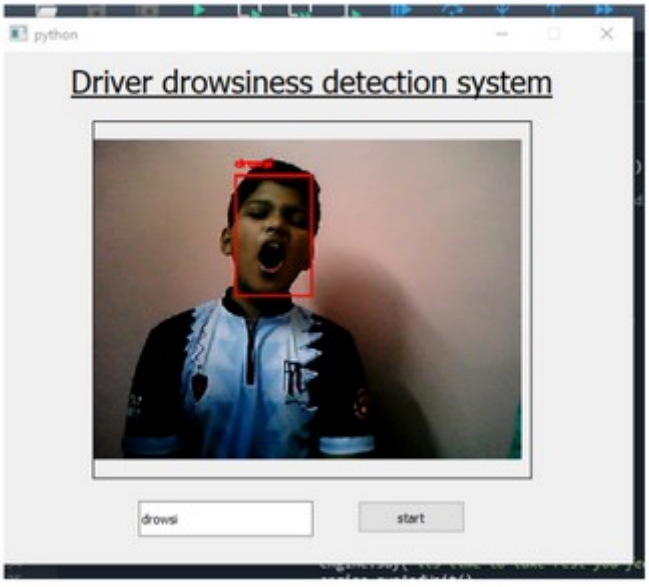
After training our model,Deep Neural Network Face Detector in OpenCV is using in the testing phase for face detection.In these stage by passing our trained model and caffe model it is predicting whether awake or drowsy.

Alarming the driver if drowsy

By placing a count value and increasing if the output is drowsy and decrease the count if awake.if the count value increases more than a threshold at a particular time limit the system will warn the driver by giving alarm that ”its time to take rest”.

RESULTS





CONCLUSION

The paper proposed a deep learning-based method which uses adaptive deep neural networks with the transfer learning approach for drowsiness detection.We designed and perfected these networks developed on the advanced networks of MobileNet-V2 , which are more efficient in terms of memory and complexity. The proposed networks are very good feature extractors, since they can capture and learn relevant features of drowsiness automatically.The dataset is collected by haar features face detector.The use of a transfer learning approach to well solve the problem of fast training, a small training dataset and accuracy improvement.Since the caffe model is used in capturing the drivers face it has its own advantages like Expressive architecture ,Speed for capturing frames per second,in built extensible code.This method develops 95% accuracy on predicting the result.The proposed method is useful for monitoring the fatigue of drivers, to give early warning of falling asleep,and thereby avoiding unfortunate traffic accidents.