ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) Vol. 9, Issue 8, August 2022

Driver Yawning Prediction Using CNN Recognizing Subtle Facial Actions

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Abstract: Driver Yawn is not an easy problem. The progressive of Yawning recognition is more subtle to compare general action. In this paper, we present an system that we developed to recognize facial gestures in static, frontal profile-view color face images. Hence, the Driver facial recognition is still a challenging problem in Alexnet. To propose a solution for Yawning recognition that uses a combination of Alexnet and specific image pre-processing steps. It described the innovative solution that provides efficient face and deep learning with AlexNet, which have a convolutional neural network that is 11 layers deep, it has achieved great success in the classification of Yawning classification. A variety of neuron-wise and layer-wise visualization methods were applied using a Alexnet, trained with a publicly available from given image dataset. So, it's observed that neural networks can capture the face action of Yawning classification.

I. INTRODUCTION

Science:

Data science is an interdisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data, and apply knowledge and actionable insights from data across a broad range of application domains.

Data science is the field of study that combines domain expertise, programming skills, and knowledge of mathematics and statistics to extract meaningful insights from data.

Data science can be defined as a blend of mathematics, business acumen, tools, algorithms and machine learning techniques, all of which help us in finding out the hidden insights or patterns from raw data which can be of major use in the formation of big business decisions.

DEEP LEARNING:

Deep learning is a branch of machine learning which is completely based on artificial neural networks, as neural network is going to mimic the human brain so deep learning is also a kind of mimic of human brain. It's on hype nowadays because earlier we did not have that much processing power and a lot of data.

MACHINE LEARNING

Machine learning is to predict the future from past data. Machine learning (ML) is a type of artificial intelligence (AI) that provides computers with the ability to learn without being explicitly programmed.

Process Of Machine Learning

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving.

EXISTING SYSTEM

Various investigation shave shown that driver fatigue is the main cause of traffic accidents. Research on the use of computer vision techniques to detect signs of fatigue from facial actions, such as yawning, has demonstrated good potential. However, accurate and robust detection of yawning is difficult because of the complicated facial actions and expressions of drivers in the real driving environment. Several facial actions and expressions have the same mouth deformation as yawning. A keyframe selection algorithm is designed to select the most representative frame sequence from subtle facial actions. This algorithm rapidly eliminates redundant frames using image histograms with low computation cost and detects outliers by median absolute deviation.Most of these methods are weak and lack temporal features.

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Moreover, these methods are inefficient in several situations, such as facial actions and expressions with the same deformation of mouth as yawning. This algorithm has low computation costs and effectively eliminates redundant frames from original frame sequences. Second, a subtle action recognition network based on 3D convolutional network is proposed to extract spatiotemporal features and detect yawn in. However, low image resolution and large camera vibration reduce the effectiveness of the proposed method.

These limitations will be addressed in a future study by using improved image pre-processing methods, such as resolution recovery for low-resolution images using image super-resolution and handling blurred images with deblurring methods.

Drawbacks

- It has not focused on increasing the recognition rate and classification accuracy of severity of Yawn face expression.

PROPOSED SYSTEM:

- The recent success of Alexnet convolutional neural networks (CNNs) in tasks such as Yawn facial classification extends to the problem of Yawn facial expression recognition.
- In the following sections, we will present an overview of our problem to classify images of human faces into discrete Yawn categories.
- Many established facial recognition systems use standard machine learning and extracted features, which do not have significant performance when applied to previously unseen data
- A baseline classifier with one convolutional layer .A deeper CNN with a parameter number of convolutional layers, filter dimensions, and number of filters. For each of these models, we tuned parameters including learning rate, regularization, and dropout.
- During training, the system received a training data comprising gray scale images of faces with their respective expression label and learns a set of weights for the network.
- Output from the second hidden layer is connected to output layer having seven distinct classes and output is obtained using the probabilities for each of the seven classes.

ADVANTAGES

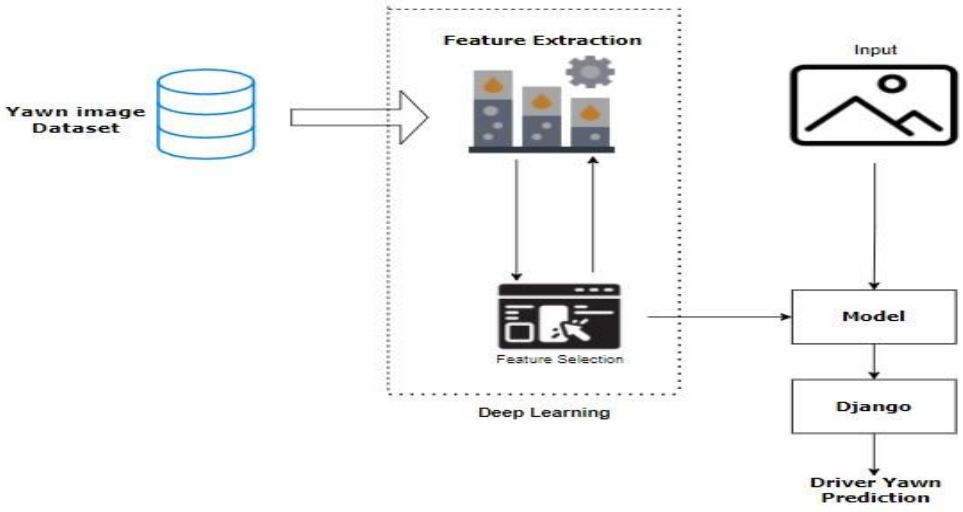
- CNN algorithm are mainly used for image classification so it performs better.
- The accuracy of the models can be improved by using the layers combination.

PREPARING THE DATASET:

This dataset contains approximately 1500 train and 400 test image records of features extracted, which were then classified into 4 classes:

- Close
- Open
- Yawn
- No yawn

SYSTEM ARCHITECTURE



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LIST OF MODULES

1. Manual Net
2. AlexNet
3. LeNet
4. Deploy

MODULE DESCRIPTION:

IMPORT THE GIVEN IMAGE FROM DATASET:

We have to import our data set using keras preprocessing image data generator function also we create size, rescale, range, zoom range, horizontal flip. Then we import our image dataset from folder through the data generator function. Here we set train, test, and validation also we set target size, batch size and class-mode from this function we have to train using our own created network by adding layers of CNN.

WORKING PROCESS OF LAYERS IN CNN MODEL:

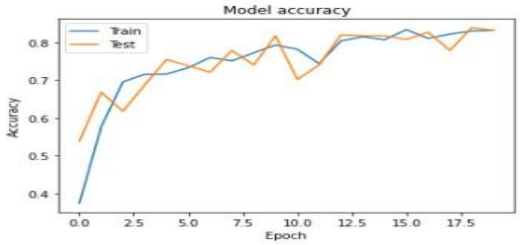
A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics. The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. Their network consists of four layers with 1,024 input units, 256 units in the first hidden layer, eight units in the second hidden layer, and two output units.

Input Layer:

Input layer in CNN contain image data. Image data is represented by three dimensional matrixes. It needs to reshape it into a single column. Suppose you have image of dimension 28 x 28 =784, it need to convert it into 784 x 1 before feeding into input.

Cnvo Layer:

Convo layer is sometimes called feature extractor layer because features of the image are get extracted within this layer. First of all, a part of image is connected to Convo layer to perform convolution operation as we saw earlier and calculating the dot product between receptive field (it is a local region of the input image that has the same size as that of filter) and the filter. Then the filter over the next receptive field of the same input image by a Stride and do the same operation again. It will repeat the same process again and again until it goes through the whole image. The output will be the input for the next layer.



CNN model trained dataset accuracy

Pooling Layer:

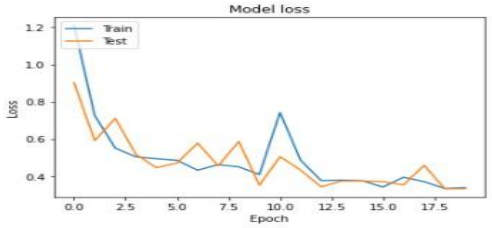
Pooling layer is used to reduce the spatial volume of input image after convolution. It is used between two convolution layers. If it applies FC after Convo layer without applying pooling or max pooling, then it will be computationally expensive. So, the max pooling is only way to reduce the spatial volume of input image. It has applied max pooling in single depth slice with Stride of 2. It can observe the 4 x 4 dimension input is reducing to 2 x 2 dimensions.

Fully Connected Layer (FC):

Fully connected layer involves weights, biases, and neurons. It connects neurons in one layer to neurons in another layer. It is used to classify images between different categories by training.

Softmax / Logistic Layer:

Softmax or Logistic layer is the last layer of CNN. It resides at the end of FC layer. Logistic is used for binary classification and softmax is for multi-classification.



CNN model trained dataset loss values

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TESTING AND IMPLEMENTATION

Testing

System Analysis and Design process including Requirement Analysis, Business Solution Options, Feasibility Study, Architectural Design was discussed in previous chapter.

Generally Software bugs will almost always exist in any software module. But it is not because of the carelessness or irresponsibility of programmer but because of the complexity. Humans have only limited ability to manage complexity. This chapter discusses about the testing of the solution and implementation methodologies.

Unit Testing

Software Testing is the process of executing a program or system with the intent of finding errors. The scope of software testing often includes examination of code as well as execution of that code in various environments and conditions. Testing stages of the project can be explained as below and system was tested for all these stages.

● **System testing**

- Testing of the system as a whole. Testing of emergent properties is particularly important.

Acceptance testing

- Testing with customer data to check that the system meets the customer's needs.

Testing Methods and Comparison

Black Box Testing

Black Box Testing is testing without the knowledge of the internal workings of the item being tested. When black box testing is applied to software engineering, the tester selects valid and invalid input and what the expected outputs should be, but not how the program actually arrives at those outputs. Black box testing methods include equivalence partitioning, boundary value analysis, all-pairs testing, fuzz testing, model-based testing, traceability matrix, exploratory testing and specification-based testing. This method of test design is applicable to all levels of software testing: unit, integration, functional testing, system and acceptance.

CONCLUSION:

It focused how image from given dataset (trained dataset) and past data set used to predict the pattern of driver yawn using CNN model. This brings some of the following insights about driver yawn prediction.

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classification framework is the ability to classify images automatically. The eye drowsiness mainly happen due to lack of sleep and tired. In this study, we have discussed the overview of methodologies for detecting the driver yawn images which includes collection of yawn image data set, preprocessing techniques, feature extraction techniques and classification schemes.

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