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# EMOTION RECOGNITION AND DROWSINESS DETECTION USING PYTHON

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## Abstract:

The natural expressions of human emotions are those that individuals enjoy making without exerting any conscious effort, and which are followed by the reflexing of face muscles rather than any deliberate effort on the part of the individual. Among the most basic feelings that a human face might express depending on the scenario in which one finds himself or herself are: happiness, grief, surprise and wrath, to mention a few examples: stability, joy, and stability, among others (normality). As part of this work, we present software that detects and recognises faces, as well as providing a wealth of additional information about that individual. This information can be used to solicit feedback from customers, or to determine whether a person requires an incentive to engage in certain behaviours. The ultimate goal of the project is to build a product that is both cost-effective and efficient in terms of operation and maintenance. AI and DIP technologies were employed in the development of the system, which was written in Python and implemented using Artificial Intelligence. When it comes to avoiding an accident or tragedy, the ability to recognise eye blinking is vital in a variety of situations, such as driving or in security vigilance scenarios. The fact that the system also recognises the identification card makes this a fundamental function. As a result of the training provided, the camera that has been installed initially focuses on the card and recognises its form and colour before going on to the next item.

## 1. INTRODUCTION

A growing number of people are becoming involved in the fields of artificial intelligence (AI) and digital image processing (DIP) all over the globe. The usage of deep learning-based artificial intelligence (AI) methods and applications is increasing across a broad variety of industries, with many of them relying on deep learning as their foundation. The project might be performed for marketing and improvement purposes, as well as with the objective of creating a completely new item from the ground up. Please let us know if you have any product development projects that we should be aware of that you would want to share with us. Because of this, it is able to offer an accurate and detailed assessment of the implications. While the features of artificial intelligence technologies are simple to implement and understand in the most common systems, they can also be installed in a cost-effective and efficient manner in schools, colleges, and any other area where surveillance is required; however, a lack of funding is the most significant factor causing difficulties in the development of artificial intelligence technologies. Monitoring might be included into the project, which would aid in the maintenance of a regular health check, identification of a person's mental state while at work, and other tasks. This statement may also be used to criticise employees who have made significant contributions to the growth of the organisation in which they work, even after they have been recognised for their efforts.

The system was developed using a mix of artificial intelligence and digital image processing technology, and it integrates elements such as face recognition, emotion identification, and fatigue detection in the user to provide a more personalised experience. The kNN facial recognition technique, which is standard in this sector, has been used in this instance. Following the proposed work, it has been demonstrated that combining Tensorflow, deep learning feature extraction, and the K Nearest Neighbor and Sparse Representation Classifier (KNN- SRC) for classification to under the classification to under the, the performance of face recognition technique can be significantly improved. It has been shown that the performance of the face recognition strategy may be significantly improved by using a KNN-SRC (Kind Neighbor and Sparse Representation Classifier) for classification to under the classification to under the Our study objective is to construct a Convolutional-Neural Network (CNN) based on the Face Expression Recognition System (FER) for the purpose of analysing facial expressions using facial recognition software. Because the deep learning algorithm for sleepiness detection is fed a live video feed from a camera placed on the subject's face, the blinking of an eye is recognised by the algorithm, which is utilised to identify tiredness.

## 2. LITERATURE SURVEY

Conducting a literature survey is the most significant phase in the software development process, and it takes place first. It is vital to examine the time factor, the economics, and the overall strength of the organisation before creating the tool. In order to design and develop the tool, the tenth stage requires that the operating system and programming language be determined. Once these requirements have been met, the tool may be designed and developed. The programmers will need a significant amount of assistance from other sources in order to accomplish their task once they begin working on the tool. It is possible to get this assistance from senior programmers, bookkeepers, or via the use of web resources, among other options. It is vital to analyse the aspects described above before to commencing work on the proposed system in order to verify that it will perform effectively.

Nian Zhang, WelezaneKarimoune, Lara Thompson, and Hongmei Dang are among the co-authors of the work, which also includes additional researchers. "A BetweenClass Overlapping Coherence-Based Algorithm in KNN Classification," et al. "A BetweenClass Overlapping Coherence-Based Algorithm in KNN Classification." "A BetweenClass Overlapping Coherence-Based Algorithm in KNN Classification," as published in "KNN Classification." "A BetweenClass Overlapping Coherence-Based Algorithm in KNN Classification," as published in the journal "KNN Classification," is an example of such an algorithm.

Because the distribution of classes is skewed, as seen in the figure, it is required to use an enhanced KNN algorithm in order to overcome the issue of class overlap. Instead of only identifying the k nearest neighbours of each sample (including the test object itself) in the training dataset, the approach additionally finds the neighbours of an unknown test object in the training dataset, which represents a major advance over the traditional KNN technique. When a data point is genuine, the validity value of that data point is calculated by taking into consideration its label, as well as the labels of the data point's k closest neighbours, in the same way as previously mentioned. Before the unknown test item can be allocated to a class membership based on the validity ratings equations that have been given for it, it must first be classified by a classifier.

In the paper "Fast K-nearest neighbour search strategy for nonparametric classification" by SeongJoonBaek and Koeng-Mo Sung, which is an excellent instance of what they mean, the authors demonstrate how they used a K-nearest neighbour search approach for nonparametric classification.

An effective fast KNN search approach makes use of a projection value to determine whether or not a distance calculation is needed in order to determine whether or not one is required. The existence of a connection between the projection values and distance is established, and this relationship is subsequently included into the classification technique. As is the case in the case of K-nearest neighbour, experimental data is used to show that the results are right, which also serves to validate that the findings are accurate in general. The artists Wen-Jyi Hwang and Kuo-Wei Wen are two of Taiwan's most well-known painters, and they are both from the Taipei area. "Fasithm based on partial distance search.", "Fasithm based on partial distance search.", "Fasithm based on partial distance search.", "Fasithm based on partial distance search.", "Fasithm based on partial distance search.", "Fasithm based on partial distance search."

### 3. SYSTEM ANALYSIS

#### 3.1 Existing System

The present state of technology has not been able to determine the emotional state of the person using the device. It does not have any machine learning (ML) or artificial intelligence (AI) features in this version (AI). In this situation, the database is just being used for data collection and administration reasons, rather than for actual data storage purposes. In terms of taking images and recognising facial emotion expressions in real time, existing technology is woefully inadequate at this point. The following are some of the downsides of using this method: The results were incorrect; it was unable to distinguish the expression on the face.

- You will be unable to access the database anymore.

#### 3.2 Proposed System

In this system, a more accurate face expression recognition approach is suggested, which makes use of the area of interest to achieve this. This enables convolution neutral networks (CNNs) to concentrate exclusively on those portions of the human face that are linked with the specific expression that the human face is making, rather than on the whole human face. Convolutional neutral networks (CNNs) are neural networks that recognise face expressions by using convolutional networks to do so. Convolutional neutral networks are neural networks that recognise facial expressions by employing convolutional networks to do so. This method is also valuable in building a link between various segments of the training data, which is beneficial in enhancing the accuracy of the predictions and, as a result, increasing the dependability of the objectives that have been forecasted. When we were in the testing phase, we spent a lot of time delving into the concept of recognition. A decision fusion approach is used in certain areas, and direct identification of the test image is performed. The use of spontaneous facial expressions, followed by the refluxing of facial muscles, rather than making a deliberate attempt to communicate, is preferred by individuals. According to the scenario in which the person finds themselves, when you look at a human face you may observe a range of feelings such as happiness, sadness, surprise (surprise), rage (fury), stability (normalcy), and so on. You can find out how someone is feeling emotionally if you use this methodical technique. A significant benefit is the opportunity to save time.

- Consider the circumstance and choose the facial expression that best suits the situation.

Acquiring exact findings is a difficult task.

In a nutshell, this is an introduction to convolutional neural networks.

The reader is presumed to be familiar with the notion of a Neural Network before continuing with the remainder of this section.

Artificial Neural Networks outperform their human counterparts in a range of domains, but notably in Machine Learning, according to recent research. To mention a few examples of the many tasks for which Artificial Neural Networks are utilised include the categorization of pictures and sounds, as well as the recognition of words and phrases. When it comes to predicting word sequences, recurrent neural networks, particularly the LSTM, are employed, while convolutional neural networks are used to categorise images. It is also possible to utilise recurrent neural networks to predict word sequences and to categorise pictures. It is possible to create many different kinds of Neural Networks, each of which may be utilised for a different purpose. The foundation for CNN's fundamental building components will be laid in this section, which will be addressed in more depth later.

Convolution Neural Networks need a thorough understanding of some basic principles in neural network theory, which may be found in this article. Ordinary Neural Networks are made up of three sorts of layers that are all linked. These layers are referred to as the input layer, the output layer, and the hidden layer.

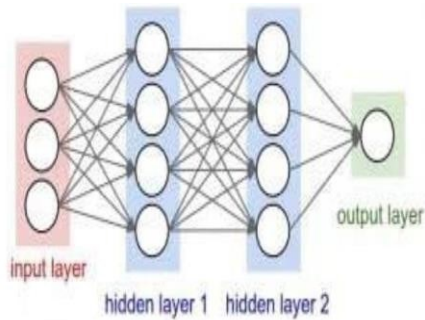
**Information Input Layers:** This is the layer in which we provide information to our model, which is also referred to as an information input layer. When the total number of neurons in this layer is equal to the total number of characteristics in our data set, we have a complete representation of our data set (number of pixels incase of an image).

**Input Layer:** After the input from the input layer has been processed, it is sent on to the hidden layer for further processing. Depending on our model and the amount of data we have accessible, there might be a myriad of hidden layers. The number of neurons in each hidden layer varies depending on the layer. Most of the time, the number of neurons in a hidden layer is larger than the number of characteristics in the layer immediately below it. The output of a new layer is generated by performing matrix multiplication of the preceding layer's output with the learnable weights of the new layer, followed by the addition of learnable biases and an activation function, which causes the network to become nonlinear as a result.

An auxiliary logistic function, such as the sigmoid or softmax, is then applied to the output of each class in order to calculate the likelihood scores for each class. At this time, the algorithm has reached the end of its journey.

Feedforwarding is the term used to describe the process of feeding input into a model and retrieving output from each layer. A error function must be used for computing error; some examples of error functions include cross entropy error, square loss error, and various variations on the theme. We may backpropagate into the model to examine how it works after the derivatives have been calculated, as seen in the illustration below.





## 4. IMPLEMENTATION

### 4.1 Logistic Regression:

The logistic regression formula is derived from the usual linear equation for a straight line, which is known as the linear equation for a straight line. The logistic regression formula is derived from the normal linear formula by transforming it.

$$f(z) = 1 / (1 + e^{-z})$$

The logistic regression function is useful for predicting the class a binomial target feature.

### 4.2 Neural Network:

When a neural network is utilised in combination with a logistic algorithm, the desired outcomes are obtained, as described in the proposed technique. The results of both algorithms were put to the test in a poll in order to establish whether or not they give individual accuracy of the UCI dataset. In order to include neural networks into the suggested strategy, we took the following factors into consideration:

**Lbfgs:** It is an optimizer that belongs to the family of quasi-Newton processes and is known as a quasi-Newton approach.

**The next layer is not visible:** This was accomplished by the employment of a total of 15 neurons in the hidden layer.

**Activation** Following their activation, the linear unit functions that have been corrected are referred to as Relu.

**Eyeballs** that have been trained can discriminate between exhaustion and drowsiness. Despite the fact that the person is able to revive themselves with vital energy by consuming energy boosters, tiredness is characterised by a reduced degree of awareness that is characterised by languor and difficulty remaining awake for extended periods of time. It is possible that not getting enough sleep, taking medicine, abusing drugs, or having a mental health condition are all contributing reasons to this symptom. As a rule, it is the result of fatigue, which may manifest itself in a number of

ways, including both mentally and physically, and is the most common cause. Physical weakness, also known as muscular depletion, is defined as a temporary physical disappointment produced by a muscle's inability to execute its typical function over an extended length of time in the ideal case. One must overcome mental weakness if they are to maintain peak mental performance throughout the day. Mental weakness is unavoidable, and it is impossible to avoid. Mental weariness is a dynamic phenomenon that is dependent on a person's mental capacity, as well as a variety of other factors such as lack of sleep and overall well-being, when it starts to set in during any particular activity. Furthermore, it has been shown that mental fatigue has a negative impact on one's physical performance while participating in sports. Chronic fatigue syndrome is characterised by symptoms such as exhaustion, lethargy, and a diminished ability to think clearly and concisely (CFS).

As previously reported by The New York Times, the National Highway Traffic Safety Administration has classified driver drowsiness as a valid cause of road accidents that have caused destruction, significant physical injury, and economic losses in recent years, among other things. For example, driver drowsiness has been established as a valid contributing factor to road accidents that have resulted in destruction, serious physical injuries as well as economic losses, among other consequences. The possibility of colliding with another vehicle or an immovable object exists in the event that a driver loses control of his or her car. To minimise or reduce the incidence of accidents, it is essential for drivers to be constantly conscious of their own level of fatigue.

## Measures for detection of Drowsiness

In accordance with the results of the study, the root cause of a catastrophe may be divided into three basic categories: natural disasters, human-caused disasters, and other causes of disaster. (1) A person, (2) a vehicle, and (3) a component of the environment are all taken into consideration. The driver made a clerical mistake on the road. This factor was shown to be responsible for 91 percent of all reported accidents. Aside from that, there were two additional types of causal factors that were identified: 4 percent for the surrounding environment and 5 percent for the kind of vehicle that was being used. It is possible to assess sleepiness in a variety of ways, the most frequent of which are as follows:

1. The measures taken are determined by the kind of vehicle.

Tests and measurements of the physiological functioning of the organism.

Interventions in the field of behavioural health

Depending on the vehicle, various safety precautions are used.

Researchers may use car-based surveys to track the location of the vehicle as it aligns with route markers and collect steering wheel movement data to estimate the driver's degree of fatigue on the road, which can vary from a moderate to severe level of fatigue on the road. This method has been used in a large number of research endeavours to identify weariness, demonstrating the continual nature of this non-intrusive and cost-effective monitoring device and demonstrating its effectiveness. This is accomplished by the use of the following techniques:

A vehicle that abruptly veers away from its designated lane position is an example of this kind of behaviour.

Second, there is an element of surprise in the way the steering wheel moves.

3. The application of force to the accelerator paddles is shown.

It is considered sleepy if a driver's drowsiness is detected at any of the set threshold values for any test, regardless of the measure.

**Advantages:**

1. It is noninvasive in nature.
2. Provides almost accurate result.

**Disadvantages:**

For vehicle-based measures, it is critical to examine the road's design since it may cause the alarm system to be activated needlessly if the road is not designed properly.

- It must be taught and practised in a manner that is consistent with the driving style of the present driver in order for it to be successful.

Identifying conditions such as micro sleeping, which is most frequent on straight roadways and difficult to detect, has become impossible due to technological limitations.

measures taken by the executive branch of government As a result of being fatigued, our bodies undergo physical changes that are objectively measured by medical professionals. These changes are referred to as physiological parameters. It is simple to quantify these physiological changes when the appropriate tools are used to do this. The following are some of the most important of these tools:

**ECG (electro cardiogram)**

EMG (electromyogram)

EOG (electro oculogram) EEG

(electroencephalogram) Behavioral measures.

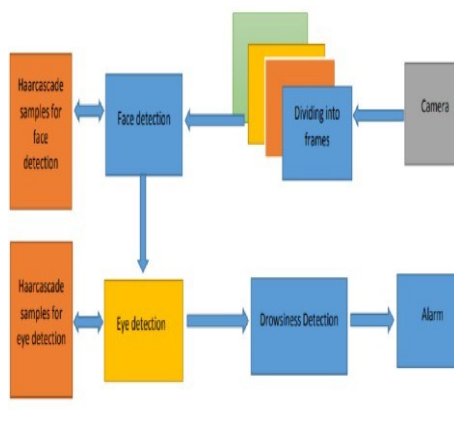
Certain behavioral changes take place during drowsing like

1. Yawning
2. Amount of eye closure
3. Eye blinking
4. Head position

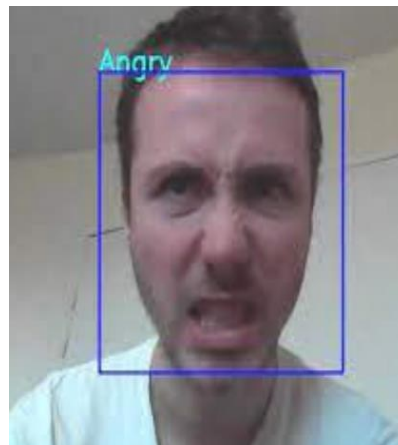
The most exact and trustworthy of these four ways is the one that is based on physiological measurements collected by humans. This is true for all four approaches. This method is specifically implemented in two ways: first, by monitoring changes in physiological signals such as brain waves, heart rate, and eye flashing; and second, by measuring changes in physical signs such as sagging posture, inclining of the driver's head, and the open/closed positions of the eyes. Because the detecting electrodes would have to be placed directly on the driver's body, this method, despite the fact that it is very precise, is not realistic at this time. Consequently, it is not suggested since it would be uncomfortable and distracting for the driver. The accumulation of perspiration on the sensors as a consequence of constant driving impairs the sensors' ability to screen correctly and accurately. The amount of eye closure, also known as the (PERCLOS) percentage of eye closure, will thus be the primary focus of this method since it gives the most reliable information on sleepiness of all of the available measures, even those that are noninvasive. In addition to the fact that it is non-intrusive in nature, it has no effect on the driver's mental state and the driver feels completely at ease while utilising this system. The functioning of this gadget is not affected by



elements in the surrounding environment, such as road conditions. On the basis of the threshold value that has been selected, it is also possible to identify the presence of a micro sleep. Face identification and tracking, detection and placement of the human eye, human eye monitoring, eye condition detection, and driver exhaustion evaluation are just a few of the features now being explored by researchers. The identification and localization of human eyeballs, as well as the evaluation of driver weariness, were the most important components of the detection framework, according to the researchers. According to the number of frames collected during each time period, a percentage of the driver's eyes were open and shut was computed for each time period, which was an improvement over the previous approach for calculating PERCLOS estimations of the driver.



## Architecture



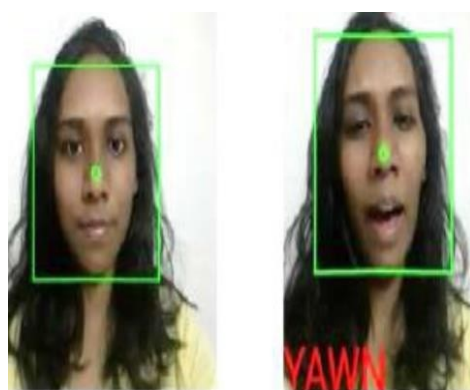
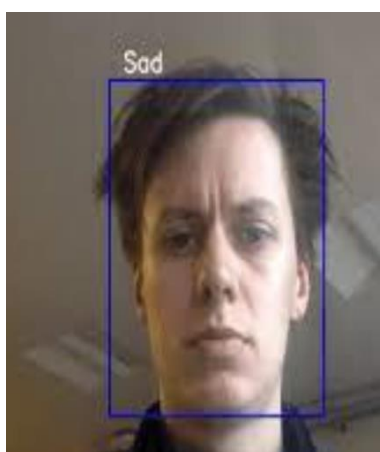
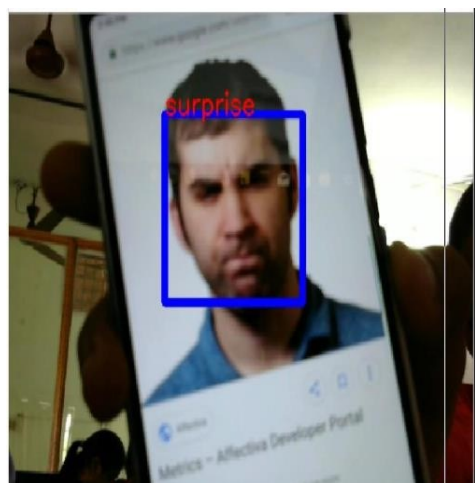


Table for different value of k

| Method             | k       | Number of distance calculations | Time in PC clocks |
|--------------------|---------|---------------------------------|-------------------|
| VQ-KNN             | for all | 512                             | 22832             |
| Proposed algorithm | 5       | 71.19                           | 1972              |
|                    | 10      | 81.38                           | 2503              |
|                    | 15      | 89.21                           | 2954              |
|                    | 20      | 95.95                           | 3384              |
|                    | 25      | 102.34                          | 3795              |

Rate e for calculation errpr and their computing

|      | kNN<br>(r=9216) | fast<br>kNN<br>(t=9216) | VQ-<br>kNN<br>(r=768) | fast<br>VQ-<br>kNN<br>(r=768) | VQ-<br>kNN<br>(t=1536) | fast<br>VQ-<br>kNN<br>(t=1536) |
|------|-----------------|-------------------------|-----------------------|-------------------------------|------------------------|--------------------------------|
| T[s] | 471.02          | 60.93                   | 40.68                 | 8.47                          | 79.01                  | 12.37                          |
| E    | 5.44%           | 5.44%                   | 6.51%                 | 6.51%                         | 5.63%                  | 5.63%                          |

## 5. CONCLUSION

When using the typical kNN technique, the k-nearest neighbours of any given sample are discovered by doing a k-nearest neighbour search on the sample in question. Despite the fact that the kNN approach has been refined, it still only discovers the items that are closest to the present test objects. It now finds the test objects that were previously unknown at the time of the test, as well as their immediate neighbours. Incorporating Tensorflow with deep learning and employing the K Nearest Neighbor and Sparse Representation Classifier (KNN- SRC) for classification can significantly improve face recognition performance. The KNN- SRC is a combination of the K Nearest Neighbor and Sparse Representation Classifier and is a combination of the K Nearest Neighbor and Sparse Representation Classifier (KNN- SRC). It is anticipated that, in the future, while constructing models of computer-based emotion detection systems, the assessment process using the proposed technique would provide consistently better findings with more accuracy than the previous strategy. Nonverbal communication in its natural form may be used to identify a person's present state, feelings, and current sentiments by monitoring their facial expressions in its natural form. It is possible to grasp a person's emotions when one has the capacity to analyse their sentiments at various levels of identification. As a person passes through various stages of life, the feelings that they experience change dramatically.

When viewing the eye area, it calculates the form of the frame before applying the convex hull from side to side to determine whether or not a curve is convex in order to see what is going on within. It is tested at the beginning of each frame to determine whether the calculated eye aspect ratio is less than the supplied threshold value, and if it is, the result is saved. If this is not the case, the result is not reported. After three consecutive frames with an eye aspect

ratio greater than the threshold are taken, it is determined that the individual under examination is sleeping. This results in a warning signal being created in the project in the case that this occurs.

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