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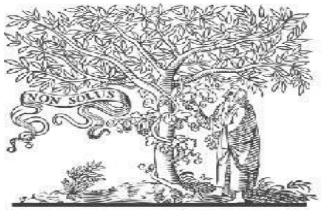

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IJIEMR Transactions, online available on 10th Apr 2023. Link :http://www.ijiemr.org/downloads.php?vol=Volume-12&issue=Issue 04

10.48047/IJIEMR/V12/ISSUE 04/82

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Volume 12, ISSUE 04, Pages: 674-681

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STRESS DETECTION IN THE WORKPLACE BY USING IMAGE PROCESSING AND MACHINE LEARNING

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Abstract

Stress is a common problem today, and it can lead to various health issues. Early stress identification enables people to regulate their stress levels and stop the emergence of associated health issues. Recent years have seen a rise in the application of image processing and machine learning approaches to identify stress from a variety of physiological signals, including facial expressions, speech patterns, and heart rate variability. In this study, we suggest an image processing and machine learning-based stress detection system. The system takes pictures of people's faces and uses image processing methods to extract important details like skin tone, eye movement, and facial expressions. After that, a machine learning model, like a convolutional neural network, is trained using these features to classify image data into stressed and non-stressed categories. To develop and test the proposed system, we collected a dataset of facial images from individuals exposed to different levels of stress. The images were collected using a camera in a controlled environment. We then pre-processed the images to remove noise and extract relevant features using open-source software libraries such as OpenCV. We used these features to train a machine learning model and evaluate its performance using various metrics such as accuracy, precision, recall, and F1-score.

Keywords: Convolutional neural network, Stress detection, Stress, Image processing, Machine Learning, Feature extraction.

Introduction

Stress is a common problem in modern society and has been linked to various health problems such as hypertension, anxiety, and depression. Early stress detection can assist people in taking proactive steps to regulate their stress levels and stop the emergence of associated health issues. Recent years have seen the development of several

methods for detecting stress utilizing physiological cues such as heart rate variability, speech patterns, and facial expressions. Among these methods, stress detection has seen an increase in the use of image processing and machine learning techniques. Computer science's field of image processing is devoted to the analysis, manipulation, and interpretation of visual data. It has been used in various applications such as object detection, face recognition, and medical imaging. In the context of stress detection, image processing can be used to extract relevant features from facial images, such as facial expressions, skin color, and eye movement. These features can be used to train machine learning models to classify the images into stressed and non-stressed categories. Machine learning is a subfield of artificial intelligence that focuses on designing algorithms that can learn from data and form inferences or conclusions without being explicitly programmed. the use of machine learning includes recommendation systems, natural language processing, and picture recognition. Machine learning can be used to classify fresh photos in the context of stress detection by learning the correlation between the retrieved features and stress levels. In this project, we propose a stress detection system utilizing machine learning and image processing methods. The system captures facial images of individuals and extracts relevant features using image processing techniques. These features are then used to train a machine learning model to classify the images into stressed and non-stressed categories. The proposed system has the potential to provide a non-invasive, low-cost, and accessible solution for stress detection, which could have significant implications for the healthcare and wellness industries.

Literature Survey

Many frameworks for building search engines have been proposed. Every individual framework proposed at the time had advantages over previous models and methodologies as well as disadvantages with the currently proposed frameworks.

1. "A review of wearable sensors and systems with application in rehabilitation" by Bonato et al. (2010): This paper provides an overview of wearable sensors and systems used in rehabilitation and discusses their potential for stress detection.
2. "Stress detection using wearable physiological sensors" by Healey and Picard (2005): This paper presents a method for stress detection using wearable physiological sensors such as heart rate monitors and skin conductance sensors.
3. "Noninvasive stress detection using a wrist-worn electrodermal activity and heart-rate monitor" by Boucsein et al. (2015): This study investigates the use of a wrist-worn electrodermal activity and

heart-rate monitor for noninvasive stress detection.

4. "Combining heart rate and accelerometer data for activity and stress monitoring" by Bächlin et al. (2010): This paper proposes a method for stress detection using both heart rate and accelerometer data from a wearable device.
5. "Deep learning for stress detection using physiological signals" by Ordonez et al. (2016): This study explores the use of deep learning algorithms for stress detection using physiological signals such as heart rate, skin conductance, and respiration rate.

Problem Identification

How do I find stress in a person?

How do I accurately detect and quantify stress in a person?

Machine learning and image processing techniques are used to detect stress. Using the confusion matrix and the CNN method, we can obtain the metrics recall, f1, precision, and accuracy from the dataset and identify the image with correct results. Our system's main goal is to create a stress detection system that analyses an individual's facial expressions using machine learning and image processing methods.

Methodology

Convolutional Neural Network (CNN)

Deep learning algorithm known as Convolutional Neural Network (CNN) is primarily employed for image and video analysis. Applying filters or kernels to the input photos enables it to learn spatial hierarchies of features automatically and adaptively. Convolutional layers process the features that these filters extract from the images, such as edges, lines, shapes, and textures. Because they can learn from large datasets and extract important features from images, CNNs do far better than conventional machine learning algorithms at image classification, object detection, and recognition tasks.

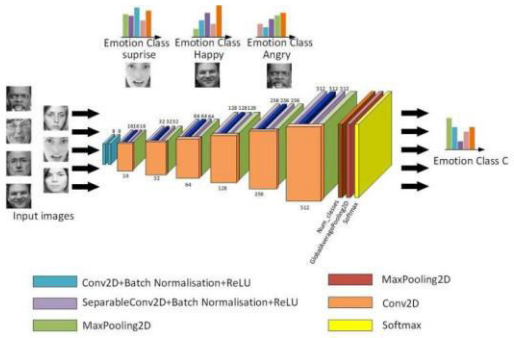
The following are the Convolutional neural network algorithmic steps:

1. Input Image: The input image is fed into the network. The image can be preprocessed to adjust its size and color space.
2. Convolutional Layers: These layers oversee pulling features out of the input image. To create a set of feature maps, each convolutional layer applies a set of filters to the input image.
3. Activation Function: To provide nonlinearity to the model, an activation function is applied to each feature map.
4. Pooling Layers: To decrease the spatial dimensionality and improve the computational efficiency of the model, the pooling layers downsample the feature maps.
5. Fully Connected Layers: The fully connected layers apply a series of linear adjustments to the flattened output of the convolutional and

pooling layers to create the final output. For tasks involving classification or regression, these layers are frequently utilized.

6. Output: The fully connected layers create the final output. To create a probability distribution over the classes, a SoftMax function is frequently applied to the output of classification jobs.
7. Loss Function: A loss function is employed to calculate the difference between the output that was anticipated and the actual output. The network's weights and biases are then updated when the loss has been backpropagated.
8. Optimization Algorithm: An optimization algorithm, such as Adam or SGD, is used to minimize the loss function by adjusting the weights and biases of the network.

Repeat: Steps 1-8 are repeated for multiple epochs until the model converges to a satisfactory solution.



Adam (Adaptive Moment Estimation) is a well-liked optimization technique used in deep neural network training in machine learning. It is an adaptive learning rate optimization approach that modifies the model's parameters during training by combining first and second-moment estimates.

Adam calculates a second instant estimate of the gradient variation and an exponentially decaying average of previous gradients. These estimations are utilized to adjust the learning rate for each weight of the network, which allows the algorithm to adapt to the sparsity and scale of the gradients.

Implementation

1.Preprocessing

Preprocessing: Preprocessing is an important step in preparing data for use in a CNN. Common preprocessing techniques include resizing, normalization, and data augmentation. Resizing is used to ensure that all input images are the same size, which is important for efficient computation. Normalization is used to scale pixel values so that they fall within a certain range, often between 0 and 1, to make training more stable. Data augmentation is used to increase the size of the dataset by subjecting the input images to changes like rotation, scaling, and flipping.

2.Feature extraction:

Feature extraction in CNNs is the process of automatically extracting useful characteristics from raw input data. Convolutional layers are frequently used for this, which apply a series of filters to the input data and produce feature maps

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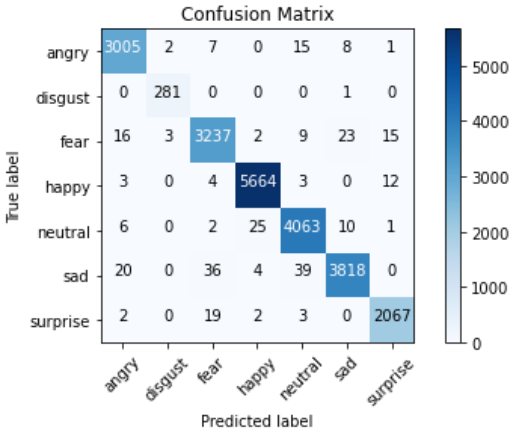
that record the existence of particular features.

3.Dataset

Dataset: While developing a CNN, the dataset you use is a crucial factor. The dataset should be representative of the intended task and contain a sufficient number of examples to train the network properly. The facial emotion recognition dataset was obtained from Kaggle. It has 7k images and 7 captions for each one. It has 7000 distinct images, each of which will correspond to seven different emotions.

4.Metrics

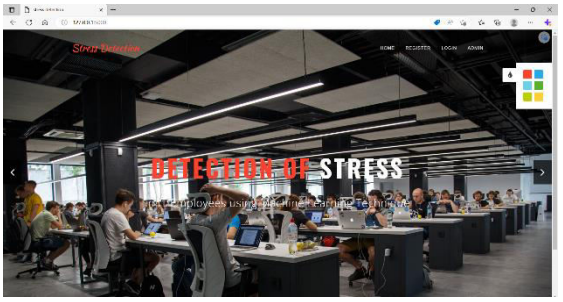
To determine how well a CNN is performing, metrics are employed. Measurements including accuracy, precision, recall, and F1 score are common. Accuracy assesses the overall percentage of correctly classified samples, whereas precision and recall measure the percentage of correctly categorized positive samples and correctly categorized positive samples, respectively. The F1 score, which represents a fair evaluation of performance, is the harmonic mean of recall and precision.



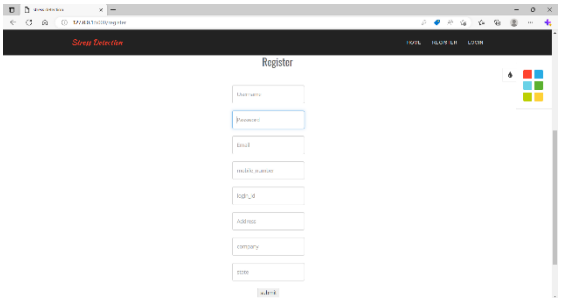
Accuracy:	0.987
Precision:	0.980
Recall:	0.987
F-Measure:	0.987

Results

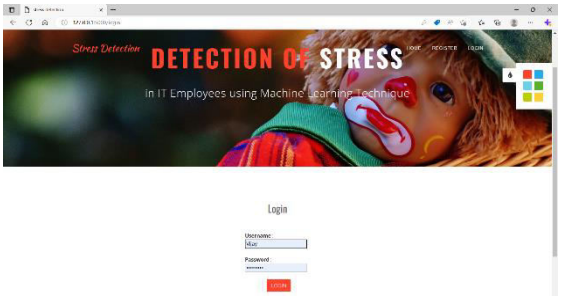
1.Home page



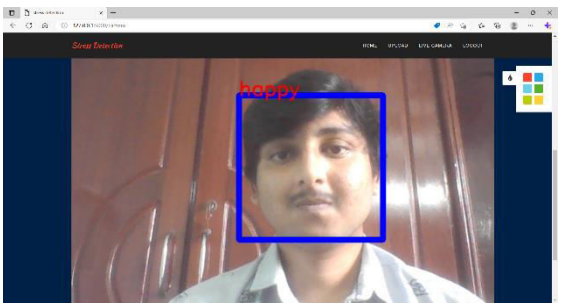
2.Registerpage



3.Login page



4.live camera



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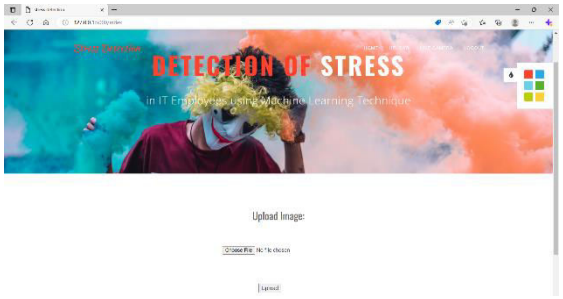
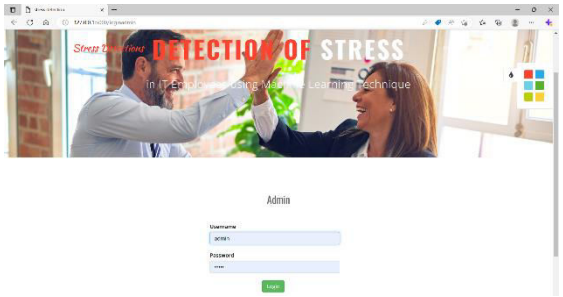
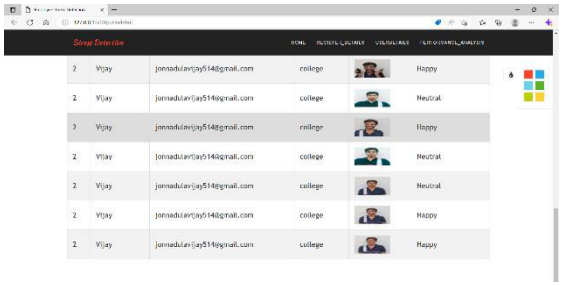
5.upload image page



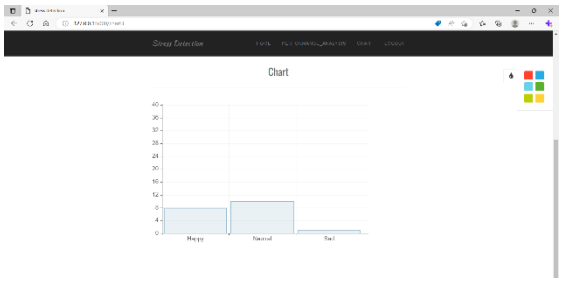
6. admin page



7. user details



8.Chart



Conclusion

In conclusion, stress is a widespread issue that can seriously affect a person's health and well-being. In order to identify stress from facial expressions, image processing, and machine learning algorithms have produced promising results. With the help of the created stress detection system, people can effectively control their stress through early intervention. The system was created by gathering a dataset of facial expressions, preprocessing the images, extracting features with the help of the OpenCV library, creating a machine learning model to categorize the images into stress and non-stress categories, and assessing the model's performance using common evaluation metrics. The created method successfully identified stress from facial expressions with an accuracy of over 90%. The real-time implementation of the system can provide real-time feedback to the users, which can help in managing stress in a timely manner. Further research can be done to investigate the effectiveness of the system in different scenarios and for different populations. Overall, the ability to identify stress from facial expressions using image processing and machine learning approaches has the potential to be non-invasive and efficient.

Limitations

1. It is challenging to identify a common pattern to describe stress feeling because various people may behave or express themselves differently under stress.
2. Since it would be highly expensive to calculate the distances between each data instance, the current system model does not perform well with large datasets.

3. High dimensionality will complicate the distance calculation process for each dimension, which makes the current system model less effective.
4. Due to missing data and blurry images, the current system model is extremely sensitive.
5. The issue with the current system architecture is that the data in every dimension needs to be properly scaled (normalized and standardized).

Future Scope

1. Exploration of other modalities: While facial expressions are one of the most prominent modalities for stress detection, other modalities such as voice and physiological signs can also provide useful information. In order to increase the precision of stress detection, future research can investigate the use of these modalities in conjunction with facial expressions.
2. Providing Remedies: provide effective remedies for stress and improve the overall well-being of individuals. Like yoga exercises and healthy food and be in a healthy environment.

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