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# FACIAL EMOTION RECOGNITION USING MACHINE LEARNING ALGORITHM

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## ABSTRACT

A facial expression is exhibited by the movement of muscles underneath the face skin. Facial emotion recognition is the process of detecting human emotions from facial expressions. The facial expression for emotion detection has always been a challenging task in achieving through computer algorithms. In the field of Artificial Intelligence, Facial Emotion Recognition (FER) is an active research area, with several recent studies. With the recent advancement in computer vision and machine learning, it is possible to detect emotion from images. The automatic emotion recognition based on facial expression is an interesting research field, which has presented and applied in several areas such as safety, health and in human machine interfaces. The human brain recognizes emotions automatically, and software has now been developed that can recognize emotions as well. This technology is becoming more accurate all the time, and will eventually be able to read emotions as well as our brains do. In this project we propose a technique called facial emotion recognition using convolutional neural networks and haar cascade classifier.

## INTRODUCTION

Human emotion recognition plays a vital role in interpersonal communication and humanmachine interaction. Emotions are expressed through speech, hand gestures and by the movements of other body parts and through facial expressions . Facial emotions are one of the most important factors in communication that helps us to understand what theother person trying to communicate.People understand only one- third of the message verbally, and two-third of it is through non-verbal means. There are many face emotion recognition systems present right now but in real-life scenarios, they do not perform efficiently. Though there are many systems which claim to be a nearperfect system and to achieve the results in favourable and optimal conditions. The wide variety of expressions shown by different people will not help in the process of coming up with a system that is definite in nature. Hence, developing a reliable system without any flaws showed by the existing system is a challenging task. Machine learning based algorithms for an effective recognition are being refined, emphasizing emotion recognition in real-time and not just ideal laboratory conditions. Hence, building a system that is capable of both face detection and emotion recognition has been a crucial area of research. This technique is used to determine the emotion of humans based on their expressions. The current dataset focuses on seven essential facial expression classes reported, which are happy, sad, surprise, fear, neutral, disgust and anger.


Figure 1. Facial Emotion Classification Stages.

## TECHNOLOGY USED

Our system represents a comprehensive integration of cutting-edge technologies, primarily focusing on Image Processing and Machine Learning, to develop an advanced emotion classification system. At the project's inception, we employed Haar cascade classifiers, a highly precise face detection technique. These classifiers form the foundation of our system, ensuring accurate identification of facial regions for subsequent analysis. Moving forward, Image Processing techniques were strategically applied to translate facial images into a digital format, setting the stage for further computational analysis.

A critical aspect of our methodology involved the extraction of features from key facial components such as eyes, brows, nose, and mouth. This meticulous process aims to capture the intricate details of facial expressions, facilitating a nuanced understanding of the emotional content conveyed through these expressions. By dissecting facial features, our system gains the capability to discern subtle cues and variations, contributing to the overall accuracy of emotion classification.

The core Machine Learning component of our systemis embodied byConvolutional
Neural Networks (CNN). These sophisticated neural networks serve as the cornerstone of our emotion classification model. Trained on a wealth of data, the CNNs learn to associate extracted facial features with specific emotional states, enabling them to make informed predictions during the classification phase. The adaptability and learning capacity of CNNs make them particularly well-suited for this task, as they can discern complex patterns and relationships within the facial features dataset.

To ensure a well-organized and efficient project structure, we adopted a modular approach. This approach encompasses distinct modules dedicated to key stages of the emotion classification pipeline, including face detection, feature extraction, classification, and evaluation. Each module contributes to the seamless functioning of the overall system, emphasizing both effectiveness and real-time processing capabilities.

our project represents a harmonious integration of Image Processing and Machine Learning technologies, culminating in an advanced emotion classification system. The utilization of Haar cascade classifiers, Image Processing techniques, and Convolutional Neural Networks collectively form a robust framework for real-time emotion recognition. The comprehensive and modular nature of our approach positions the project at the forefront of advancements in the burgeoning field of Facial Emotion Recognition.

## CNN ALGORITHM

A CNN is a Deep Learning algorithm which takes an input image, assigns importance to various aspects/objects in the image and is able to differentiate between images. The preprocessing required in a CNN is much lower than other classification algorithms. Figure shows the CNN operations. The architecture of a CNN is analogous to that of the connectivity pattern of neurons in the human brain. One role of a CNN is to reduce images into a form which is easier to process without losing features that are critical for good prediction. This is important when designing an architecturewhich is not only good at learning features but also is scalable to massive datasets.

FER Dataset consists of 48x48 pixel grayscale images of faces. The faces have been automatically registered so that the face is more or less centered and occupies about the same amount of space in each image. The task is to categorize each face based on the emotion shown in the facial expression in to one of seven categories.

These are:

0=Angry

1-Disgust

2=Fear
3-Happy

4-Sad 5=Surprise

6-Neutral.

When using CNN algorithm the train.csv contains two columns, "emotion" and "pixels". The "emotion" column contains a numeric code ranging from 0 to 6, inclusive, for the emotion that is present in the image. The "pixels" column contains a string surrounded in quotes for each image. The contents of this string a space- separated pixel values in row major order. test.csv contains only the "pixels" column and your task is to predict the emotion column

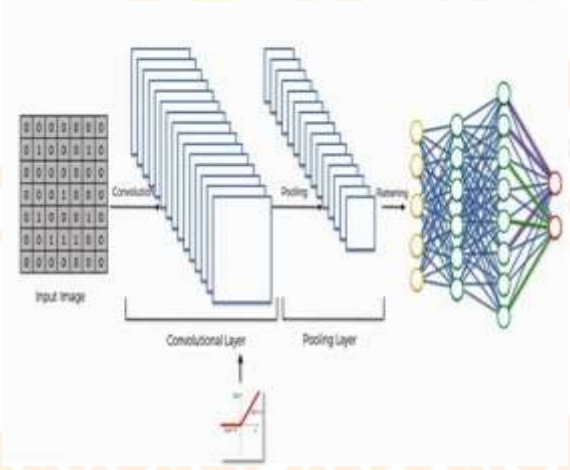


*Figure 2. Convolutional Neural Network*

## PROPOSED SYSTEM

In the proposed System Machine Learning algorithms like CNN classifiers are applied to classify emotions. Image Processing is used at the initial stage for detection, an image of a person is given by the browser which serves as input. In order to get an enhanced image or to extract some useful information from it image processing is used by converting image into digital form and performing some operations on it. By taking input as an image and output be the characteristics associated with that images andthen the emotions are displayed as output.

## METHODOLOGY

•**DataCollection :** The system would require a dataset of labeled facial expressions to train and test the emotion recognition models. The dataset should be diverse enough to cover a wide range of facial expressions and emotions.

•**Preprocessing :** The raw video data would need to be preprocessed to extract meaningful features such as the shape of the facial features, the position of the eyes, eyebrows, and mouth, and the color of the skin. This preprocessing can be done using computer vision techniques such as neural networks, or deep learning models.

•**Neural Network Models:** The system would use neural network models such as Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN) to learn and recognize facial emotions from the extracted features. These models would be trained using the labeled dataset.

•**Real-Time Emotion Detection :** The trained models can be used for real-time emotion detection by analyzing the pictures and predicting the emotions of the person being analyzed. This can be done using a camera, webcam, or other video sources.

•**Haar Classifier :** Haar features can be measured by expanding or reducing the size of the pixel group. It used Haar-like features to detect an image. This method will allow objects to be detected in various sizes. Haar classifier will identify a set of features which are most contributing for the face detection problem in training phase itself. Therefore, it is suitable for face detection in training phase as it may indicates to high detection accuracy since the computation complexity is small.

## RESULTS


## CONCLUSION

The purpose of this work was not to get conclusive results but to bear out the main challenges and difficulties involved in emotion detection from facial expressions. The project helps in identifying the different emotions of a person which are angry, disgust, happy, sad, fear, surprise and neutral. These facial emotions can be mainly used in E-learning, criminal investigation, online gaming, psychology and many other applications. Using a public dataset of train and test samples for seven different classes of human emotions, we build and train a convolutional neural network model and use it along with haar cascade classifier to produce the final predicted emotion of an uploaded image.

## FUTURE SCOPE

As emotion recognition technology becomes more sophisticated and more deeply embedded in our array of devices, it will become expected that our computers and phones provide us with a continual progression of customized triggers and messaging. The technology will be found even in future car dashboards, refrigerator doors, and conference room walls etc. The future enhancements of this project are:

- To increase the accuracy
- To predict the compound emotions

This work can be carried out by others in order to convert it into a model for predicting the emotions of a person by using the real time capturing of the face. Similarly, the other advancement of this project may include the extraction of images from the videos and predicting the emotions from those images.

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