# COIMBATORE INSTITUTE OF TECHNOLOGY


# MACHINE LEARNING TECHNIQUES
# 21AD42

## FACIAL EMOTION AND EXPRESSION DETECTION

## SUBMITTED BY


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## ABSTRACT

Face detection has been around for ages. Taking a step forward, human emotion displayed by face and felt by brain, captured in either video, electric signal (EEG) or image form can be approximated. Human emotion detection is the need of the hour so that modern artificial intelligent systems can emulate and gauge reactions from face. This can be helpful to make informed decisions be it regarding identification of intent, promotion of offers or security related threats. Recognizing emotions from images or video is a trivial task for human eye, but proves to be very challenging for machines and requires many image processing techniques for feature extraction. Several machine learning algorithms are suitable for this job. Any detection or recognition by machine learning requires training algorithm and then testing them on a suitable dataset. This paper explores a couple of machine learning algorithms as well as feature extraction techniques which would help us in accurate identification of the human emotion.


## INTRODUCTION

The purpose of emotion recognition systems is the appliance of emotion related knowledge in such a way that human computer communication will be enhanced and furthermore the user's experience will become more satisfying. By enabling computers to sense the emotional state of the user and react accordingly, this communication can be renovated to a satisfying one. Refining communication with computers is not the only application of emotion recognition. There can be specialized systems that can be developed and can be used for even more serious problems like in various medical applications aggression detection, stress detection, autistic disorder, asperger syndrome, hepatolenticular degeneration, frustration detection.

## PROBLEM STATEMENT

To detect the facial expression and identify the emotion using Machine Learning models. Supervised or unsupervised methods can be used to achieve highest accuracy.

## APPLICATIONS

Machine learning-based facial expression recognition finds extensive applications, and we have discussed a few of them below.

- Facial Expression Recognition Technology is used for medical research in autism therapy and deepfake detection.
- FER technology can be leveraged to ensure safe driving on roads. So, if a driver is feeling drowsy and is about to faint, the ride-hailing service can deploy a system to raise the alarm after reading their facial expressions.
- The facial emotion recognition project solution codes are widely used to automate clicking selfies. An individual must look at the camera with beautiful smiles, and the device will click the image without any external push.
- Another everyday use case is for businesses. They can use this technology to analyze the feedback emotions of their customers for their service. They can leverage that information to plan their next course of action in upscaling their business growth. For example, serving a sad customer can be prioritized.

## LIBRARIES AND TOOLS USED

- Open CV
- Scikit-Learn
- CNN
- Tensor Flow
- Keras
- Jupyter Notebook
- DataSet

## MACHINE LEARNING APPROACHES USED

### CNN AND KERAS:

Convolutional Neural Networks (CNNs) are a specific type of deep learning model that are widely used for computer vision tasks, such as image classification, object detection, and image segmentation. CNNs are well-suited for these tasks because they can automatically learn hierarchical representations from raw image data

Keras is a high-level neural network library written in Python. It is designed to be user-friendly, modular, and extensible, making it a popular choice for deep learning tasks. Keras provides a simplified interface to build, train, and deploy deep learning models, allowing researchers and developers to focus more on model architecture and experimentation rather than low-level implementation details.

Performance and Accuracy: CNNs, when properly trained, have shown remarkable performance in facial emotion and expression detection tasks. They can achieve high accuracy rates by effectively learning and

capturing the subtle visual cues present in facial expressions, enabling robust and accurate emotion classification.

Feature Extraction: CNNs can learn to extract high-level features directly from raw images without the need for manual feature engineering. This is advantageous in facial emotion and expression detection, as it allows the model to automatically learn relevant facial features that contribute to different emotional states, such as eye movements, mouth shape, or eyebrow positions.

**KNN:**

KNN can perform well when the dataset for facial emotion and expression detection is relatively small. Since KNN stores the entire training dataset in memory, it can effectively compare the new data point with the limited number of training samples. This can be useful when the dataset is not large enough to train more complex models like neural networks.

**SOLUTION**

The problem of facial emotion and expression detection involves developing a machine learning model that can analyze facial images and accurately predict the corresponding emotion or expression. The process typically involves the following steps,

**Image Acquisition:** Static image or image sequences are used for facial expression recognition. 2-D gray scale facial image is most popular for

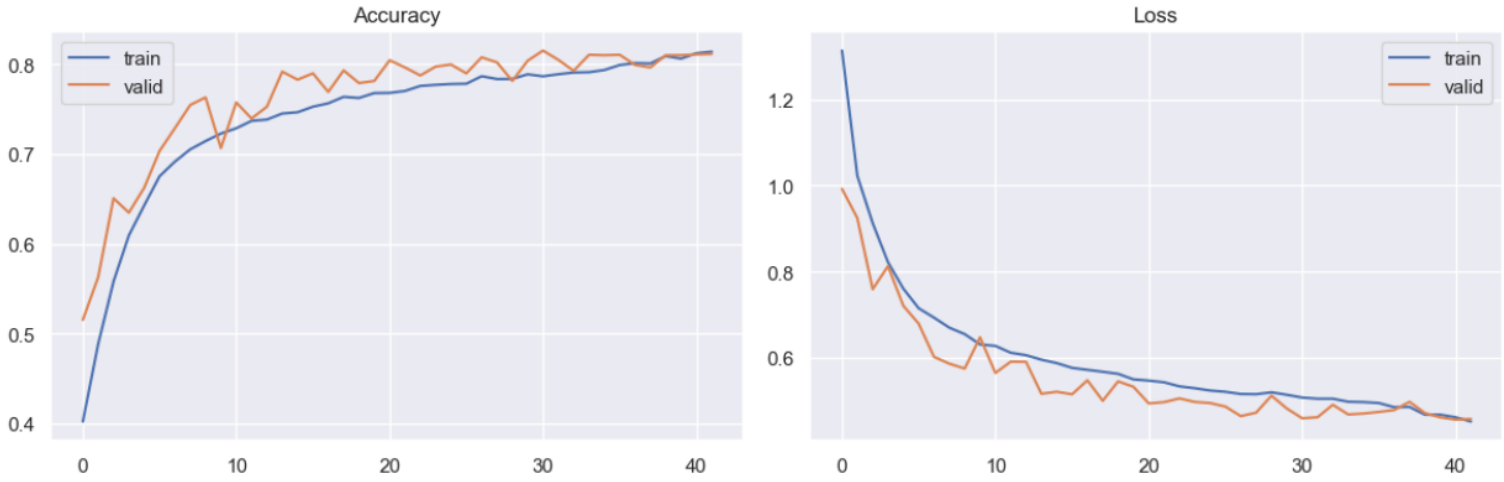
facial image recognition although color images can convey more information about emotion such as blushing. In future color images will be preferred for the same because of low cost availability of color image equipment. For image acquisition Camera, Cell Phone or other digital devices are used.

**Pre-processing:** Pre-Processing plays a key role in the overall process. The PreProcessing stage enhances the quality of input image and locates data of interest by removing noise and smoothing the image. It removes redundancy from images without the image detail. Pre-Processing also includes filtering and normalization of image which produces uniform size and rotated image.

**Segmentation:** Segmentation separates images into meaningful reasons. Segmentation of an image is a method of dividing the image into homogenous, self consistent regions corresponding to different objects in the image on the bases of texture, edge and intensity.

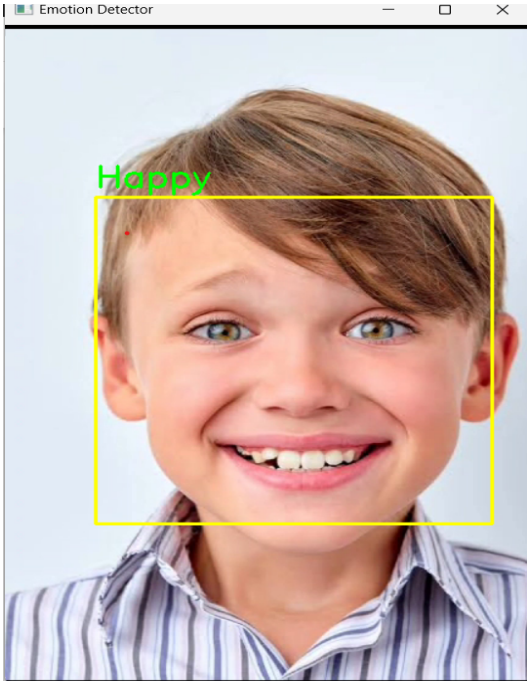
**Feature Extraction:** Feature extraction can be considered as Dzinterestdz part in image. It includes information of shape, motion, color, texture of facial image. It extracts the meaningful information from the image. As compared to original image feature extraction significantly reduces the information of the image, which gives advantage in storage.

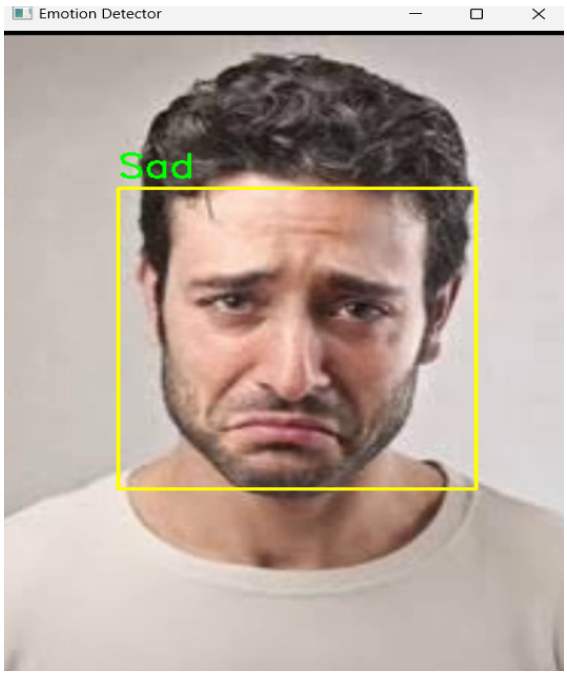
**Classification:** Classification stage follows the output of the feature extraction stage. Classification stage identifies the facial image and grouped them according to certain classes and helps in their proficient recognition. Classification is a complex process because it may get affected by many factors. Classification stage can also be called feature selection stage, deals with extracted information and group them according to certain parameters.

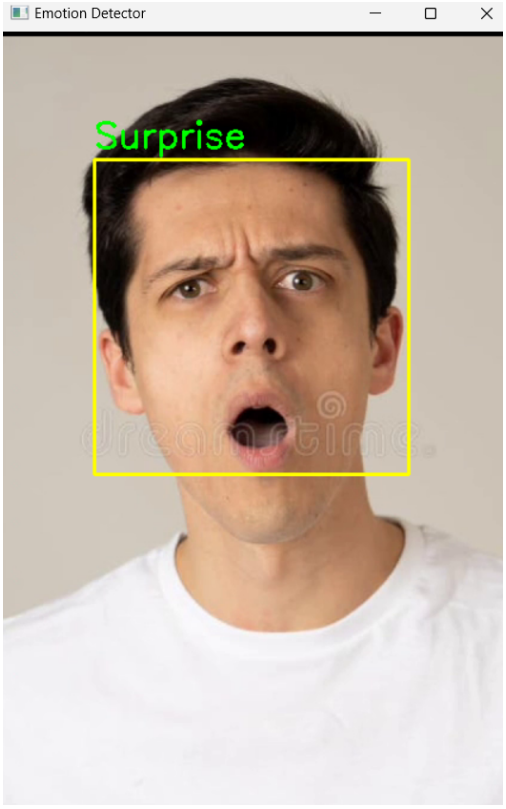


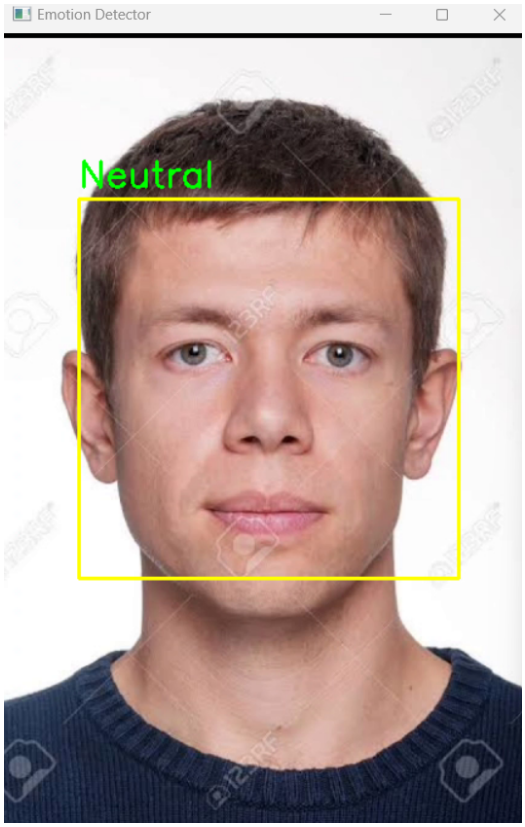

## RESULT

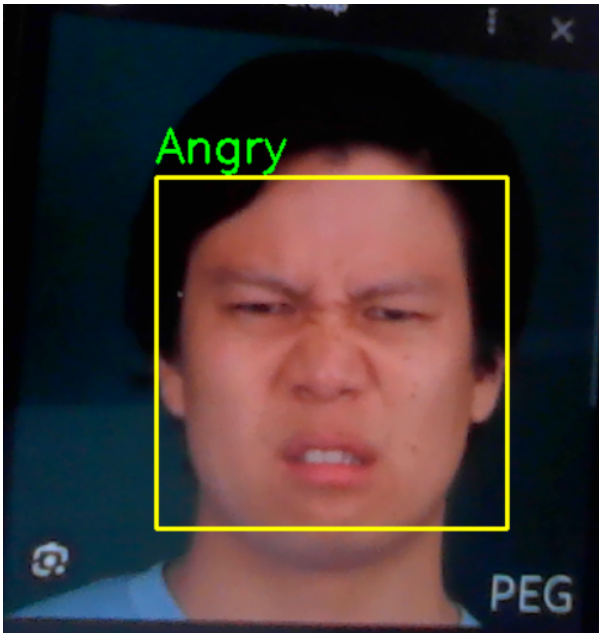
The training and testing datasets are from a Kaggle Facial Expression Recognition Challenge (FER2013). It comprises pre cropped grayscale photos of faces classified as pleased, sad, disgusted, angry, surprised, fearful, or neutral. The webcam image will be used as the input for processing the output. The output labels human facial expressions as pleased, sad, disgusted, angry, surprised, fearful, or neutral.




Emotion Detector
Surprise


Emotion Detector
Neutral


Angry
PEG

## CONCLUSION:

An image processing and classification method has been implemented in which face images are used to train a dual classifier predictor that predicts the seven basic human emotions given a test image. The predictor is relatively successful at predicting test data from the same dataset used to train the classifiers. However, the predictor is consistently poor at detecting the expression associated with contempt. This is likely due to a combination of lacking training and test images that clearly exhibit contempt, poor pre-training labeling of data, and the intrinsic difficulty at identifying contempt. The classifier is also not successful at predicting emotions for test data that have expressions that do not clearly belong exclusively to one of the seven basic expressions, as it has not been trained for other expressions. Future work should entail improving the robustness of the classifiers by adding more training images from different datasets, investigating more accurate detection methods that still maintain computational efficiency, and considering the classification of more nuanced and sophisticated expressions.

## REFERENCES

https://www.kaggle.com/datasets
https://www.analyticsvidhya.com/
https://ieeexplore.ieee.org/abstract/document/4624313/
https://d1wqtxts1xzle7.cloudfront.net/54663429/
https://ieeexplore.ieee.org/abstract/document/7862118/