# COIMBATORE INSTITUTE OF TECHNOLOGY

## MACHINE LEARNING TECHNIQUES

## 21AD42


# FACIAL EMOTION AND EXPRESSION DETECTION

**Submitted by:**


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# INTRODUCTION

## SIGNIFICANCE OF THE PROJECT:

The significance of facial emotion and expression detection in machine learning models is multi-faceted and has numerous practical applications. Facial emotion and expression detection allows machines to interpret and respond to human emotions, enabling more natural and intuitive interactions. This is crucial for various applications, such as virtual assistants, chatbots, and video conferencing systems, where understanding user emotions can enhance user experience and engagement which improves Human-Computer Interaction.

Mental Health and Well-being: Facial emotion detection can contribute to mental health assessment and intervention. By analysing facial expressions, machine learning models can help identify signs of distress, depression, or anxiety. This information can assist healthcare professionals in diagnosing and treating mental health conditions, as well as tracking patient progress.

Marketing and Advertising: Emotion detection models can provide valuable insights into consumer responses to products, advertisements, and user interfaces. By analysing facial expressions, companies can gauge the emotional impact of their offerings, optimize marketing strategies, and create more personalized experiences for customers.

Education and Learning: Facial emotion detection can be employed in educational settings to improve the effectiveness of teaching and learning processes. By analysing students' facial expressions, educators can identify engagement levels, comprehension difficulties, or emotional states. This information can inform adaptive learning systems, allowing personalized interventions and tailored educational content.

# MACHINE LEARNING APPROACHES CONSIDERED FOR SOLVING THIS PROBLEM:

## 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.

# **METHODOLOGY-** DESCRIPTION OF THE SOLUTION

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

Data Collection: A labelled dataset of facial images is collected, where each image is associated with a specific emotion or expression label. This dataset can be obtained from various sources, including publicly available datasets or by collecting data through controlled experiments or surveys. The dataset used is taken from kaagle.

Data Pre-processing: The collected facial images need to be pre-processed to ensure consistency and enhance the model's performance. This involves steps such as:

- Image resizing: Resizing the images to a fixed resolution to ensure uniformity in input dimensions.

- Face detection and alignment: Locating and aligning the faces in the images to ensure consistent positioning and scale across the dataset.

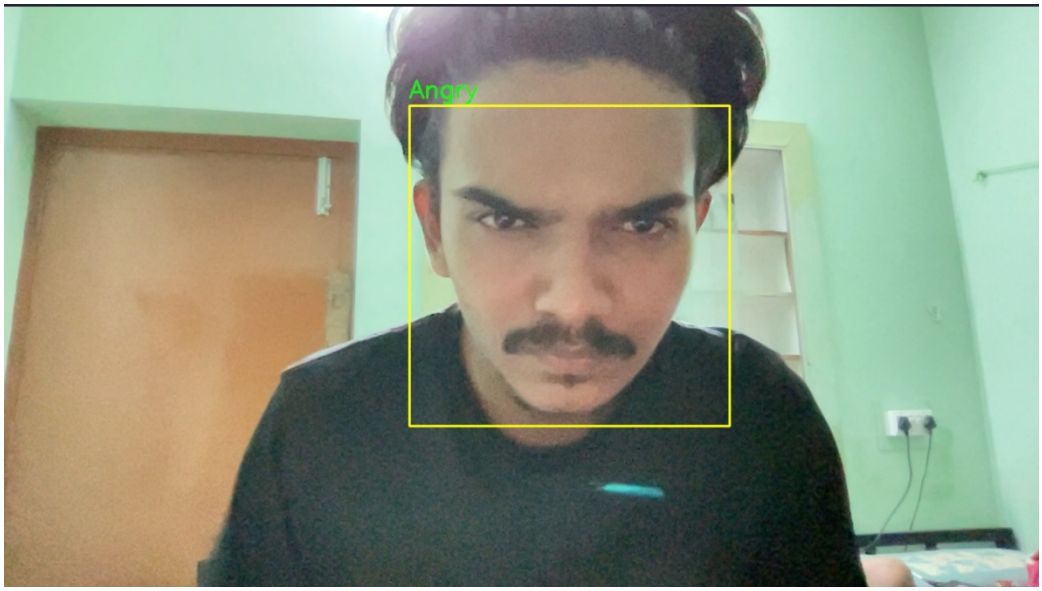
- Image normalization: Adjusting the image intensity or colour channels to reduce variations due to lighting conditions or image quality.

- Noise reduction: Applying techniques such as smoothing filters to reduce noise or artefacts in the images.

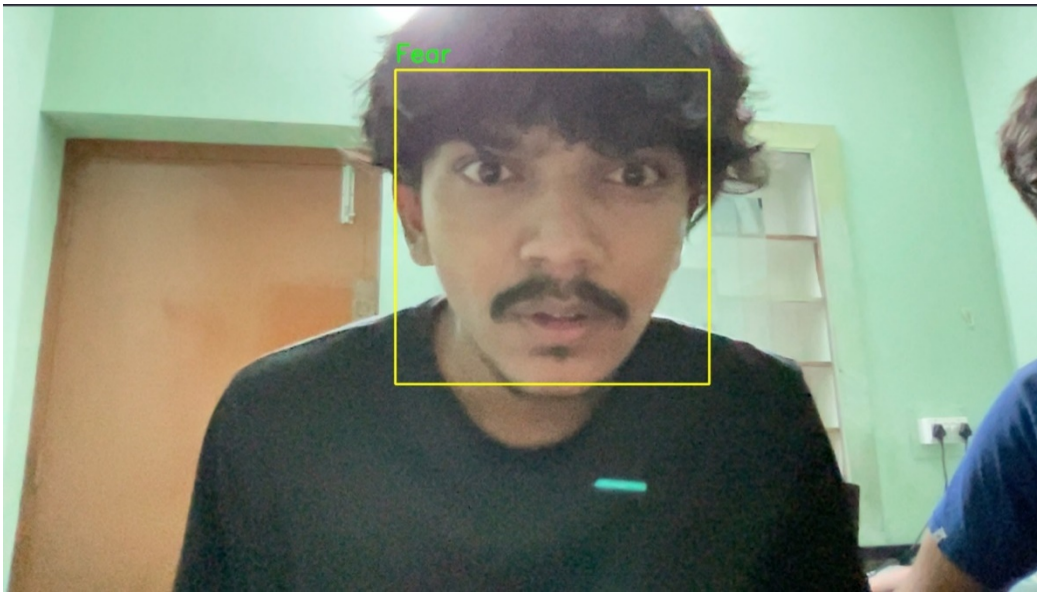
Data Split: The labelled dataset is split into training, validation, and testing subsets. The training set is used to train the model, the validation set is used to tune hyper parameters and evaluate model performance during training, and the testing set is used to assess the final model's performance.

# RESULT:

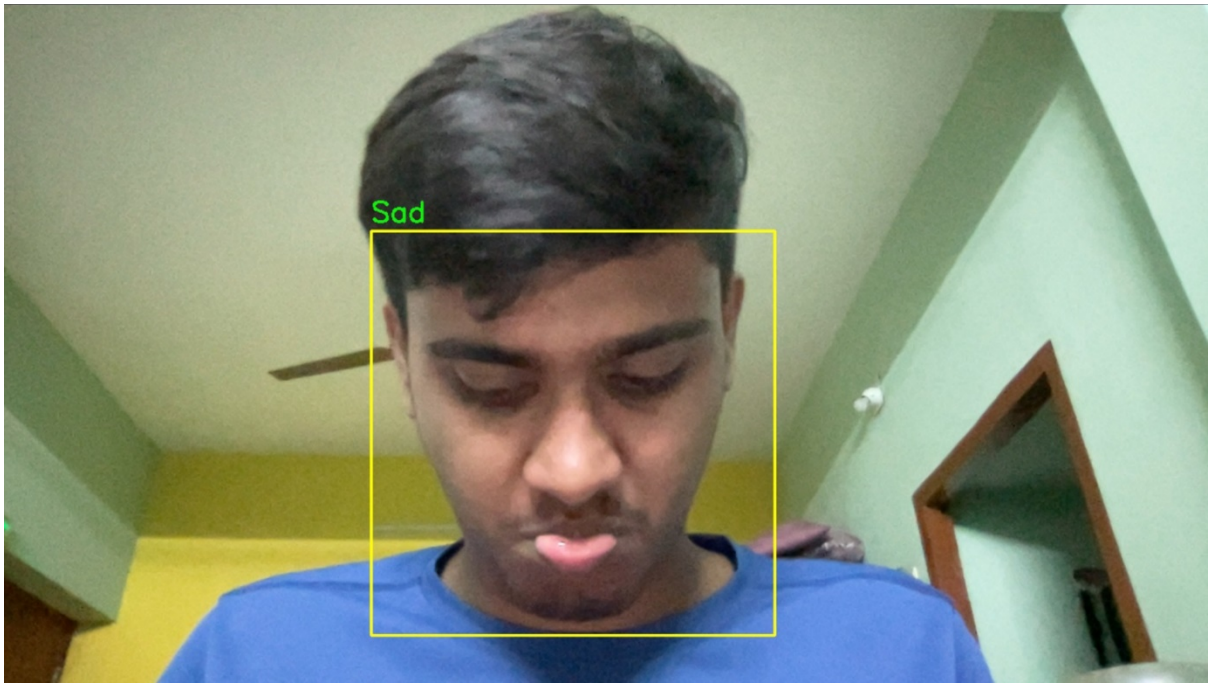
**ANGRY-**



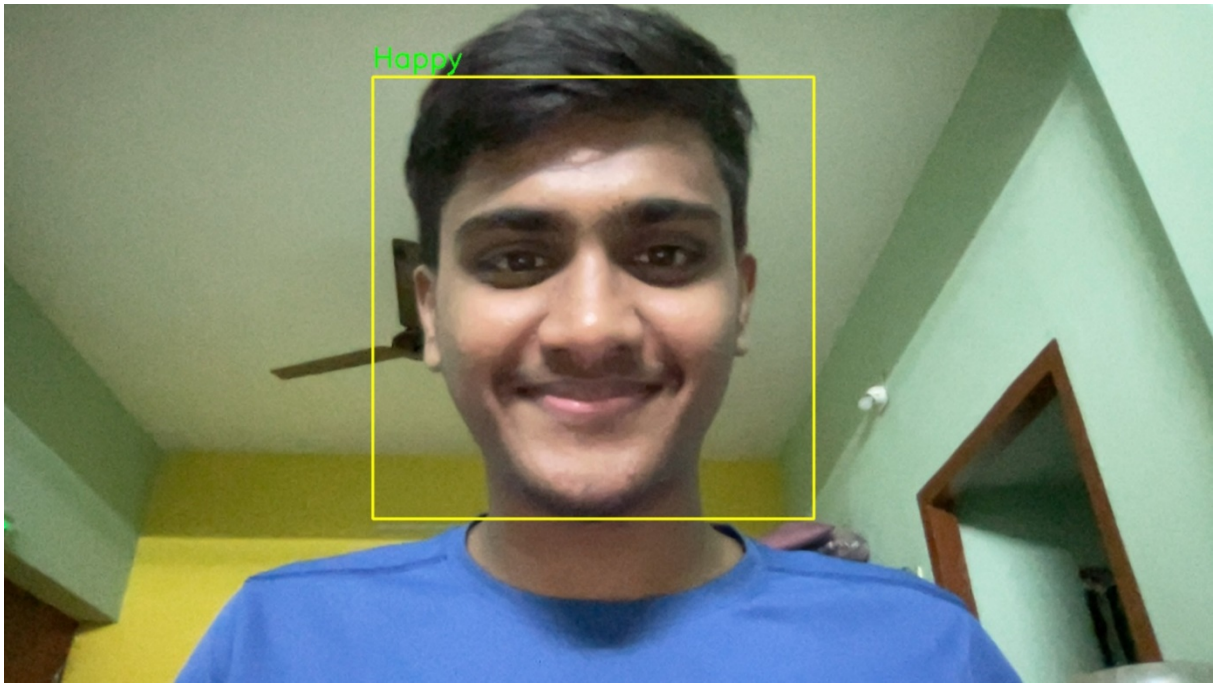

**FEAR-**



**SAD-**




**HAPPY-**



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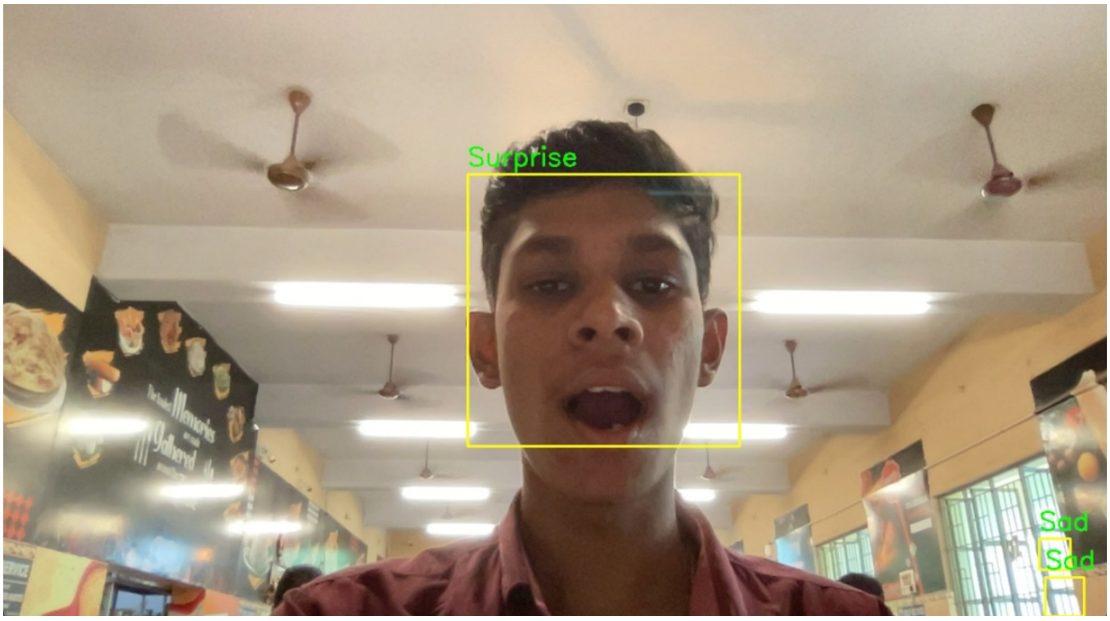
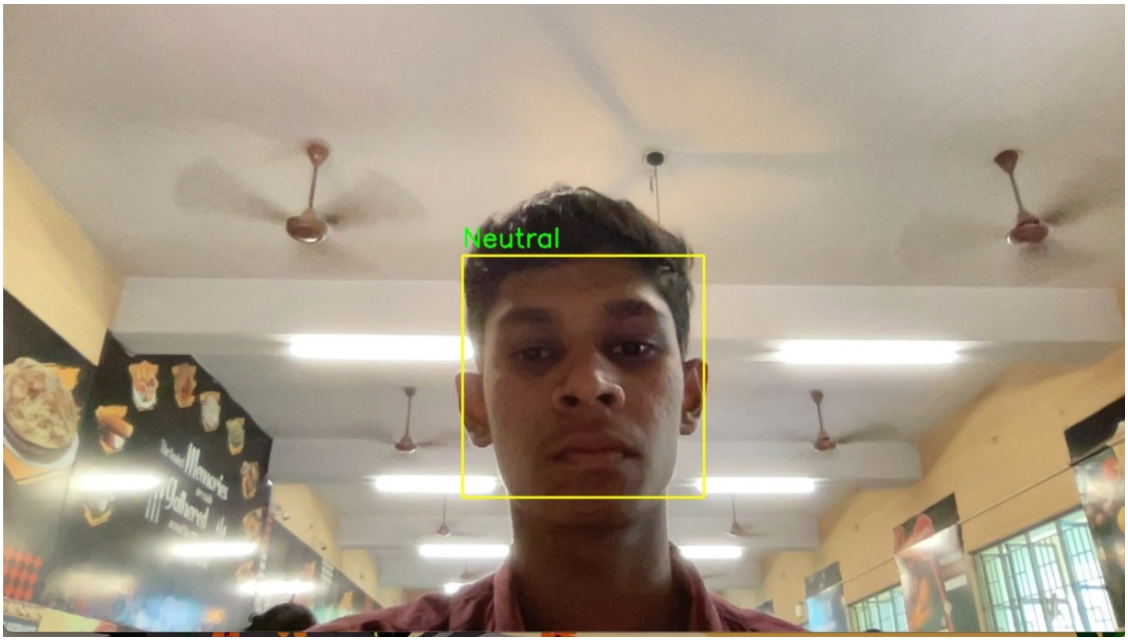



**NEUTRAL-**



The dataset is first pre-processed and made into a smaller size to detect the region of interest (face). The modified dataset is passed into the different layers of CNN which produces different variations (filters) of the available dataset. The layer is then connected appropriately to produce the output. The model is then processed with the train and test dataset. The checkpoints are then placed to monitor the accuracy and learning rate is set to 0.001 to produce higher accuracy. The generated model is then used to predict the emotion in different images and live video feeds.

## CONCLUSION:

In conclusion, emotion detection using Python is a powerful and valuable tool for analysing and understanding human emotions. Python provides a wide range of libraries and frameworks that enable developers to build accurate and efficient emotion detection models. However, it is important to note that emotion detection using Python is not without its challenges. The accuracy of emotion detection models heavily depends on the quality and diversity of training data. The accuracy achieved in the proposed solution is 73%.

CNN was used preferred over KNN as it provided more accuracy for larger dataset. The model can be improved by using high quality dataset and using a non-biased dataset. KNN was also not applicable for larger datasets.

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