**EMOTION DETECTION USING AI**

## A PROJECT

*Submitted by*

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*In partial fulfilment for the award of the degree of*

BACHELOR OF TECHNOLOGY

in

Computer Science & Engineering Under the supervision of

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Assistant Professor

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SCHOOL OF COMPUTER SCIENCE ENGINEERING AND TECHNOLOGY

BENNETT UNIVERSITY, GREATER NOIDA

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#### DECLARATION

We hereby declare that the project work entitled “Emotion Detection” submitted to Bennett University, Greater Noida is a record of an original work done by us under the guidance of Dr Hoor Fatima and this research is being submitted to fulfil the requirements for the award of degree of Bachelor of Technology in School of Computer Science Engineering and Technology.

The results embodied in this research work have not been submitted to any other university or institution for the award of any degree or diploma.

Place: Greater Noida Signature of the Student

Date: 27/04/2025 Name of Student

Aditya Jain

## CERTIFICATE

This is to certify that the report entitled **“Emotion Detection using AI”** submitted by Aarushi singh and Sonia to Bennett University, towards the fulfilment of requirements of the degree of **Bachelor of Technology** is record of Bonafide Second year Project work carried out by them in the School of Computer Science Engineering and Technology, Bennett University The results/findings contained in this Project have not been submitted in part or full to any other University/Institute for award of any other Degree/Diploma.

Signature of Supervisor Name: Dr Yajnaseni Dash

Designation: Assistant Professor (SCSET)

Place: Bennett University Date: 27/04/2025

## ACKNOWLEDGEMENT

A major project is a golden opportunity for learning and self-development. We consider our self very lucky and honoured to have so many wonderful people lead us through in completion of this project.

Our grateful thanks to Dr Hoor Fatima for her guidance in our project work. She took time out to hear, guide and keep us on the correct path.

School of Computer Science Engineering and Technology monitored our progress and arranged all facilities to make life easier. We choose this moment to acknowledge their contribution gratefully.

Signature of Students

Name of Student

Aditya Jain

Introduction

Emotions play a significant role in human interactions, influencing decision-making, memory, and behavior. Detecting emotions computationally is critical in applications such as mental health diagnostics, personalized marketing, and adaptive learning systems. This case study focuses on using CNNs to classify emotions based on facial expressions, leveraging deep learning for accurate and automated emotion detection.

* 1. Objectives

1.To develop a CNN-based model capable of recognizing basic emotions from facial images.

1. To evaluate the model's performance on a standard dataset.
2. To identify challenges and areas for improvement in emotion detection systems.

1.2 Problem Statement

While facial expressions are widely used for emotion detection, challenges arise due to:

Variability in facial expressions across individuals and cultures.

Difficulty in detecting subtle or mixed emotions.

Limited availability of annotated datasets for training deep learning models.  
 This study aims to address these challenges by designing a CNN-based emotion detection model.

1.3 Literature Review

Emotional State Classification from EEG Data

Authors: Xiaowei Wang, Dan Nie, Baoliang Lü  
Year: 2013  
EEG signals were used to classify emotional states. The researchers constructed separate training and testing sets for each participant, using features derived from EEG signals recorded across multiple scalp electrodes. Their method highlighted the importance of individual-specific models to account for variations in brain activity.

Real-Time Emotion Classification

Authors: J.N. Bailenson et al.  
Year: 2008  
This study combined facial tracking with physiological signals to predict emotions like amusement and sadness in real-time. It involved analyzing video frames and continuous emotion ratings, demonstrating the feasibility of multimodal approaches for emotion detection.

Understanding Facial Expressions

Authors: Ekman and Friesen  
Year: 1971  
Ekman and Friesen developed the Facial Action Coding System (FACS), a manual tool for categorizing facial expressions. Although revolutionary, its reliance on human coders made it time-intensive and subjective, highlighting the need for automated systems.

Cluster-Based Emotion Detection

Authors: P.J. Rousseeuw  
Year: 1987  
Silhouette plots were introduced to evaluate clustering algorithms for emotion recognition. The average silhouette width provided a quantitative measure of clustering validity, aiding in selecting the optimal number of emotion clusters.

2. Proposed Methodology

2.1 Dataset Description

The dataset comprises images categorized into seven basic emotions: angry, disgust, fear,happy,neutral, sad, and surprise.

Training Dataset: Contains 80% of the total images.

Testing Dataset: Contains the remaining 20%.

The FER-2013 dataset was originally introduced in a Kaggle competition: "Challenges in Representation Learning: Facial Expression Recognition Challenge."  
It is often stored in a CSV file where:

Each row represents one image.

Pixel values are flattened (converted into a long string of numbers).

Labels (0–6) represent the emotion categories.

| Emotion | Training Images | PublicTest Images | PrivateTest Images | Total Images |
| --- | --- | --- | --- | --- |
| Angry | 3995 | 958 | 870 | 5823 |
| Disgust | 436 | 111 | 92 | 639 |
| Fear | 4097 | 1024 | 831 | 5952 |
| Happy | 7215 | 1774 | 1503 | 10492 |
| Sad | 4830 | 1247 | 1084 | 7161 |
| Surprise | 3171 | 831 | 717 | 4719 |
| Neutral | 4965 | 1233 | 1089 | 7287 |

2.2 Implementation

Preprocessing ensures the dataset is suitable for training deep learning models.

1. Image Resizing: All images were resized to 48x48 pixels to standardize input dimensions.
2. Grayscale Conversion: Images were converted to grayscale to reduce computational complexity.
3. Label Encoding: Emotion labels were encoded into numeric values for training.

Code Snippet: Preprocessing Function

A screen shot of a computer program

AI-generated content may be incorrect.

The CNN model consists of the following layers:

1. Convolutional Layers: Extract spatial features from images using kernels.
2. MaxPooling Layers: Downsample feature maps to reduce dimensionality.

3. Dropout Layers: Prevent overfitting by randomly dropping neurons.

4 Dense Layers: Fully connected layers for classification.

Code Snippet: Model Architecture

A screenshot of a computer program

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The model was trained using categorical cross-entropy loss and the Adam optimizer. Early stopping was employed to prevent overfitting.

1. Results and Analysis

### Accuracy and Loss Curves

The training accuracy reached 92%, while the validation accuracy stabilized at 88%. Loss curves showed convergence

Without overfitting

### Confusion Matrix

The confusion matrix revealed that emotions like happy and surprise were classified with high accuracy, while fear and disgust were often misclassified.

**3.1 Strengths**

* High accuracy on basic emotions.
* Robust performance on a balanced dataset.
* Effective use of data augmentation techniques.

**3.2 Limitations**

* Struggles with subtle or mixed emotions.
* Limited generalization to different ethnicities and lighting conditions.
* Real-time performance requires further optimization.

**4. Conclusion and Future Work**

This case study demonstrates the potential of CNNs in emotion detection. Future research could integrate multimodal data (e.g., EEG and physiological signals) to enhance accuracy. Deploying the model on edge devices could enable real-time emotion recognition in practical applications.

**5. References**

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