BASAVARAJESWARI GROUP OF INSTITUTIONS
BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT
NBA and NACC Accredited Institution*
(Recognized by Govt. of Karnataka, approved by AICTE, New Delhi & Affiliated to Visvesvaraya Technological University, Belagavi) "Jnana Gangotri" Campus, No.873/2, Ballari-Hosapete Road, Allipur, Ballari-583 104 (Karnataka) (India)
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DEPARTMENT OF

CSE - ARTIFICIAL INTELLIGENCE

Neural Network and Deep Learning Project

Report On

"Emotion Detection Using CNN"

Submitted By

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Under the Guidance of

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Belagavi, Karnataka

2025-2026

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CERTIFICATE

Certified that the mini project work entitled "**Emotion Detection Using CNN"** carried out by **Varsha Meti bearing USN 3BR22CA058.** A Bonafide students of Ballari Institute of Technology and Management in partial fulfillment for the award of Bachelor of Engineering in Artificial Intelligence and Machine Learning of the Visvesvaraya Technological University, Belgaum during the year 2025- 2026. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The project report has been approved as it satisfies the academic requirements in respect of the project work prescribed for the said Degree.

Signature of Lab Co-Ordinators

Mr. Pavan kumar

Mr. Vijay kumar

Signature of HOD

Dr. Yeresime suresh

ABSTRACT

This project aims to detect human emotions from facial images using a Convolutional Neural Network (CNN). The FER2013 dataset is used, which contains thousands of grayscale face images. The model is trained to recognize five emotions: Happy, Sad, Neutral, Fear, and Surprise. By preprocessing images, applying data augmentation, and training a CNN, the system can accurately predict emotions from uploaded images using a Streamlit interface. This project shows how AI can help computers understand human feelings in real time.This project uses a Convolutional Neural Network (CNN) to detect emotions from facial images. The FER2013 dataset, containing thousands of labeled faces, is used to train the model. The images are preprocessed, augmented, and then fed into the CNN to learn important facial features.The final trained model is integrated into a Streamlit app, where users can upload a face image and get an instant emotion prediction. This project demonstrates how deep learning can help machines accurately recognize human emotions in real time.

ACKNOWLEDGEMENT

The satisfaction that accompanies the successful completion of project work on the **"Emotion Detection using CNN"** would be incomplete without mentioning those who made it possible. Their noble gestures, affection, guidance, encouragement, and support crowned our efforts with success. It is our privilege to express our gratitude and respect to all those who inspired us in the completion of this project.

We are extremely grateful to our Lab Coordinators, **Mr.Pavan kumar and Mr. Vijay kumar**, Assistant Professor, CSE-AI, BITM, Ballari, and **Dr. Yeresime suresh** Professor and Head of the Department of CSE-AI, BITM, Ballari, for their noble gestures, support, coordination, and valuable suggestions in completing the project work.

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Varsha Meti	3BR22CA058

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Emotions play a key role in human communication, and people express them through facial expressions like happiness, sadness, fear, and surprise. In modern digital systems, it is important for computers and AI-based applications to understand these emotions to improve interaction with users

This project uses a Convolutional Neural Network (CNN) to detect emotions from facial images. The FER2013 dataset, containing thousands of labeled faces, is used to train the model. The images are preprocessed, augmented, and then fed into the CNN to learn important facial features.

The final trained model is integrated into a Streamlit app, where users can upload a face image and get an instant emotion prediction. This project demonstrates how deep learning can help machines accurately recognize human emotions in real time.

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CHAPTER 2

OBJECTIVES

1. **Accurate Facial Emotion Recognition:**

The system aims to identify human emotions such as happiness, sadness, anger, fear, surprise, and neutrality with high precision. By using Convolutional Neural Networks (CNNs), it learns deep facial features and delivers reliable emotion classification in real time

2. **Deep Feature Extraction Using CNN:**

With multiple convolutional and pooling layers, the model automatically extracts meaningful patterns such as facial expressions, muscle movements, and micro-features. This enables robust emotion detection even under variations in lighting, pose, and background.

3. **Real-Time Emotion Prediction:**

The system processes live video or image inputs and instantly predicts the user's emotional state. Its optimized CNN architecture ensures fast computation, making it suitable for applications like human-computer interaction, mental-health analysis, and smart surveillance

CHAPTER 3

PROBLEM STATEMENT

Humans express emotions through facial expressions, but computers cannot understand them naturally. There is a need for an automated system that can analyze a person's face and detect their emotion accurately. The challenge is to handle different lighting, facial angles, noise, and variations in expressions. This project solves this problem by building a CNN-based model that can classify emotions from face images.

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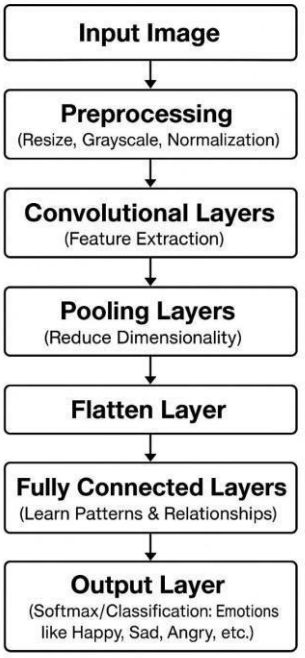
CHAPTER 4

METHODOLOGY



4.1 Block Diagram of Emotion Detection Using CNN

The block diagram shows the complete process of detecting emotions using a CNN model. First, an input facial image is taken and sent for preprocessing, where it is resized, converted to grayscale, and normalized. Then, the image moves into convolutional layers, which extract important facial features. Pooling layers follow, reducing the size of the extracted features while keeping essential information. The output is flattened into a single vector and passed through fully connected layers that learn emotion patterns. Finally, the output layer uses Softmax to classify the face into emotions like happy, sad, angry, or fear. The predicted emotion is displayed as the final result.

CHAPTER 5

REQUIREMENT ANALYSIS

FUNCTIONAL REQUIREMENTS

1. Image Upload and Input Handling
The system must allow users to upload facial images or capture photos through a webcam for emotion detection.

2. Face Detection and Cropping
The system must detect the face region from the input image and crop it accurately before sending it to the CNN model.

3. Image Preprocessing
The system must preprocess the detected face by converting it to grayscale, resizing it to 48×48, and normalizing pixel values.

4. Emotion Classification Using CNN
The system must use the trained CNN model to classify the face into one of the five emotions: Happy, Sad, Neutral, Fear, or Surprise.

NON-FUNCTIONAL REQUIREMENTS

- **Performance:**
- Ensure fast and real-time emotion detection by optimizing CNN layers for quick processing of facial images.
- **Accuracy:**
- Maintain high classification accuracy by using deep feature extraction and training on diverse emotion datasets like FER2013.
- **Scalability:**
- Support large-scale deployment by handling high-volume image inputs and adapting to various lighting, poses, and facial variations.

CHAPTER 6

DESIGN

FLOW CHART

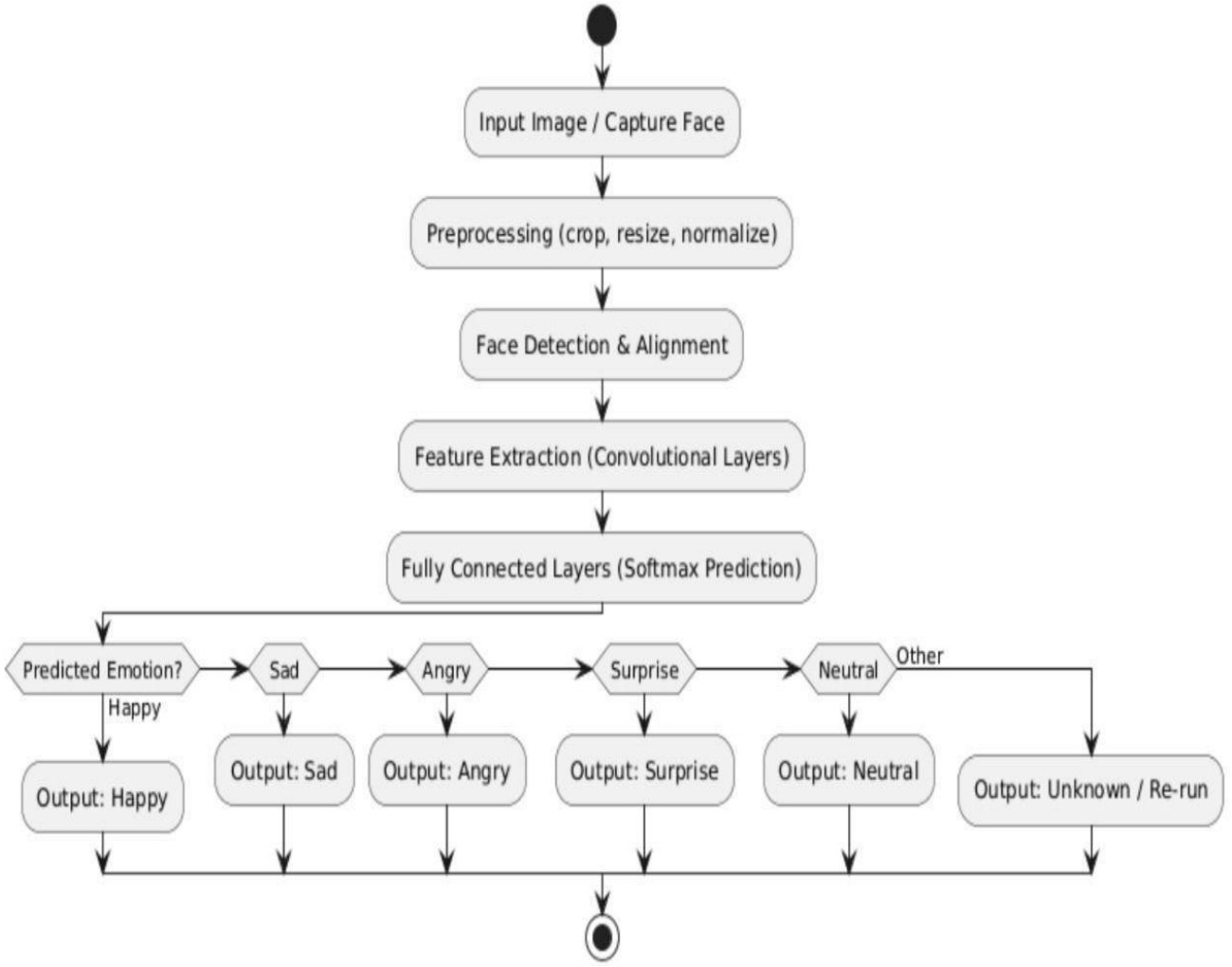


Fig 6.1 Flow Chart

USE CASE DIAGRAM

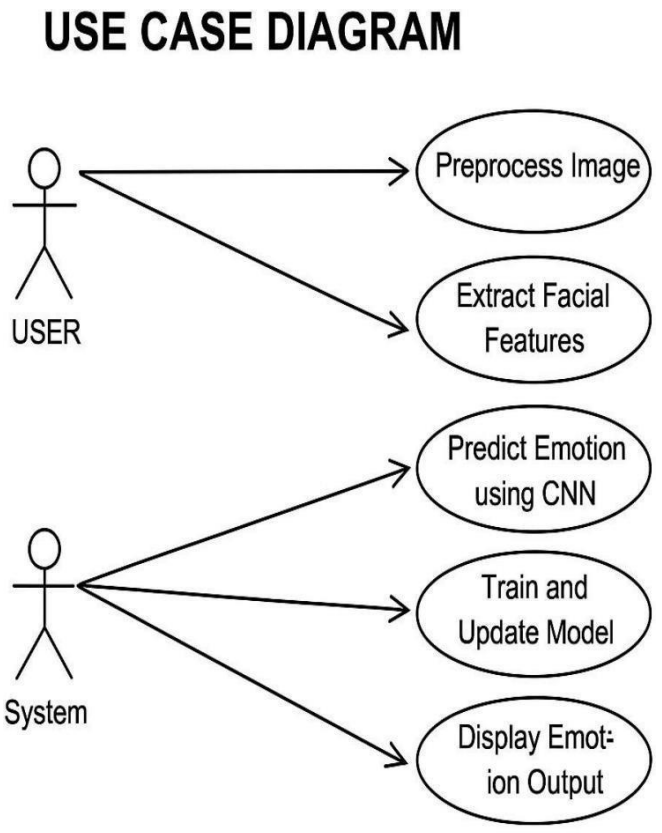


Fig 6.2 Use Case Diagram

Fig 6.2 Use Case Diagram

SEQUENCE DIAGRAM

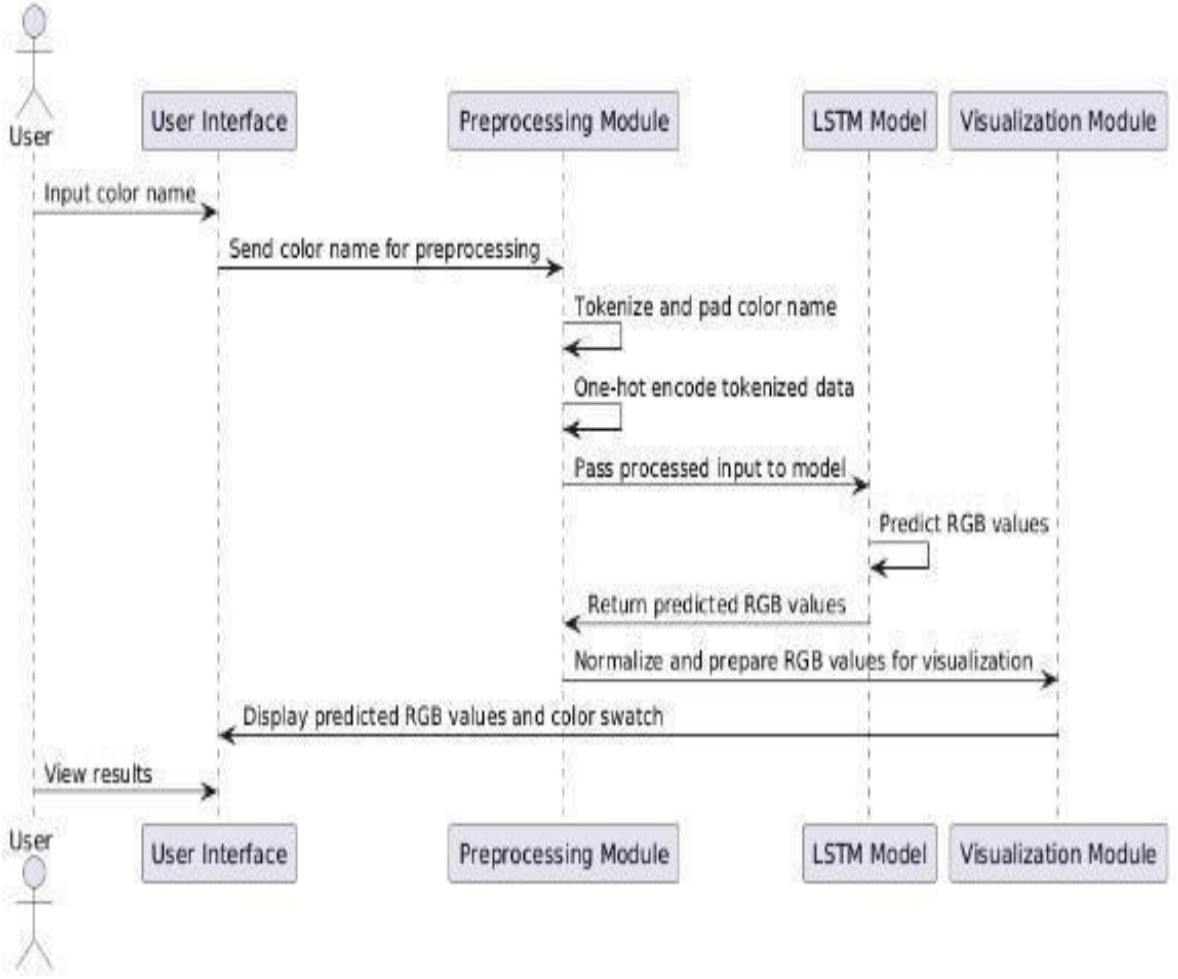


Fig 6.3 Sequence Diagram

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CHAPTER 7

IMPLEMENTATION

Phase 1: Data Preparation

- Collect facial images from FER2013 dataset contatining emotions like happy,sad,angry,fear,surprise etc
- Convert images into grayscale,resize them to 48*48 and pixel values between 0 and 1

Phase 2: Model Development

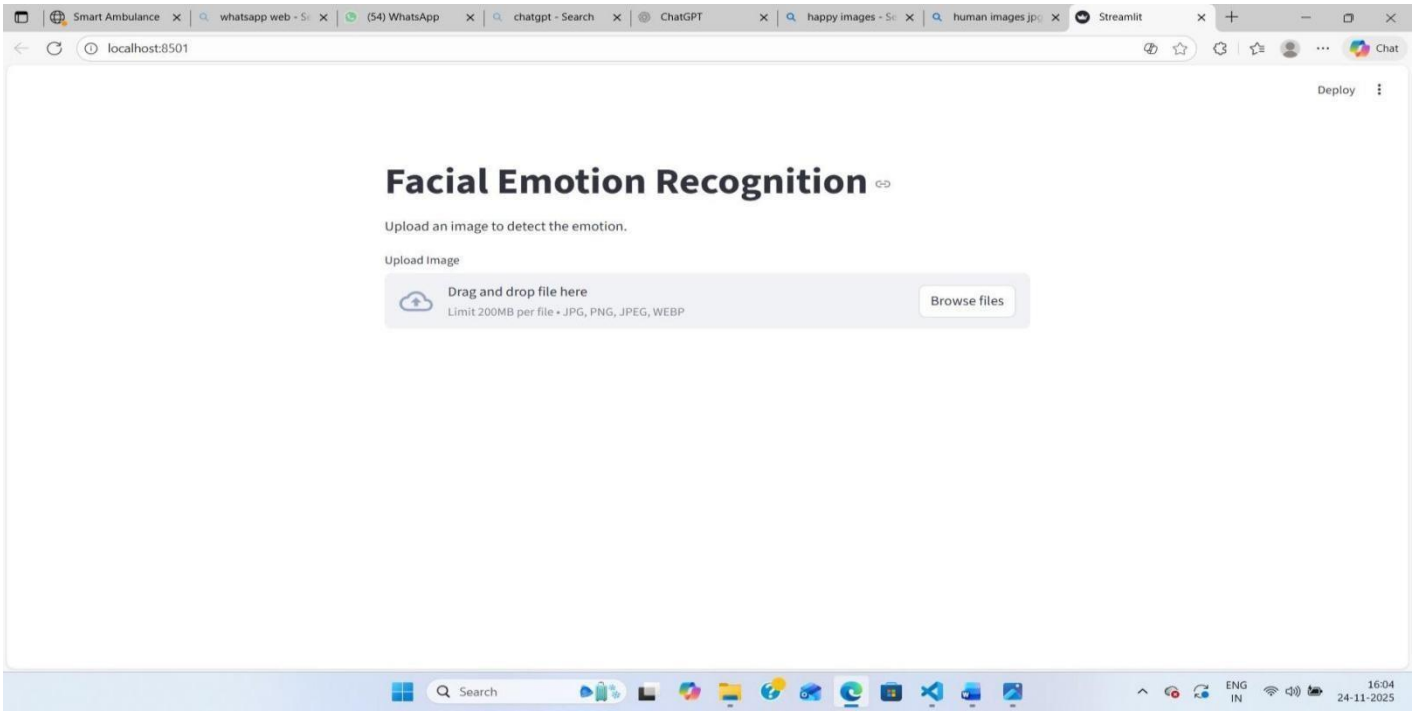
- Build Convolutional Neural Network with layers.Compile model using Adam Optimizer and cross-entropy loss.
- Train and validate the model.

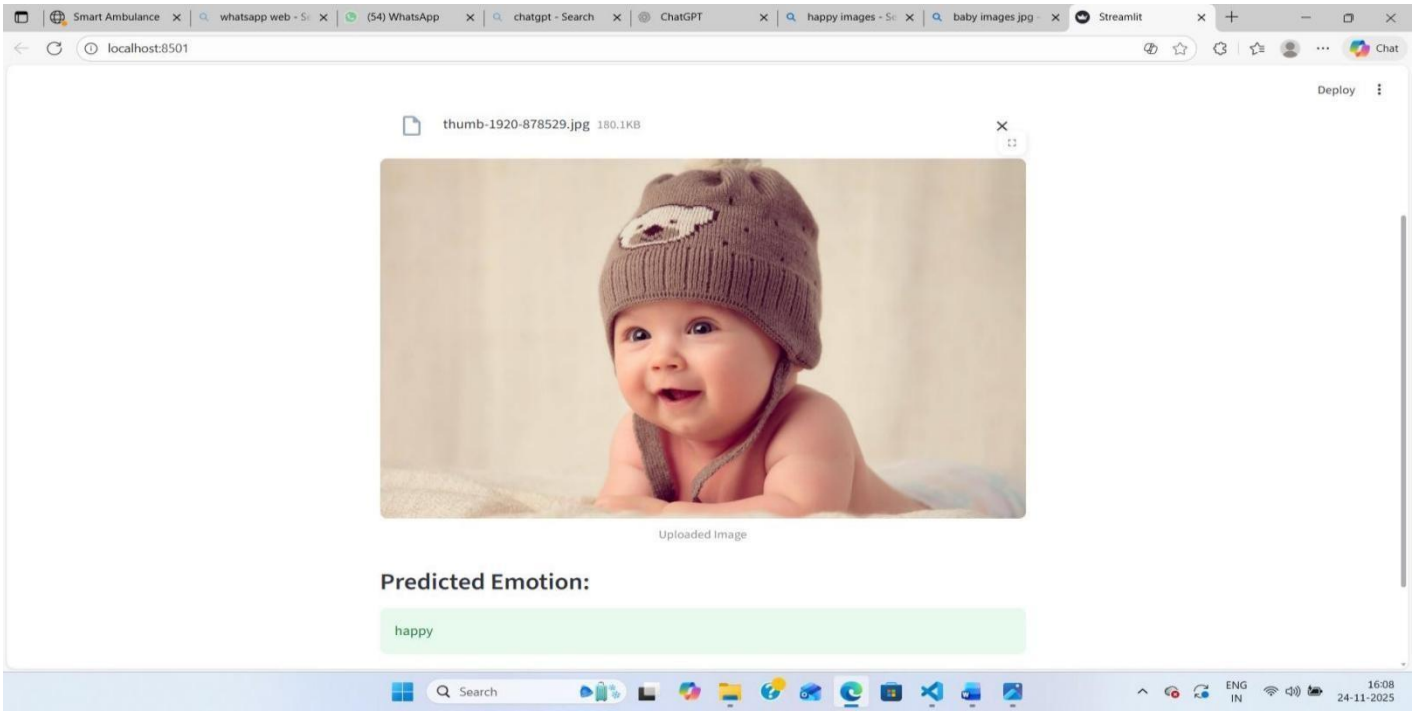
Phase 3: Deployment and Testing

- Save model and load it during execution.
- Capture/upload facial image,feed into CNN model.
- Display predicted emotion label with confidence scores,Visualize output if required.

CHAPTER 8

RESULTS AND DISCUSSION





CHAPTER 9

CONCLUSION

The project successfully demonstrates how CNNs can be used to detect human emotions from facial images. Using the FER2013 dataset and data augmentation, the model achieves good accuracy and handles real-world variations. The Streamlit interface makes the system easy to use for applications like smart classrooms, customer feedback analysis, mental health Additionally, the model performs reliably even with different lighting and face angles. It provides quick predictions, making it suitable for real-time use. Overall, this project shows how deep learning can improve the way machines understand and respond to human emotions.

CHAPTER 10

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