



# Facial Emotion Recognition Using CNN

Dr. V Suresh

Assistant Professor, Information Technology, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, India

B. Padmavathi, Information Technology, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, India

K. Tripura, Information Technology, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, India

B. V. Sandeep Kumar, Information Technology, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, India

B. Kasi, Information Technology, Anil Neerukonda Institute of Technology and Sciences, Visakhapatnam, India

**ABSTRACT:** The study of algorithms is known as machine learning (ML). It is thought to be a collection of AI.

Without being specifically designed to do so, machine learning algorithms create a mathematical model supported by training data in order to make predictions or decisions. Machine learning methods like deep learning may train computers to mimic human learning processes like learning from examples. Deep learning might be a crucial component of driverless automobiles, allowing them to recognize when to stop or distinguish between a pedestrian and a post. Voice management is crucial for client devices including phones, tablets, TVs, and hands-free speakers.

Deep learning architectures that are comparable to continuous neural networks, deep belief networks, and neural networks and convolution neural networks are utilized in a variety of fields, including computer vision, speech recognition, tongue processing, audio recognition, social network filtering, computational linguistics, bio-informatics, drug design, medical image analysis, material review, and parlor game programs, where they have produced results that are comparable to and occasionally even surpass those of human consultants.

## VOLUME 1: INTRODUCTION

This is a project about **FACIAL EMOTION RECOGNITION SYSTEM USING CNN**. In this chapter, the problem and motivation, research objectives, project scope, project contributions and the background information of the project will be discussed in detail.

### Problem Statement and Motivation:

Facial emotion recognition is an AI technology that uses machine learning algorithms to analyze a person's facial expressions and interpret their emotions. It can be applied in various fields such as psychology, marketing, and security. There are several Facial Emotion Recognition (FER) projects available that use different programming languages and deep learning techniques to recognize emotions from images and videos. In this article, we will focus on a Facial Expression Recognition project in Python that involves training a deep neural network to recognize emotions from facial images. The problem statement for a facial emotion recognition is to accurately predict a person's emotion based on their facial expression from a grayscale picture. This involves developing an algorithm that can classify the facial expression into one of the seven basic emotions: happy, sad, surprise, fear, anger, disgust, and neutral. The goal is to create a machine learning model that can accurately recognize emotions from facial expressions in real-time applications.

### Research Objectives:

"Using Convolutional Neural Network : A Review" This paper explores different deep learning techniques for facial expression recognition and compares their performance on various datasets.

"For Marketing Applications" : The research objective of this paper is to develop an emotion recognition system that can be used to analyze consumer emotions and preferences in marketing research.

"Real-time Facial Emotion Recognition using Deep Learning" : The research objective of this project is to develop a real-time facial emotion recognition system using deep learning techniques and evaluate its performance in practical settings.

**Project Scope and Direction:**

1. Data collection and preprocessing: Collecting facial expression data and preprocessing it to ensure that it is suitable for training the machine learning algorithm.
2. Algorithm selection and training: Choosing an appropriate algorithm such as Convolutional Neural Network(CNN) and training it on the dataset.
3. Feature extraction: Extracting important features from the facial expressions to improve the accuracy of emotion recognition.
4. Evaluation and testing: Evaluating the performance of the algorithm on a suitable dataset and testing it on new data to ensure that it can accurately recognize emotions in real-time applications.
5. Real-time application: Implementing the algorithm into a real-time application, such as a mobile app or a web application, depending on the specific application requirements.

**Impact, Significance and contributions:**

Here are some of the ways in which FER has contributed and impacted these fields:

1. Psychology: FER has contributed to the understanding of human emotions and behavior, and it has helped researchers to develop new theories and models of human emotional states and responses .
2. Sociology: FER has contributed to the understanding of social interactions and communication, and it has helped researchers to analyze and interpret nonverbal cues and facial expressions in social contexts.
3. Marketing: FER has contributed to the understanding of consumer behavior and preferences, and it has helped marketers to design more effective advertising and marketing campaigns .
4. Security: FER has contributed to the development of new security systems and technologies, and it has helped law enforcement to detect and prevent criminal activities .

project:

Facial emotion recognition has a long and interesting history that can be traced back to the 1800s. Here are some key milestones in the development of this technology:

- 1872: Charles Darwin wrote about the universality of facial expressions and their role in human emotion in his book, "The Expression of the Emotions in Man and Animals".
- 1960s-1970s: Psychologists such as Paul Ekman and Wallace Friesen began to develop coding systems for facial expressions, laying the groundwork for future research in this field.
- 1990s: Researchers began to develop computer-based algorithms for automatic facial expression recognition. These early algorithms used simple rules and heuristics to detect facial expressions.
- 2000s: With the advent of machine learning and artificial intelligence, facial emotion recognition algorithms became more sophisticated and accurate. These algorithms could recognize multiple emotions and were less reliant on predetermined rules.
- 2010s: Facial emotion recognition technology became increasingly accessible, with companies such as Affectiva and Emotient developing software for commercial use
- 2020s: Facial emotion recognition is now widely used in a variety of industries, including healthcare, marketing, education, and security. However, ethical concerns have also arisen regarding the use of this technology, particularly in the areas of privacy and bias.

**VOLUME 2: LITERATURE SURVEY**

- Facial emotion recognition (FER) is a rapidly evolving field with a vast amount of literature available. Here is a brief literature survey of some of the key studies and research in this field.
- Because deep learning can extract complex information from photos or videos, it has been frequently used in FER. To categorise emotions from facial photos, researchers have employed Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and their derivatives.
- "Emotion Recognition using Facial Landmarks, Python, DLib, and OpenCV" is one significant piece in this field. To extract face features and categorise emotions, feature-based techniques use manually created features like Gabor filters, Local Binary Patterns (LBP), and Histograms of Oriented Gradients (HOG).
- Some notable works in this area include "Facial Expression Recognition Using Local Binary Patterns and Support Vector Machines" (Shan et al., 2009) and "Facial Expression Recognition using Histogram of Oriented Gradient Features and Support Vector

Machines".

- Transfer learning has been used to train FER models with limited data. Researchers have used pre-trained CNNs, such as VGG-16 and ResNet-50, to extract facial features and classify emotions. Some notable works in this area include "Facial Expression Recognition with Transfer Learning" (Keramidas et al., 2021) and "Fine-tuning pre-trained deep neural networks for facial expression recognition". Ensemble approaches combine multiple classifiers to improve FER performance.
- Some notable works in this area include "Facial Expression Recognition using a Hybrid Deep Ensemble Network" (Li et al., 2021) and "Ensemble of Shallow Networks for Facial Expression Recognition".

### VOLUME 3 :SYSTEM DESIGN

**Network Interface Card (NIC):** A NIC is required to connect the FER system to the internet or other networked devices, allowing for remote access and control. Depending on the intended use case, the NIC may need to support different types of networks and protocols.

**Power Supply:** A stable and reliable power supply is essential for the FER system to function properly, especially in cases where the system is deployed in remote or harsh environments. Depending on the intended use case, the power supply may need to support different voltages, currents, and backup options.

**Camera:** A high-quality camera is essential for capturing high-resolution images or video feeds of human faces. Depending on the intended use case, the camera may need to support different frame rates, resolutions, and lighting conditions.

**Processor:** A powerful processor is required to process the images or video feeds captured by the camera, and to perform the complex machine learning algorithms required for emotion recognition. Depending on the intended use case, the processor may need to support different processing speeds, memory capacities, and power consumption levels.

**Graphics Processing Unit (GPU):** A GPU can accelerate the performance of machine learning algorithms and image processing tasks, allowing the FER system to recognize emotions more quickly and accurately. Depending on the intended use case, the GPU may need to support different types of architectures and computing capabilities.

The minimal hardware requirements are as follows:

1. Processor : i5
2. RAM : 4 GB
3. Processor : 2.4 GHz
4. Camera : 2MP
5. GPU : 2-4 GB of VRAM

#### Software Requirements.

**Image Processing Software:** The FER system requires image processing software to extract and manipulate the images or video feeds captured by the camera. The software should support the necessary features for image filtering, enhancement, segmentation, and feature extraction, as well as the ability to work with different file formats. Common image processing software options include OpenCV, MATLAB, and ImageJ.

**Machine Learning Frameworks:** The FER system requires machine learning frameworks to develop and deploy the emotion recognition algorithms. The frameworks should support the necessary algorithms, models, and tools required for training and testing the system, as well as the ability to work with different programming languages. Common machine learning frameworks options include TensorFlow, PyTorch, and Keras.

**Emotion Recognition Algorithms:** The FER system requires emotion recognition algorithms to analyze the facial expressions captured by the camera and generate output data. The algorithms should be accurate, reliable, and capable of handling different lighting conditions, facial expressions, and backgrounds. Common emotion recognition algorithms include support vector machines (SVM), convolutional neural networks (CNN), and deep belief networks (DBN).

**User Interface:** The FER system requires a user interface (UI) to allow users to interact with the system, configure the settings, and view the output data. The UI should be intuitive, responsive, and customizable, and should support different platforms and devices. Common UI options include web-based interfaces, desktop applications, and mobile apps.

The minimal hardware requirements are as follows:

Language:: python

IDE:: python 3.7

Operating system: Any OS

Machine Learning Frameworks: Tensorflow, Keras, Pyaudio, Cv2, Imutils, Numpy, Gtts

The goal of this study is to develop an automated and effective method for facial emotion recognition along with the percentage of the emotion detected. To give completeness to the project we have also added a recommendation system based on an audio. Depending upon the emotion detected, the audio is played which is a recommendation for the betterment of your mood, if any. 69% accuracy has also been shown during the implementation the code.

We also claim that, this project is unique as we combined two different systems that are existent in the real-time. The advantages of the both the existing systems are combined thus eliminating the traditional methods.

The System consists of the following steps:

Firstly, we spot the face region from the non-inheritable image here .We use native abstraction position or displacement of specific points and regions of the face (pre-process to minimize the environmental and different variations within the image)

Secondly, we extract expression options here we have to two main classes of feature extraction: Geometric based and Appearance based.

**Geometric based feature extraction:** Geometric relationships equivalent to angles and positions between completely different facial components like nose, eyes, ears. The face expression is decided by the movement of the facial points

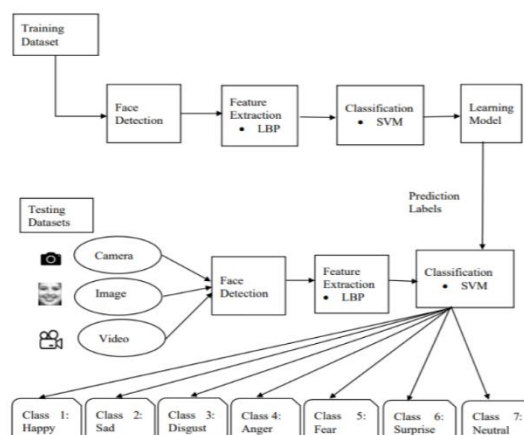
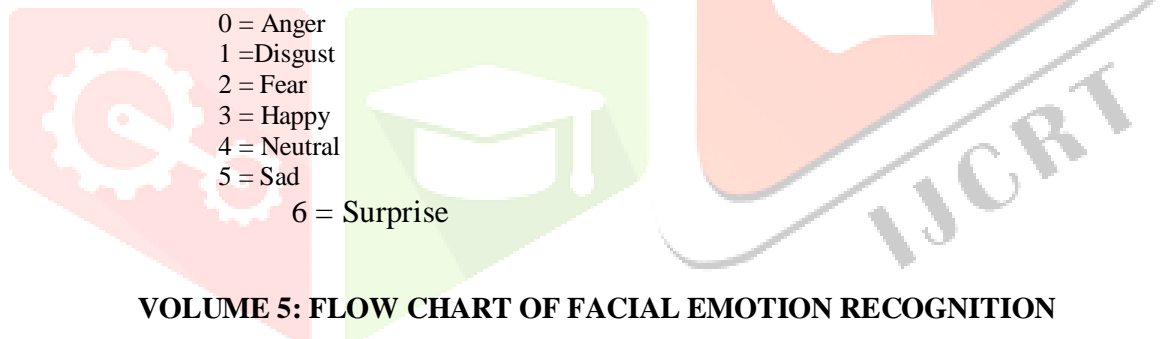
**Appearance based extraction:** The features are chosen to be the pixel intensity values in an image of the object and it captures the spatial shape of face during actions.

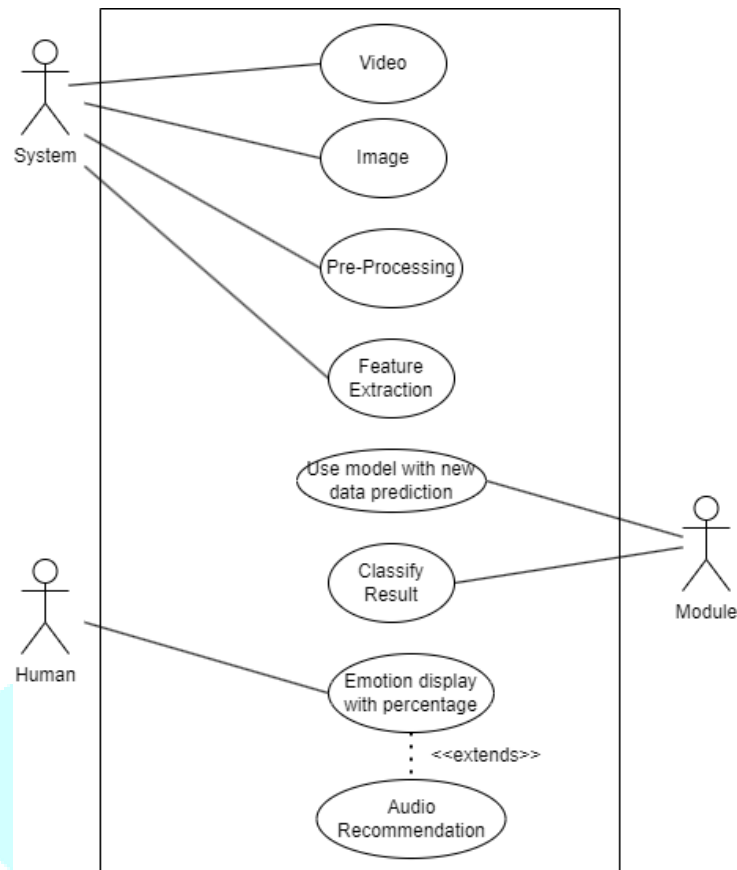
Thirdly, the spotted face is compared with the images from the database and the classifier provides the output of the expression that is recognized.

Finally, we display the percentage level of stress based on the emotion displayed, by clicking on a stop button, which is "S" on the keyboard. All of this process is carried out on a separate interface box.

The suggestion or audio recommendation will be displayed to give the project completeness.

In this project, seven different facial expressions of various person's pictures from different datasets are analyzed. Different facial expressions include 0-Anger,1-Disgust,2-Fear,3-Happy. 4-Neutral,5-Sad and 6-Surprise.





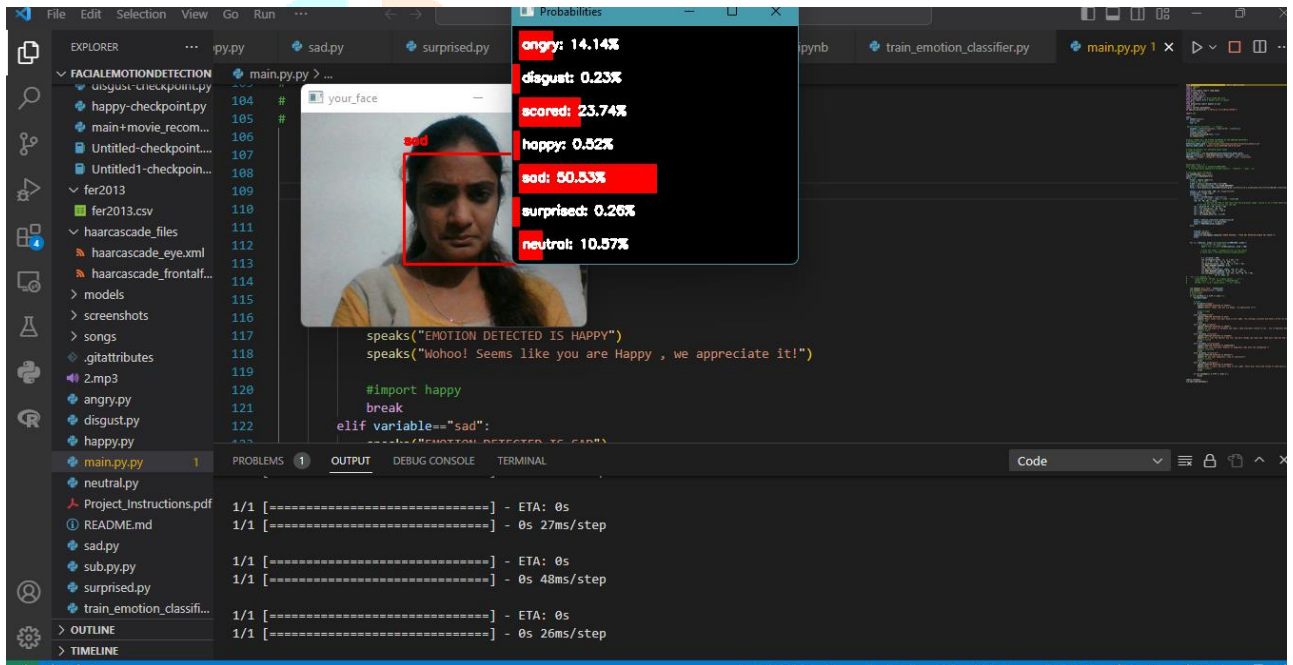
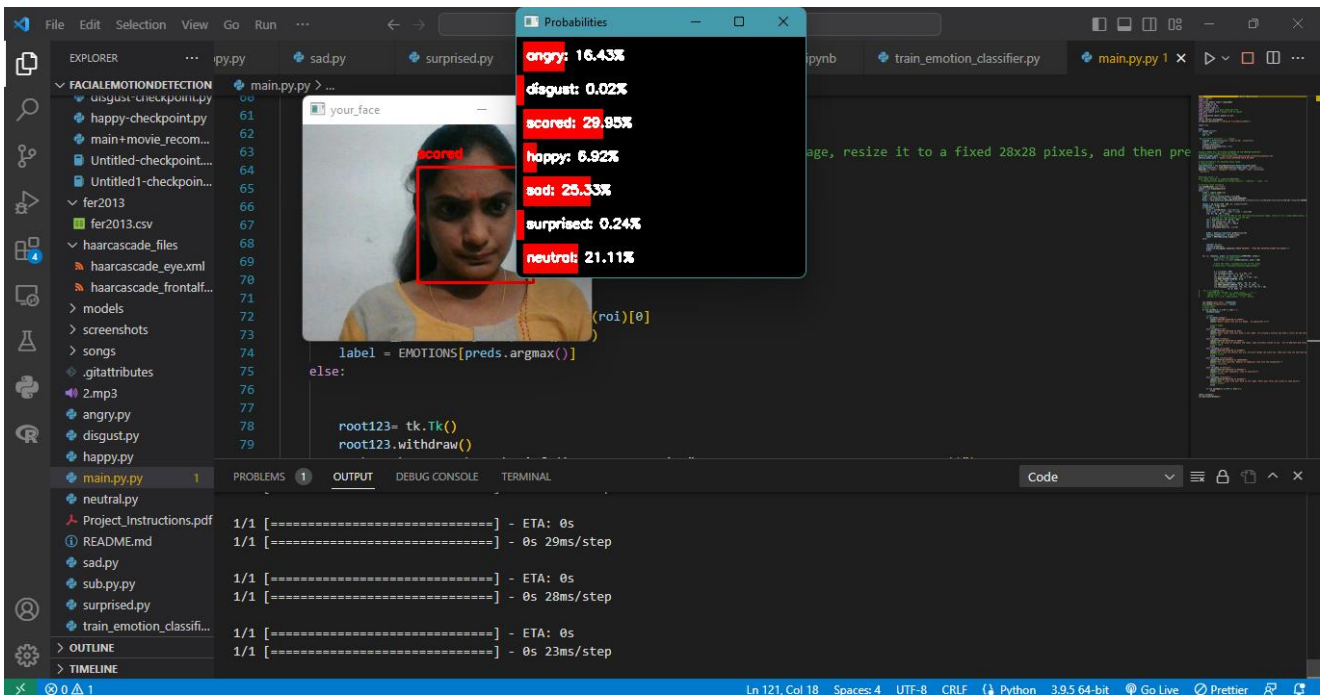
### VOLUME 6 :RESULTS

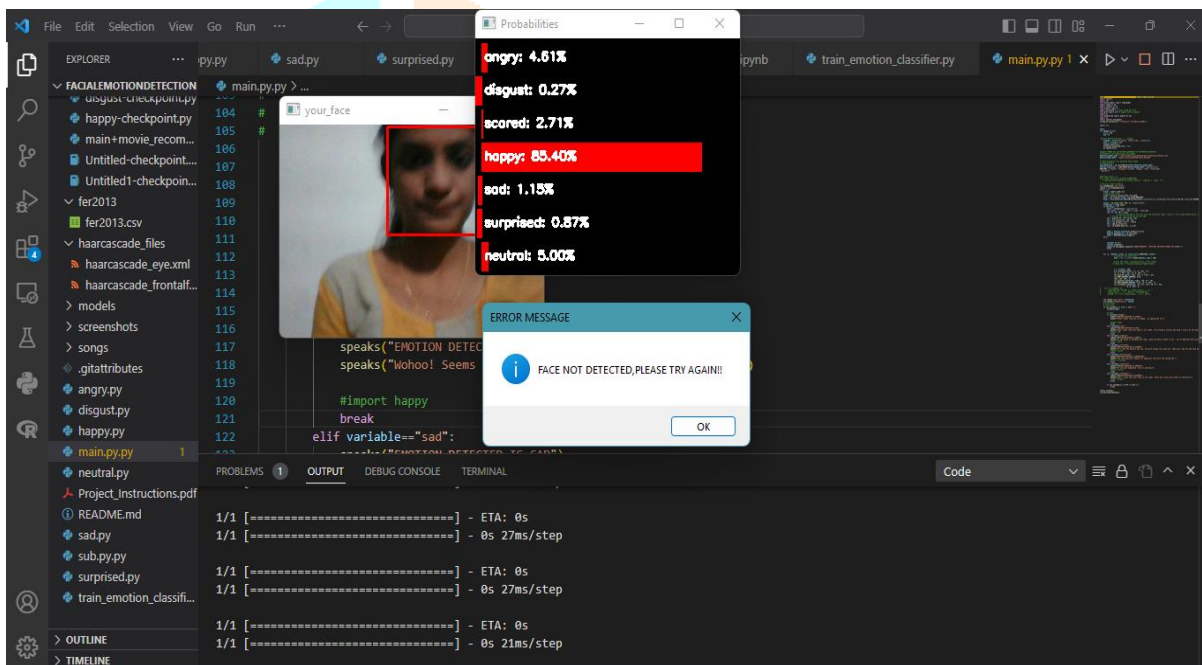
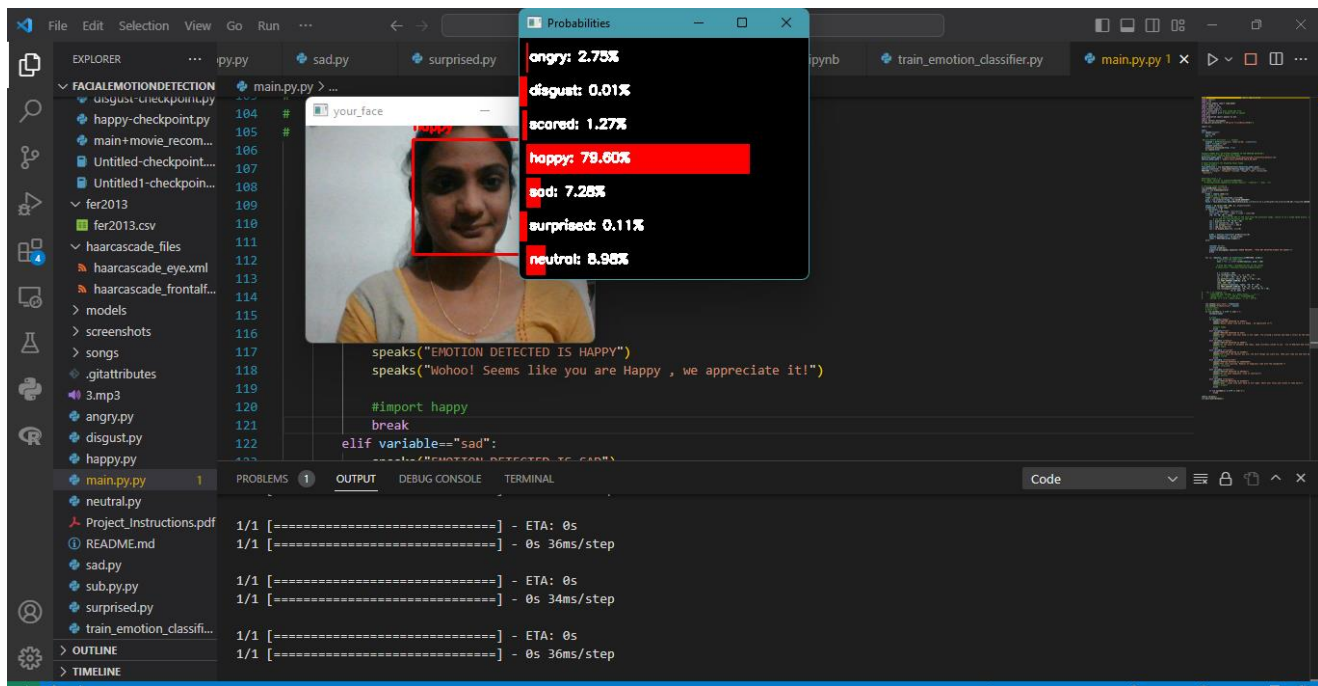
The screenshot shows a Python IDE with a video feed of a woman's face. A red box highlights the face, and the word "neutral" is written in red above it. A "Probabilities" window is open, showing the following results:

Emotion	Percentage
angry	21.61%
disgust	1.04%
scared	9.46%
happy	3.55%
sad	29.48%
surprised	0.35%
neutral	34.51%

The IDE also shows a code editor with Python code for video processing and emotion classification, and a terminal window with output logs.







## VOLUME 7: CONCLUSION

Infirmary Triage Check provides a high-quality user experience, meeting user needs and requirements. The system is designed to improve the efficiency of medical care, by enabling patients to quickly and accurately assess their medical needs, and connect with appropriate medical care. With its user-friendly interface, reliable functionality, and secure architecture, Infirmary Triage Check has the potential to make a significant impact on the healthcare industry.

## VOLUME 8: REFERENCES

- [1]. BEGINNING PHP 5 ---DAVE MERCER
- [2]. BLACK BOOK HTML ---WILEY DREAMTECH
- [3]. PHP AND MYSQL WEB DEVELOPMENT --- LUKEWELLING,LAURA
- [4]. THE JOY OF PHP PROGRAMMING: A BEGINNER'S GUIDE ---PLUM ISLAND