



EMOTION DETECTOR

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Abstract - In computer vision and machine learning, emotion detection is a crucial field of research. In this project, a machine learning model is developed to recognize facial expressions of various emotions using a dataset of facial images. The FER2013 dataset is pre-processed and augmented to increase the variety of facial expressions and used for training the machine learning model with a Convolutional Neural Network architecture. The model is built using a convolutional neural network (CNN) with various layers that extract features from the images. The GUI(Graphical User Interface) is designed to allow users to input images for emotion detection or access live camera feeds for real-time emotion detection. The system also utilizes the Haar Cascade algorithm, for facial detection. The results of the emotion detection are displayed on the GUI in a user-friendly manner. The proposed system can have various applications in areas such as psychology, human-computer interaction, and entertainment.

Keywords — *Emotion Detection, Facial Images, Haar Cascade Algorithm, Machine Learning, Graphical User Interface, Real-Time Detection.*

Emotion detection is an important and challenging problem in computer vision and machine learning. The ability to accurately recognize facial expressions and emotions has a wide range of potential applications, including healthcare, education, entertainment, and human-computer interaction. Recent years have seen significant progress in the creation of machine-learning algorithms for facial image-based emotion identification. In this project, we propose an application for Emotion Detection using facial images. This application utilizes the Haar Cascade algorithm for facial detection and a Convolutional Neural Network (CNN) for emotion detection. The Haar Cascade algorithm is a widely used method for facial detection that is based on the analysis of patterns in grayscale images. More exactly we use the "haarcascade_frontalface_default.xml" file, which is a pre-trained classifier file that is used in face detection applications. It contains a Haar Cascade classifier trained to detect frontal faces in images or video frames. Convolutional Neural Networks (CNNs) have shown great promise in achieving high accuracy in emotion detection by learning complex features directly from the images. The CNN used in our project is trained on the FER2013 dataset, which contains over

35,000 facial images labeled with seven basic emotions: anger, disgust, fear, happiness, neutral, sad, and surprise. To improve the performance and robustness of our model, we pre-process and augment the dataset using various image transformations, such as rotation, scaling, and flipping. We then build a CNN model using the Keras API with TensorFlow as the backend. The machine learning model uses a combination of feature extraction and classification techniques to accurately detect emotions. The trained model is integrated into a Graphical User Interface (GUI) designed using Python's Tkinter library. Our system provides two options for emotion detection where users can interact using GUI: users can input static images to detect emotions or access live camera feeds for real-time emotion detection.

components, how the software architecture is mapped onto the hardware architecture, and how users interact with these components. It comprises the major physical properties, structure, style, interactions, and purpose of a system.

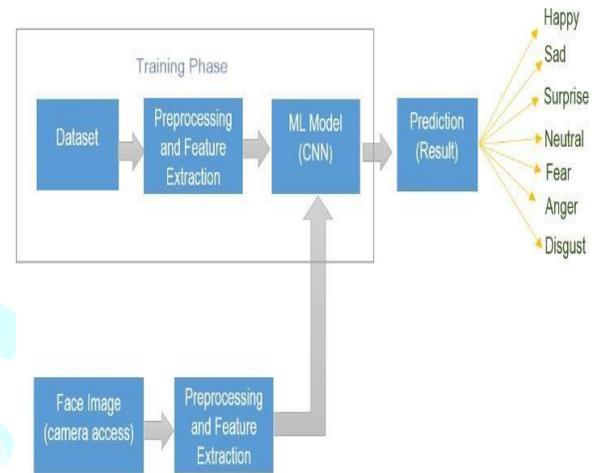


Figure 1: Architecture diagram

II. PROPOSED SYSTEM

The proposed system uses the haar cascade algorithm which is a popular algorithm for facial detection, to detect facial images from the user's input. After the facial images are detected, a machine learning model analyzes the detected images to determine the emotions conveyed by the facial expressions. The machine learning model uses a combination of feature extraction and classification techniques to accurately detect emotions. The system's graphical user interface (GUI) provides users with two options for emotion detection: one is to upload images, and the other is to access live camera feeds for real-time emotion detection.

A. ADVANTAGE

1. The GUI provides an Intuitive and User-Friendly interface for Users.
2. It provides accurate results.

III. ARCHITECTURE DIAGRAM

Architecture is a picture of a system that shows how functionality is mapped onto software and hardware

IV. MODULES USED

A. Graphical User Interface

The GUI is designed using Python's Tkinter library to provide a user-friendly interface for emotion detection. It has two options, one for uploading images for emotion detection and the other for accessing live camera feeds for real-time emotion detection.

B. Uploading Images for Emotion Detection

The first option allows users to upload images of faces for emotion detection. The user can select an image from their local device and upload it to the GUI for processing. Once the image is uploaded, the Haar Cascade algorithm is used to detect the face in the image, and the trained machine learning model is applied to detect the emotion on the detected face.

C. Real-Time Emotion Detection

The second option allows users to access their device's camera feed for real-time emotion detection.

OpenCV's video capture module is used to access the camera feed, and the Haar Cascade algorithm is used to detect faces in the frames of the video feed. The trained machine learning model is then applied to detect the emotion on the detected face in real time. The detected emotions are displayed on the GUI along with the camera feed, allowing the user to visualize the detected emotions in real-time.

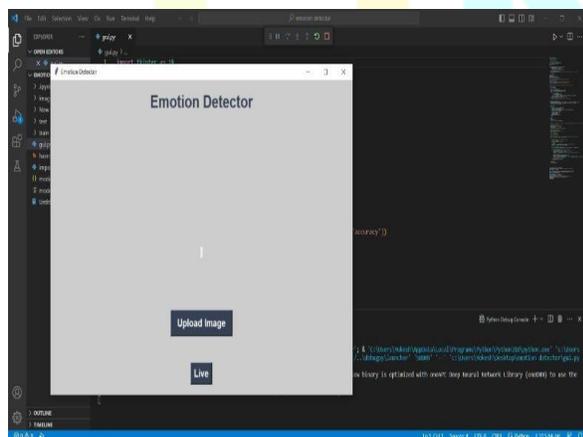
V. TECHNOLOGY USED

A. OpenCv

OpenCV (Open Source Computer Vision) is an open-source library of programming functions for computer vision, image processing, and machine learning. It provides a wide range of tools and techniques for developing computer vision applications, including object detection, face recognition, and emotion recognition.

B. Tkinter

A typical Python GUI (Graphical User Interface) package is Tkinter. It provides a set of tools and widgets for creating desktop applications with a graphical interface. In the context of machine learning, Tkinter can be used to create a graphical user interface for machine learning models. The application can be created to allow users to input data for a machine-learning model and visualize the results. This can



make the machine-learning model more accessible to users who are not familiar with programming and command-line interfaces.

C. Keras

Keras is a popular high-level deep learning API, written in Python and capable of running on top of TensorFlow, Microsoft Cognitive Toolkit, R, or Theano. It provides a user-friendly interface for building neural networks, making it easy to quickly prototype and test deep learning models. Keras allows users to define a neural network by simply stacking layers on top of each other, without the need for manual configuration of weights or optimization parameters. It also supports a wide range of layer types and activation functions, making it a versatile tool for building different types of models.

D. Tensorflow

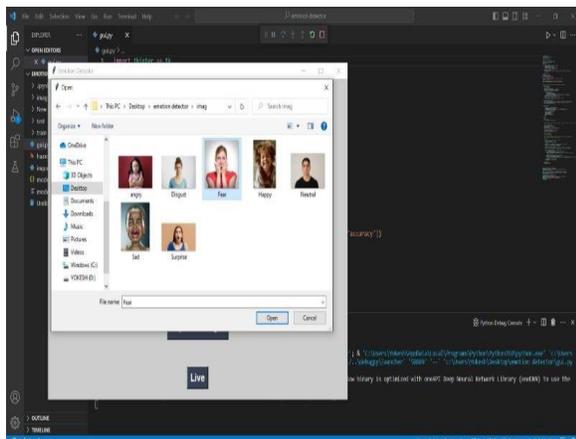
TensorFlow provides a platform for building and training machine learning models using a variety of data types, including numerical and text data. TensorFlow enables users to create complex machine learning algorithms and neural networks, and it is widely used in the development of applications for computer vision, natural language processing, and other fields.

VI. RESULT

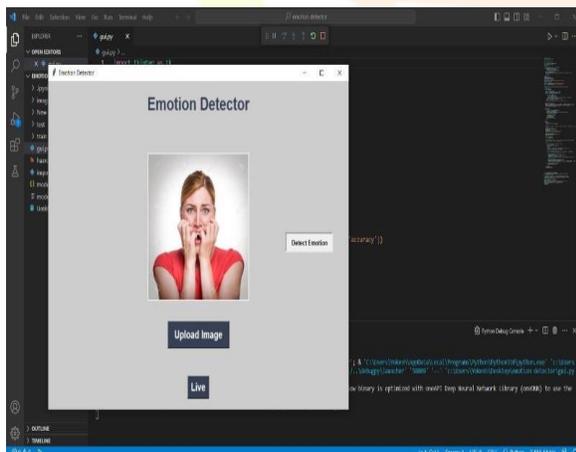
The developed emotion detector model achieved an accuracy of more than 60% on the FER2013 dataset. The model was able to recognize the seven basic emotions of anger, disgust, fear, happiness, neutral, sad, and surprise from facial images. The procedure may be described in depth in this publication, and the results can be illustrated as follows:

1. To begin, Open the GUI of the application by running the source code.
2. choose the option for uploading an image or accessing the live camera feed. If you choose to upload an image, click on the "Upload

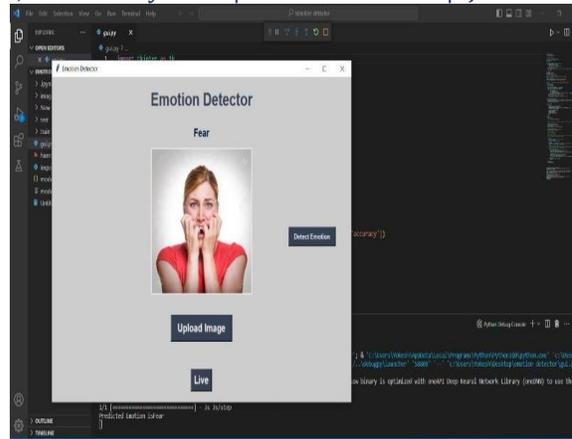
Image" button and select the desired image from your local storage.



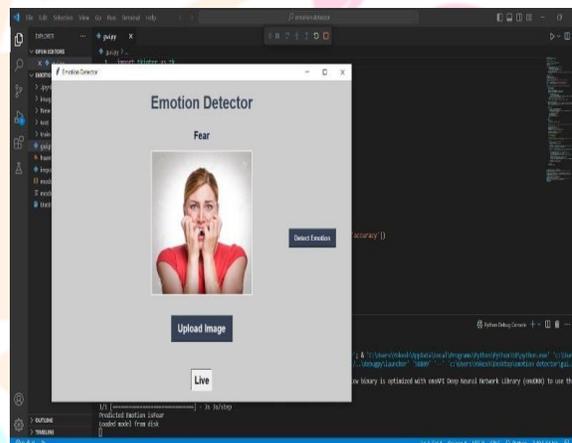
3. Once the image is selected, click on the "Detect Emotion" button to analyze the facial expression and determine the corresponding emotion.



4. The result of the selected image will be displayed at the top of the GUI (above the image).



5. If you choose to access the live camera feed, make sure that the camera is working properly and positioned appropriately to capture the face. Click on the "Live" button to start analyzing the facial expressions in real time.



6. New Window will be opened, and detection of real-time emotion detection will get started. The result will get displayed on the window itself.

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