ANOMALY DETECTION IN HUMAN EMOTIONAL ANALYSIS

Project Report

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ABSTRACT

Anomaly detection in human emotion analysis involves identifying unusual or unexpected patterns in emotional data to detect outliers that significantly deviate from typical emotional expressions. By employing statistical machine learning algorithms such as Support Vector Machines (SVM) and deep learning models like Inception V3 from Convolutional Neural Networks (CNN), anomalies in human emotion data can be effectively flagged for further investigation. This method aids in understanding rare emotional states, detecting fraudulent behaviour, and uncovering hidden patterns in emotional responses.Human emotion detection encompasses the process of recognizing and analyzing emotions through various modalities, including facial expressions, voice tone, physiological signals, and text analysis. The goal is to accurately discern and interpret emotional states, such as happiness, sadness, anger, neutrality, fear, and surprise. Commonly used datasets for training and evaluating emotion detection algorithms include CK+ (Extended Cohn-Kanade Dataset) and FER2013 (Facial Expression Recognition 2013). The applications of human emotion analysis span several fields, including psychology, market research, customer service, and the development of virtual assistants. This technology helps in understanding how individuals feel and respond to different situations, offering valuable insights for improving user experience and engagement. Keywords: Anomaly Detection, Human Emotion Analysis, Machine Learning, Support Vector Machines, Convolutional Neural Networks, Inception V3, Emotion Detection, CK+ Dataset, FER2013 Dataset, Psychology, Market Research, Customer Service, Virtual Assistants.

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CHAPTER 1

INTRODUCTION

1.1 MOTIVATION

Addressing the growing challenge of effectively organizing and managing the ever-increasing volume of human-related data, our proposed application aims to provide a comprehensive and user-friendly solution. This platform offers an intuitive interface, enabling users to easily manage, customize, and share their human analysis data while tailoring the experience to their unique needs and preferences.

1.2 PROBLEM STATEMENT

Managing In various applications, understanding human emotions is crucial for improving user experience, communication, and mental health support. Emotion detection involve identifying and categorizing the emotional state. By addressing these challenges, we aim to crate emotions detection model that can better understand and respond to human emotions, thereby enhancing communication and support in various domain

1.3 PROJECT OBJECTIVE

This project about detecting human emotion through the facial expressions. This computer vision is envisioned as a comprehensive and interactive tool that helps to interaction interact with the human Key objectives include enhancing accuracy in emotion classification and integrating real-time detection capabilities. Users will gain insights into various techniques. In the field of photograph this technology helps photographers capture more authentic emotional moments by providing feedback on unusual emotional expressions and offering tutorials for improvement. For customer support, it enhances service quality by analyzing customer interactions to identify signs of frustration or satisfaction, guiding support teams in addressing issues more effectively.

In market, it offers valuable insights into consumer reactions to products and advertisements, helping companies understand customer satisfaction and brand perception. In the realm of health care and mental health, it supports mental health professionals by detecting emotional states in patients, aiding in diagnosis and therapeutic planning. For education and e-learning, it monitors student engagement and emotional responses during online learning sessions, providing feedback to improve teaching methods and materials. The technology also plays a role in the automotive industry by analysis driver emotions to enhance safety and comfort in vehicles. In gaming and entertainment, it detects players' emotional reactions to improve game design and create more engaging experiences. Finally, in security and surveillance, it identifies suspicious or unusual emotional behaviour in surveillance footage, contributing to public safety and threat detection. Overall, Anomaly detection of human emotions offers a versatile and impactful tool for understanding and improving emotional expressions across a wide range of applications.

CHAPTER 2

LITERATURE SURVEY

Anomaly Detection in Human Emotion is a field of growing importance with applications in various domains including photography, customer service, healthcare, and more. This chapter reviews significant research and technologies related to detecting and analysis emotional anomalies.

1) Emotional Expression Recognition

1. "Facial Expression Recognition Using Deep Learning: A Review"

This paper reviews deep learning methods for facial emotion recognition, highlighting techniques like Convolutional Neural Networks (CNNs) and their effectiveness in identifying basic emotions. It sets the foundation for detecting anomalies in emotional expressions by exploring the strengths and limitations of these methods

2. "Emotion Recognition from Facial Expressions: A Comparative Review"

This study compares traditional and modern emotion recognition techniques, including Facial Action Coding System (FACS) and deep learning approaches. It addresses challenges in detecting subtle emotional anomalies and suggests improvements for emotion recognition systems.

2) Anomaly Detection Techniques

1. "A Survey of Anomaly Detection Techniques in Data Mining"

This paper surveys various anomaly detection methods like Isolation Forest and One-Class SVM, focusing on their applications in identifying deviations from normal behaviour. These techniques are crucial for detecting emotional anomalies in facial expressions.

2. "Anomaly Detection with Autoencoders: A Survey"

This research explores Autoencoders for anomaly detection, detailing architectures like Variational Autoencoders and their effectiveness in detecting outliers. It provides insights into how these methods can be used for emotional anomaly detection.

2.1 Existing System

TITLE	AUTHORS	PUBLICATIONS	KEY FINDINGS
Facial emotion detection in deep learning	Pancy nandwani, Rupali verma	28 may 2020	challenges faced during sentiment and emotion analysis.
Computational approaches in emotion detection	Haji binali,cgen wu, vidyasagar	13 april 2010	presents emotion theories that provide a basis for emotion models.
Automatic emotion detecting model from facial expression	Debi shree dagar,abir hudait,h.k.tripathy.M.N.Das	2016	determine the facial expressions separately the processed feature vector is channeled through the already learned pattern classifiers.

Table- 2.1 Literature Survey

In today's digital era, the capture and sharing of visual data, such as photos, videos, and facial expressions, are ubiquitous across various applications and fields. However, effectively detecting anomalies in human emotions represented in these diverse datasets poses significant challenges. To address this, we aim to develop a user-friendly application capable of detecting anomalies in human emotions across different contexts and applications.

2.2 Limitations of Existing System

- Limitations of Existing System
- Limited personalization in anomaly detection
- Restricted search capabilities for emotional anomalies
- Dependency on consistent
- For applications requiring real-time emotion detection, such as in customer service or interactive systems, processing and analyzing data quickly enough to be meaningful can be technically demanding and sometimes prone to errors.

CHAPTER-3

SOFTWARE REQUIREMENT SPECIFICATION

This chapter gives an overview of the software and hardware components required for our project

3.1 SOFTWARE REQUIREMENTS

Operating System : Windows 10

Coding Language :Python 3.7

3.2 HARDWARE REQUIREMENTS

System : intel i5 or above

Storage : Sufficient storage

3.3 FUNCTIONAL REQUIREMENTS

These are the specific functionalities that the human emotion detection system should provide.

Emotion Data Collection:

- Capture emotional data from input sources such as:
- Webcam for facial expressions
- Microphone for voice intonation

Real-time Processing:

- Process input data in real-time to detect and classify emotions.

Emotion Classification:

- Implement algorithms to classify emotions such as happiness, sadness, anger, etc.

Visualization:

- Provide visual feedback of detected emotions (optional).

3.4 NON-FUNCTIONAL REQUIREMENTS

These are the quality constraints and considerations for the human emotion detection system:

Portability:

- Ensure the system can be easily deployed and run on different Windows environments.

Security:

- Implement data encryption and secure storage practices for emotional data.

Maintainability:

- Provide clear documentation and modular code structure for easy maintenance.

Reliability:

- Ensure accurate and consistent emotion detection results.

Performance:

- Optimize algorithms and data processing for efficient performance on Intel i5 or above processors.

Scalability:

- Design the system to handle increasing volumes of emotional data if required.

Reusability:

- Develop components that can be reused for similar emotion detection applications.

Flexibility:

- Allow customization of emotion detection models or algorithms based on project requirements.

CHAPTER-4

SYSTEM DESIGN

4.1 System Design

In this phase, the system and software design documents are prepared as per the requirementspecification document. This helps define overall system architecture.

There are two kinds of design documents developed in this phase:

High-Level Design (HLD)

- Capture and Manages video and process the video
- Analyses the video and identify the face and detect emotions using the pre trained model
- Generate the rectangle box around the face and label the emotions

Low-Level Design (LLD)

- Implement data collection routines and preprocess the data
- Develop a computer vision model and train it detect the emotions of human
- Compile the data
- Addresses all types of dependency issues
- Listing of error messages

4.1 SYSTEM ARCHITECTURE:

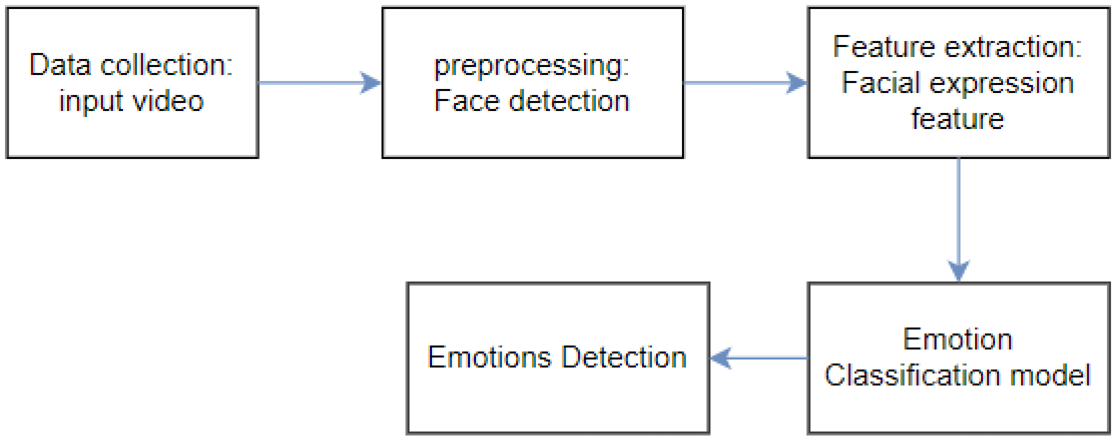

Figure-4.1.1 System Architecture

4.2 UML Design

Unified Modeling Language (UML) is a general purpose modeling language. The main aimof UML is to define a standard way to visualize the way a system has been designed. It is quite similar to blueprints used in other fields of engineering. UML is not a programming language; it is rather a visual language. We use UML diagramsto portray the behavior and structure of a system, UML helps software engineers, businessmen and system architects with modeling, design and analysis. The Object Management Group (OMG) adopted Unified Modeling Language as a standard in 1997. It's been managed by OMG ever since. International Organization for Standardization (ISO) published UML as an approved standard in 2005. UML has been revised over the years and is reviewed periodically.

Do we really need UML?

- Complex applications need collaboration and planning from multiple teams and hence require aclear and concise way to communicate amongst them.
- Businessmen do not understand code. So UML becomes essential to communicate with non programmer’s essential requirements, functionalities and processes of the system.
- A lot of time is saved down the line when teams are able to visualize processes, user interactionsand static structure of the system.
- UML is linked with object oriented design and analysis. UML makes the use of elements and formsassociations between them to form diagrams. Diagrams in UML can be broadly classified as:

The Primary goals in the design of the UML are as follows:

- Provide users a ready-to-use, expressive visual modeling Language so that they can develop andexchange meaningful models.
- Provide extendibility and specialization mechanisms to extend the core concepts.
- Be independent of particular programming languages and development process.
- Provide a formal basis for understanding the modeling language.
- Encourage the growth of OO tools market.
- Support higher level development concepts such as collaborations, frameworks, patterns andcomponents.
- Integrate best practices.

Types of UML Diagrams:

Structural Diagrams:

Capture static aspects or structure of a system. Structural Diagrams include: Component Diagrams,Object Diagrams, Class Diagrams and Deployment Diagrams.

Behavior Diagrams:

Capture dynamic aspects or behavior of the system. Behavior diagrams include: Use CaseDiagrams, State Diagrams, Activity Diagrams and Interaction Diagrams.

The image below shows the hierarchy of diagrams according to UML

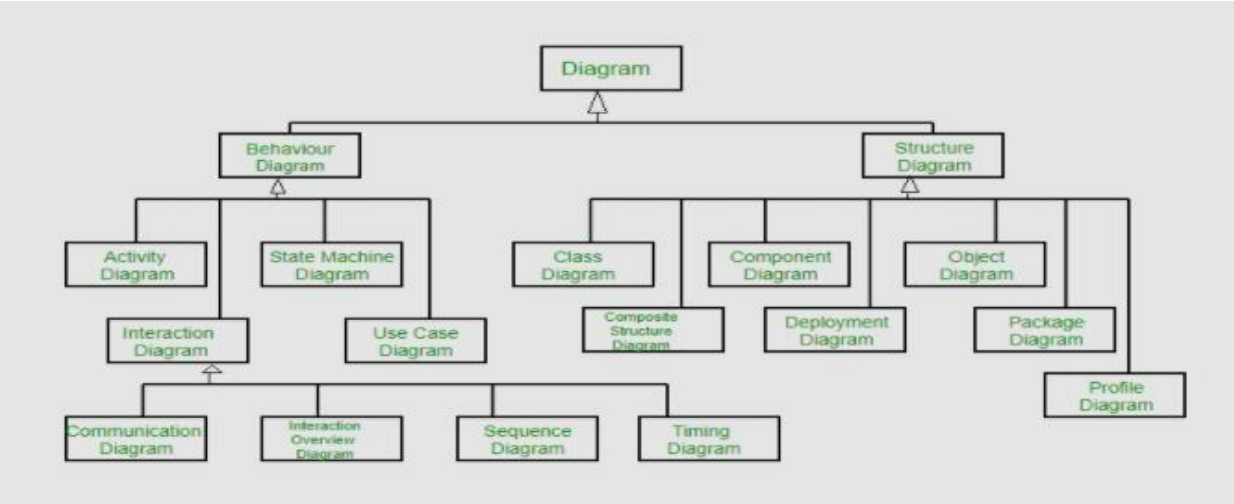

Figure-4.2.1 UML Hierarchy diagrams

4.3.1 CLASS DIAGRAM:

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

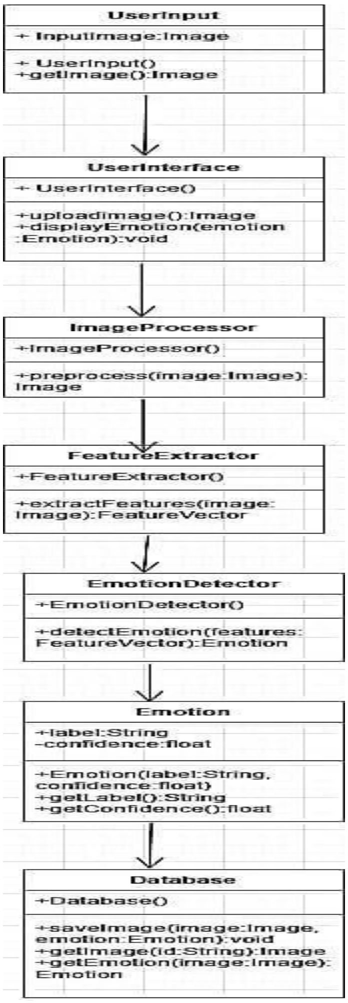

Figure-4.3.1 Class Diagram

4.3.2 USE CASE DIAGRAM:

Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted

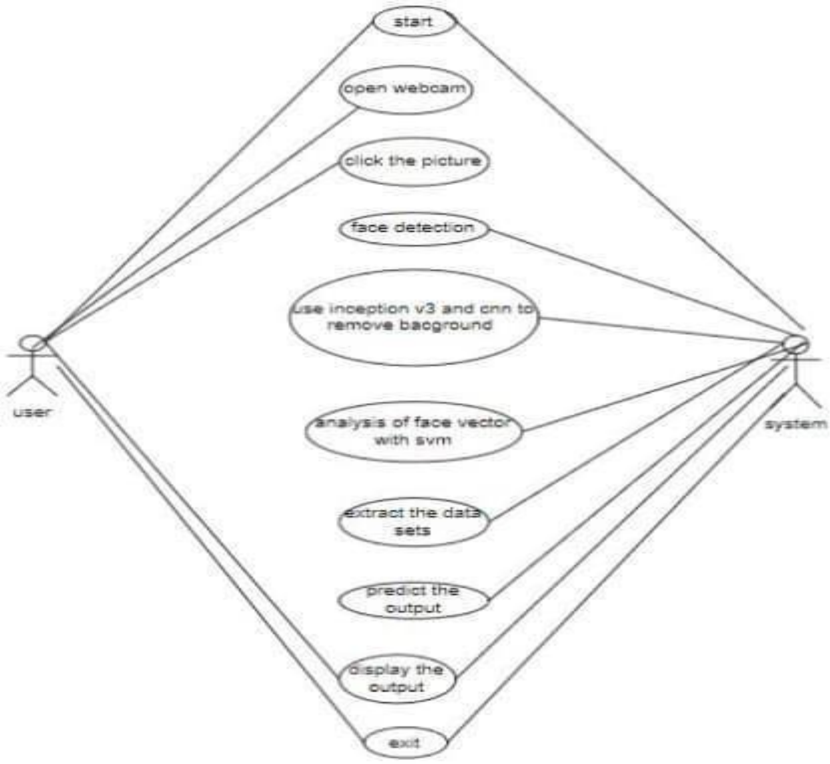

Figure-4.3.2 Use Case Diagram

4.3.2 COMPONENT DIAGRAM:

A component diagram, also known as a UML component diagram, describes the organization and wiring of the physical components in a system. Component diagrams are often drawn to help model implementation details and double-check that every aspect of the system's required functions is covered by planned development.

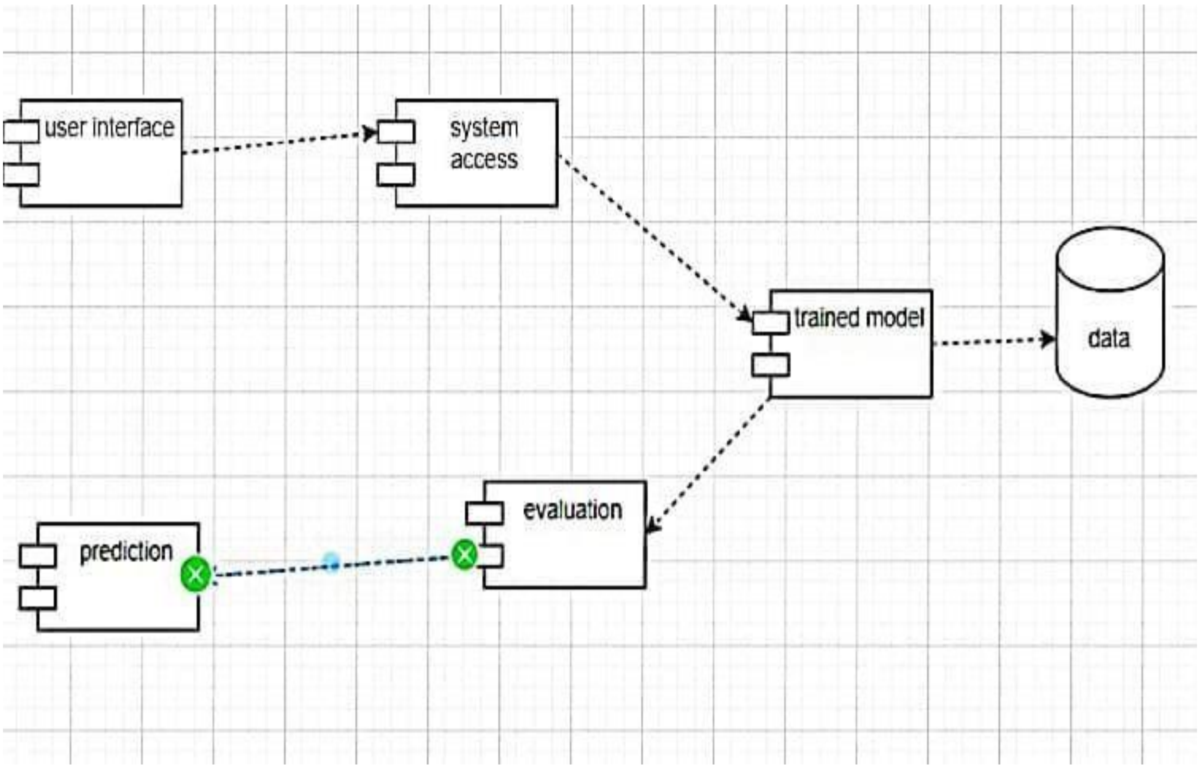

Figure-4.3.2 Component Diagram

4.3.4 SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of aMessage Sequence Chart. Sequence diagrams are sometimes called event diagrams, eventscenarios, and timing diagrams.

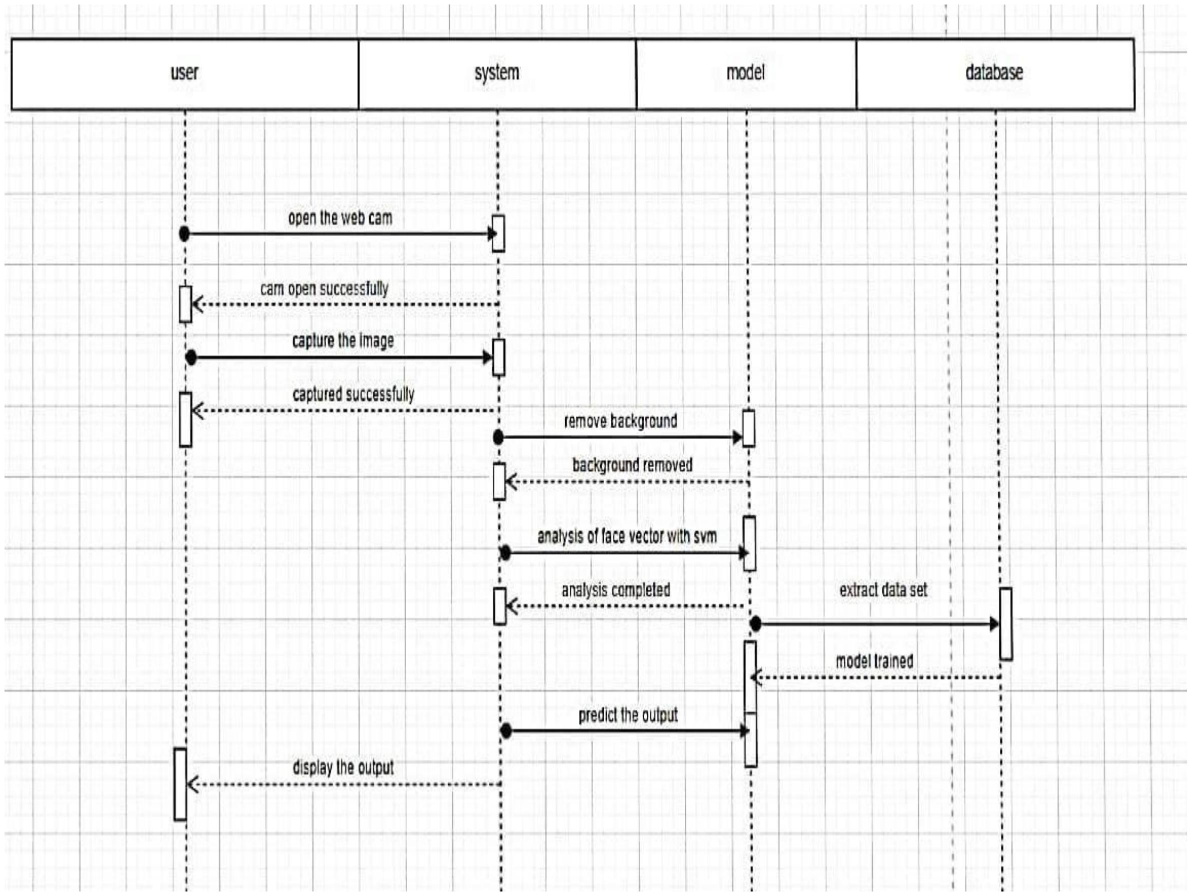

Figure-4.3.4 Sequence Diagram

4.3.5 ACTIVITY DIAGRAM:

In UML, an activity diagram is used to display the sequence of activities. Activity diagrams show the workflow from a start point to the finish point detailing the many decision pathsthat exist in the progression of events contained in the activity.

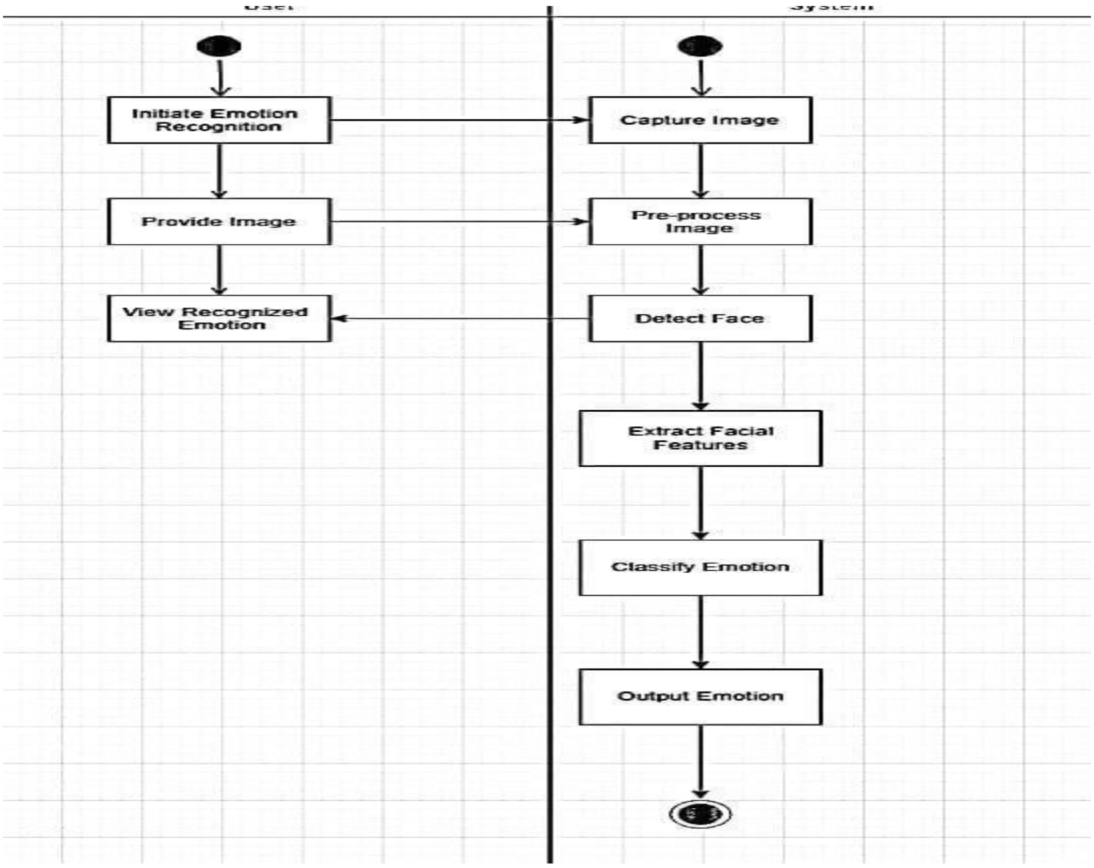

Figure-4.3.5. Activity Diagram

4.4 TECHNOLOGY DESCRIPTION

Python:

Python serves as the primary programming language for implementing the real-time emotion detection system. It facilitates seamless integration of OpenCV for computer vision tasks, TensorFlow/Keras for deep learning, and general application logic.

Video Capture:

The Video Capture functionality within OpenCV is utilized to access and capture frames from the webcam in real-time. This capability enables continuous processing of live video feeds for facial detection and emotion analysis.

NumPy:

NumPy is employed for efficient numerical computations and data manipulation tasks within the Python environment. It aids in preprocessing image data, performing mathematical operations, and managing arrays required for feeding data into machine learning models.

Environment:

The project is developed and executed in a suitable development environment that supports Python, OpenCV, TensorFlow/Keras, and related libraries. Integrated Development Environments (IDEs) such as PyCharm or Jupyter Notebook may be utilized for coding, testing, and debugging purposes

TensorFlow/Keras:

TensorFlow and Keras frameworks are integrated for deep learning-based emotion classification. A pre-trained convolutional neural network (CNN) model is employed to analyze facial expressions captured in real-time video frames. TensorFlow/Keras enable efficient deployment and execution of machine learning models for accurate emotion detection.

OpenCV:

OpenCV (Open Source Computer Vision Library) is utilized for real-time facial detection within live video streams. It provides robust algorithms and tools for detecting faces, identifying facial landmarks, and extracting relevant image data for further analysis.

CHAPTER-5

5.1 IMPLEMENTATION

1) Take video as input through web came

2) Face detection from the video

3) If face is detected ,Draw bounding box around the face

4) Display the emotion label on the bounding box

Initially datasets are downloaded from Kaggle website and train the model then after that web came capture the video recording It involves using computer vision and Deep learning techniques to detect and classify emotions expressed by a person's face The system then displays the processed image with the bounding boxes, providing a clear and immediate visual indication of detected emotions. This setup implementation of our Emotions detection system involves advanced Deep learning algorithms, particularly those embedded within the ensures CNN so that Emotions detection can be efficiently monitored and identified in real-time . While there are many machine learning algorithms available, SVM is specifically chosen for its efficiency and accuracy in vector detection tasks.

5.2 EXECUTABLE CODE:

```
from keras.models import load_model
from time import sleep
from tensorflow.keras.preprocessing.image import img_to_array
from keras.preprocessing import image
import cv2
import numpy as np

face_classifier =
cv2.CascadeClassifier(r"C:\Users\vanit\Downloads\Emotion_Detection_CNN-
main\Emotion_Detection_CNN-main\haarcascade_frontalface_default.xml")
classifier = load_model(r"C:\Users\vanit\Downloads\Emotion_Detection_CNN-
main\Emotion_Detection_CNN-main\model.h5")
emotion_labels = ['Angry','Disgust','Fear','Happy','Neutral', 'Sad', 'Surprise']

cap = cv2.VideoCapture(0)
while True:
_, frame = cap.read()
labels = []
gray = cv2.cvtColor(frame,cv2.COLOR_BGR2GRAY)
faces = face_classifier.detectMultiScale(gray)

for (x,y,w,h) in faces:
cv2.rectangle(frame,(x,y),(x+w,y+h),(0,255,255),2)
roi_gray = gray[y:y+h,x:x+w]
roi_gray = cv2.resize(roi_gray,(48,48),interpolation=cv2.INTER_AREA)
if np.sum([roi_gray])!=0:
roi = roi_gray.astype('float')/255.0
roi = img_to_array(roi)
roi = np.expand_dims(roi,axis=0)
```

```
prediction = classifier.predict(roi)[0]
label=emotion_labels[prediction.argmax()]
label_position = (x,y)
cv2.putText(frame,label,label_position,cv2.FONT_HERSHEY_SIMPLEX,1,(0,255,0),2)
else:
cv2.putText(frame,'No Faces',(30,80),cv2.FONT_HERSHEY_SIMPLEX,1,(0,255,0),2)
cv2.imshow('Emotion Detector',frame)
if cv2.waitKey(1) & 0xFF == ord('q'):
break

cap.release()
cv2.destroyAllWindows()
```

CHAPTER 6

RESULTS

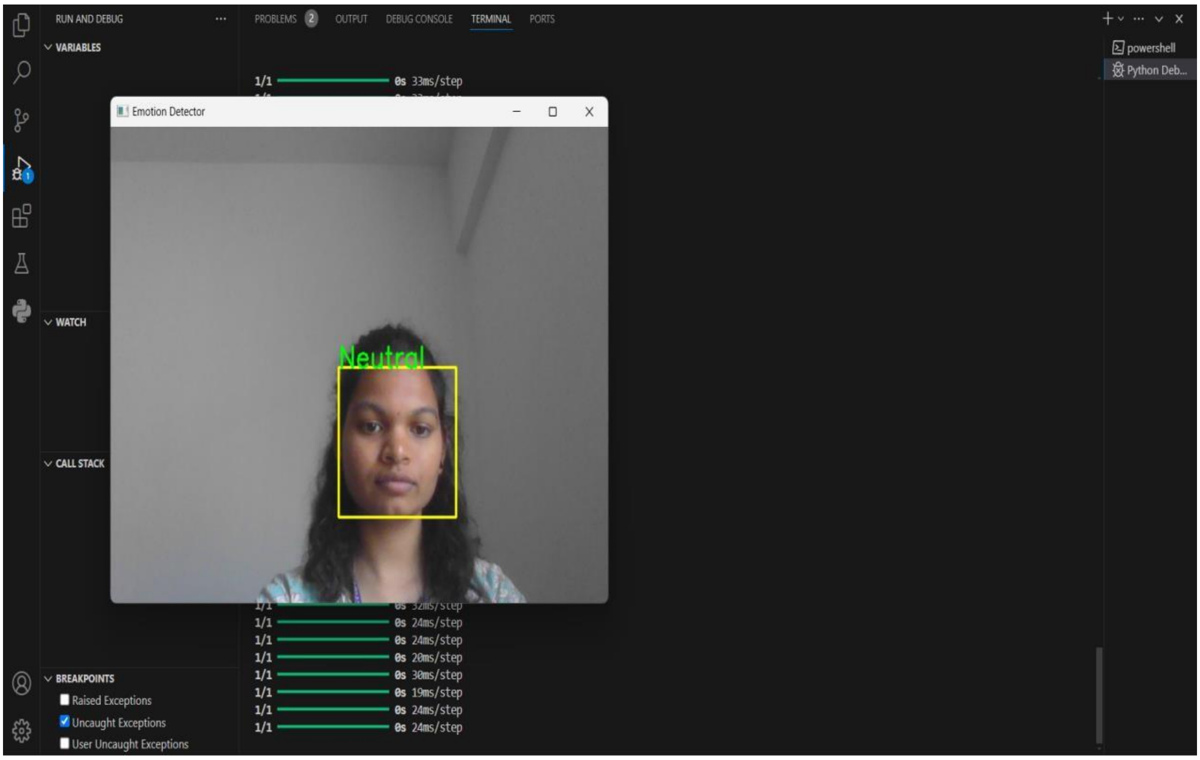

Figure-6.1 Web cam recoding the video

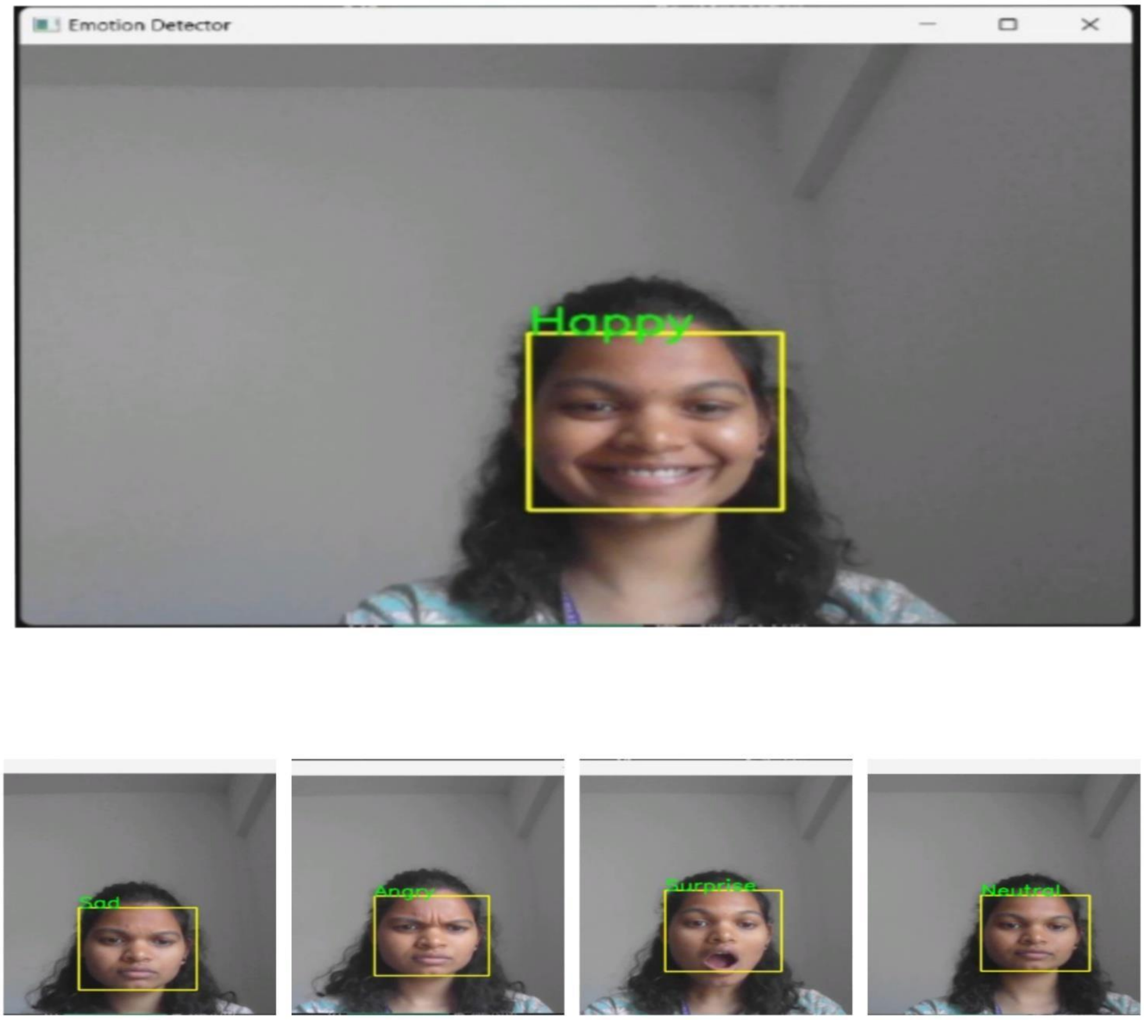

Figure-6.2 Photo Emotions Detection

CHAPTER 7

7.1 CONCLUSION:

This study explored the deep learning model's capability for detecting human emotions , particularly detect happy, sad, angry, neutral, surprise, disgust, fear. The model performed exceptionally well, indicating it could be highly useful in real -world settings. In practice, the emotions detection model could be implemented in industries such as health care, robotic, marketing, customer service, where it could monitor the emotions of human. By intergrating this technology into industries can become more useful .This research highlights the practical benefits of advance computer vision

7.2 FUTURE ENHANCEMENT

1. Improved multi model fusion
2. contextual understanding
3. Fine grained emotion detection
4. Adaptive and personalized systems
5. Transfer learning and few shot learning

REFERENCES

1.Dagar, D., Hudait, A., Tripathy, H. K., & Das, M. N. (2016, May). Automatic emotion detection model from facial expression. In *2016 International Conference on Advanced Communication Control and Computing Technologies (ICACCCT)* (pp. 77-85). IEEE.

Acheampong, F. A., Wenyu, C., & Nunoo-Mensah, H. (2020). Text-based emotion detection: Advances, challenges, and opportunities. *Engineering Reports*, *2*(7), e12189.

Binali, H., Wu, C., & Potdar, V. (2010, April). Computational approaches for emotion detection in text. In *4th IEEE international conference on digital ecosystems and technologies* (pp. 172-177). IEEE.

Jaiswal, A., Raju, A. K., & Deb, S. (2020, June). Facial emotion detection using deep learning. In *2020 international conference for emerging technology (INCET)* (pp. 1-5). IEEE.

De Silva, L. C., Miyasato, T., & Nakatsu, R. (1997, September). Facial emotion recognition using multi-modal information. In *Proceedings of ICICS, 1997 International Conference on Information, Communications and Signal Processing. Theme: Trends in Information Systems Engineering and Wireless Multimedia Communications (Cat.* (Vol. 1, pp. 397-401). IEEE.

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