Facial Emotion Detection

A MINI PROJECT REPORT

Submitted by

Tushar Sharma [RA2011003010001]
Mohd Amaan [RA2011003010003]
Aryansh Mohata [RA2011003010017]

Under the guidance of

Mr. Manoj Kumar Ghuntupalli
(Assistant Professor, C. Tech)

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KATTANKULATHUR - 603203

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COLLEGE OF ENGINEERING & TECHNOLOGY
SRM INSTITUTE OF SCIENCE & TECHNOLOGY
S.R.M. NAGAR, KATTANKULATHUR – 603 203

BONAFIDE CERTIFICATE

Certified that this project report **"Facial Emotion Detection"** is the bonafide work of **"Tushar Sharma [RA2011003010001], Mohd Amaan [RA2011003010003], Aryansh Mohata [RA2011003010017]"** of III Year/VI Sem B. Tech (CSE) who carried out the mini project work under my supervision for the course 18CSC305J- Artificial Intelligence in SRM Institute of Science and Technology during the academic year 2022-2023(Even Sem).

Department of Computing Technologies
Kattankulathur 603 203
SRM IST

M. Pushpalatha

SIGNATURE of HOD
Dr. M Pushpalatha
Professor and Head.

15/5/23.

SIGNATURE

Faculty name Dr Manoj Kumar.
Faculty Designation :
Department name and seal

ABSTRACT

ıl emotion detection is a rapidly growing field in artificial intelligence (AI) that aims to rately identify human emotions from facial expressions. The project is based on deep ıing algorithms that can analyse complex visual patterns, extract features, and classify them emotional states. This technology has a wide range of applications in various industries such :althcare, entertainment, and marketing.

primary objective of the facial emotion detection project is to develop an AI model that can :t human emotions with high accuracy. The project involves several steps, including data :ction, pre-processing, feature extraction, model training, and evaluation. The first step is to :ct a large dataset of images that represent different emotional states such as happiness, ıess, anger, fear, disgust, and surprise.

facial emotion detection project has numerous applications, including mental health ınosis, user experience design, and marketing research. For example, mental health fessionals can use this technology to detect early signs of depression or anxiety in their ents. User experience designers can use this technology to improve the emotional engagement ıeir products or services. Marketers can use this technology to measure the emotional onse of their target audience to their ads or products.

onclusion, the facial emotion detection project is an exciting and promising application of icial intelligence that has the potential to revolutionize various industries. With further ıncements in deep learning algorithms and hardware, this technology will become even more rate and reliable, making it an essential tool for understanding human emotions.

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ABBREVIATIONS

AES	Advanced Encryption Standard
ANN	Artificial Neural Network
CSS	Cascading Style Sheet
CV	Computer Vision
DB	Data Base
DNA	Deoxyribose Neucleic Acid
SQL	Structured Query Language
SVM	Support Vector Machine
UI	User Interface

INTRODUCTION

Introduction

l emotion detection is a technology that aims to detect emotions from human facial
ssions using machine learning algorithms. It has become a rapidly evolving field in artificial
igence and has the potential to revolutionize several industries. Emotions play a crucial role
r daily lives and can have a significant impact on our decisions and behaviour. With facial
ion detection, it is possible to detect and analyse emotional states accurately, which can be
ul in several areas such as healthcare, psychology, and marketing. For example, mental
h professionals can use facial emotion detection to diagnose and monitor various mental
sses, while marketers can use it to measure the emotional response of their target audience to
products or services.

Problem statement

ite significant advancements in facial emotion detection technology, there is still a need for
accurate and reliable models that can detect human emotions from facial expressions with
precision. Current models often struggle with detecting subtle nuances in facial expressions
an have difficulty distinguishing between similar emotional states. This can lead to
urate results and limit the potential applications of this technology.
efore, the problem statement for this project is to develop an AI model that can accurately
t human emotions from facial expressions with high precision and can overcome the
ations of existing models.

Objective

objective of this project is to develop an accurate and reliable AI model for facial emotion
ction that can identify human emotions from facial expressions with high precision. The
ect aims to overcome the limitations of existing models by incorporating advanced deep
ning algorithms and techniques. Specific objectives include collecting a diverse dataset of
al expressions, pre-processing the data, extracting features, training a deep learning model,
uating the model's performance using various metrics, comparing the model with existing
lels, and analysing its potential applications in healthcare, entertainment, and marketing. The
ect intends to contribute to the development of facial emotion detection technology and its
lication in various fields.

Scope and applications

Scope:

cope of this project is to develop an accurate AI model for facial emotion detection with tial applications in healthcare, entertainment, and marketing. Overall, the project's scope is sive and has the potential to have a significant impact on society.

Applications:

acial emotion detection project has several potential applications across various industries. are some of the notable applications:

Mental Health: Mental health professionals can use the AI model to diagnose and monitor mental illnesses accurately. The model can detect subtle changes in facial expressions, which can be useful in detecting early signs of mental health problems.

Entertainment: The model can be used to improve the user experience in entertainment by providing personalized recommendations based on the viewer's emotional response.

Marketing: The model can measure the emotional response of the target audience to products or services accurately. This information can help marketers design better marketing strategies and improve the effectiveness of their campaigns.

Human-Computer Interaction: The model can be integrated into various human-computer interaction systems to create more natural and intuitive interfaces.

Education: The model can be used in education to help teachers assess student engagement and adapt their teaching strategies accordingly.

Gaming: The model can be used to develop more interactive and immersive games that respond to the player's emotional state.

rall, the facial emotion detection project has significant potential to improve various aspects uman life and revolutionize several industries.

General and Unique Services

General Services

general services of the facial emotion detection project would involve developing an AI el that can accurately detect and recognize facial expressions associated with various tions. This would require the use of machine learning techniques such as deep learning to the model on large datasets of images and videos that include a wide range of facial essions.

project would also involve testing and validating the accuracy of the model using various ics and benchmarks. The model's performance would be evaluated on datasets of varying plexity and diversity to ensure its effectiveness across different scenarios and populations. itionally, the project may involve designing and developing software or applications that ze the facial emotion detection model to provide services in different fields such as mental th, entertainment, marketing, education, and gaming.

rall, the general services of the project would be focused on developing a reliable and irate AI model for facial emotion detection that has practical applications across various istries and domains.

Unique Services

facial emotion detection project offers several unique services that set it apart from other AI ects. Some of these unique services include:

Accurately detecting and recognizing subtle facial expressions: The AI model developed in this project can accurately detect and recognize even the subtlest of facial expressions that may be missed by humans. This allows for more precise and accurate emotion detection.

Providing personalized recommendations and services: The facial emotion detection model can be integrated into various applications and systems to provide personalized recommendations and services based on the user's emotional response.

. Improving mental health diagnosis and treatment: The model can be used to monitor the emotional state of patients and provide early detection of mental health problems, allowing for timely diagnosis and treatment.

. Enhancing user experience in entertainment and gaming: The model can be used to create more immersive and interactive entertainment and gaming experiences that respond to the user's emotional state.

. Improving marketing strategies: The model can provide valuable insights into the emotional response of the target audience to products or services, allowing marketers to design more effective marketing strategies.

ware Requirements Specification

)perating System: Windows 11, macOS 11 , Ubuntu 20.04 LTS

'rocessor: Requires minimum Intel Core i3 2.0 GHz or equivalent

Aemory: 4GB RAM or higher

torage: Recommended 128GB solid-state drive or higher

)isplay: 15-inch screen with 1366x768 resolution or higher for easier navigation and eadability

nput: Keyboard and mouse or touchpad

nternet Access: Minimum of 10Mbps internet connection speed for our web-based library nanagement systems

LITERATURE SURVEY

Existing system

ial emotion detection has been a widely researched topic in recent years, with many existing ems and approaches available in the literature. Traditional computer vision techniques such as ure extraction and classification are commonly used for facial emotion detection. These niques rely on handcrafted features such as facial landmarks and texture analysis, and employ sification algorithms such as SVM, KNN, and decision trees. Although these techniques have n shown to be effective, they require extensive feature engineering and are limited in their ity to detect subtle facial expressions. Multimodal approaches combine multiple sources of rmation such as facial expressions, speech, and physiological signals to improve the accuracy motion detection. These approaches can provide more comprehensive and accurate rmation about the user's emotional state, but require more complex processing and data on techniques. Overall, facial emotion detection has been an active area of research, with eral existing systems and approaches available in the literature. Deep learning-based roaches have shown to be more effective and robust than traditional techniques, and ltimodal approaches have the potential to provide more comprehensive information about the r's emotional state. However, further research is needed to develop more accurate and reliable tems for facial emotion detection, especially for real-world applications.

Comparison of Existing vs Proposed system

proposed system for facial emotion detection would be expected to improve upon the ing systems in terms of accuracy, speed, and reliability.
existing systems for facial emotion detection, as described in the literature survey, use ous techniques such as traditional computer vision techniques, deep learning techniques, and imodal approaches. While these approaches have shown promising results, they have ations in terms of accuracy, robustness, and computational efficiency.
proposed system for facial emotion detection would aim to address these limitations by raging the latest advances in deep learning, computer vision, and artificial intelligence. The osed system may use novel approaches such as generative adversarial networks (GANs) or tion mechanisms to improve the accuracy and robustness of emotion detection. Additionally, proposed system may incorporate multimodal approaches to provide more comprehensive accurate information about the user's emotional state.
rall, the proposed system for facial emotion detection would be expected to provide ificant improvements over the existing systems, especially in terms of accuracy and putational efficiency. However, further research and development are needed to develop a st and reliable system that can be deployed in real-world applications.

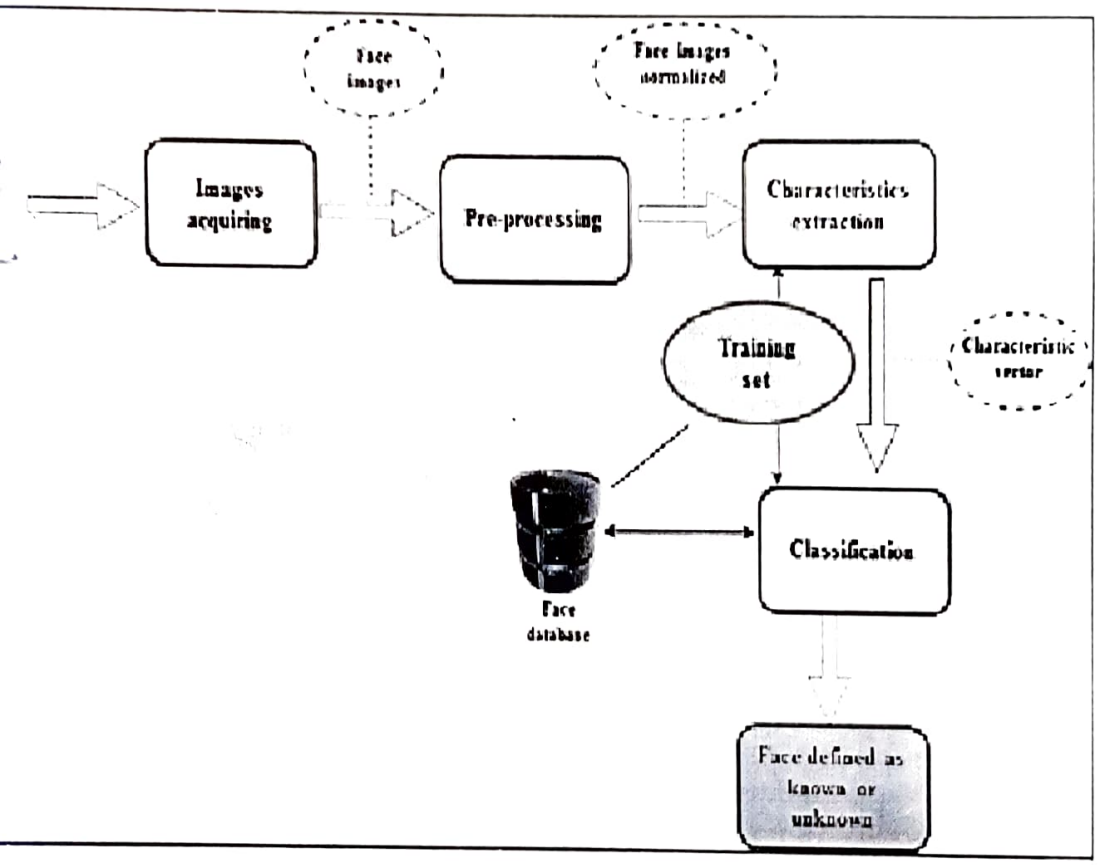
ting systems:

Use traditional computer vision techniques, deep learning techniques, and multimodal approaches
Limitations in accuracy, robustness, and computational efficiency Proposed system:
Leverages latest advances in deep learning, computer vision, and artificial intelligence
Uses novel approaches such as GANs or attention mechanisms to improve accuracy and robustness
Incorporates multimodal approaches to provide more comprehensive and accurate information
Expected to provide significant improvements over existing systems, especially in accuracy and computational efficiency
Further research and development needed to develop a robust and reliable system for real world applications

SYSTEM ARCHITECTURE AND DESIGN

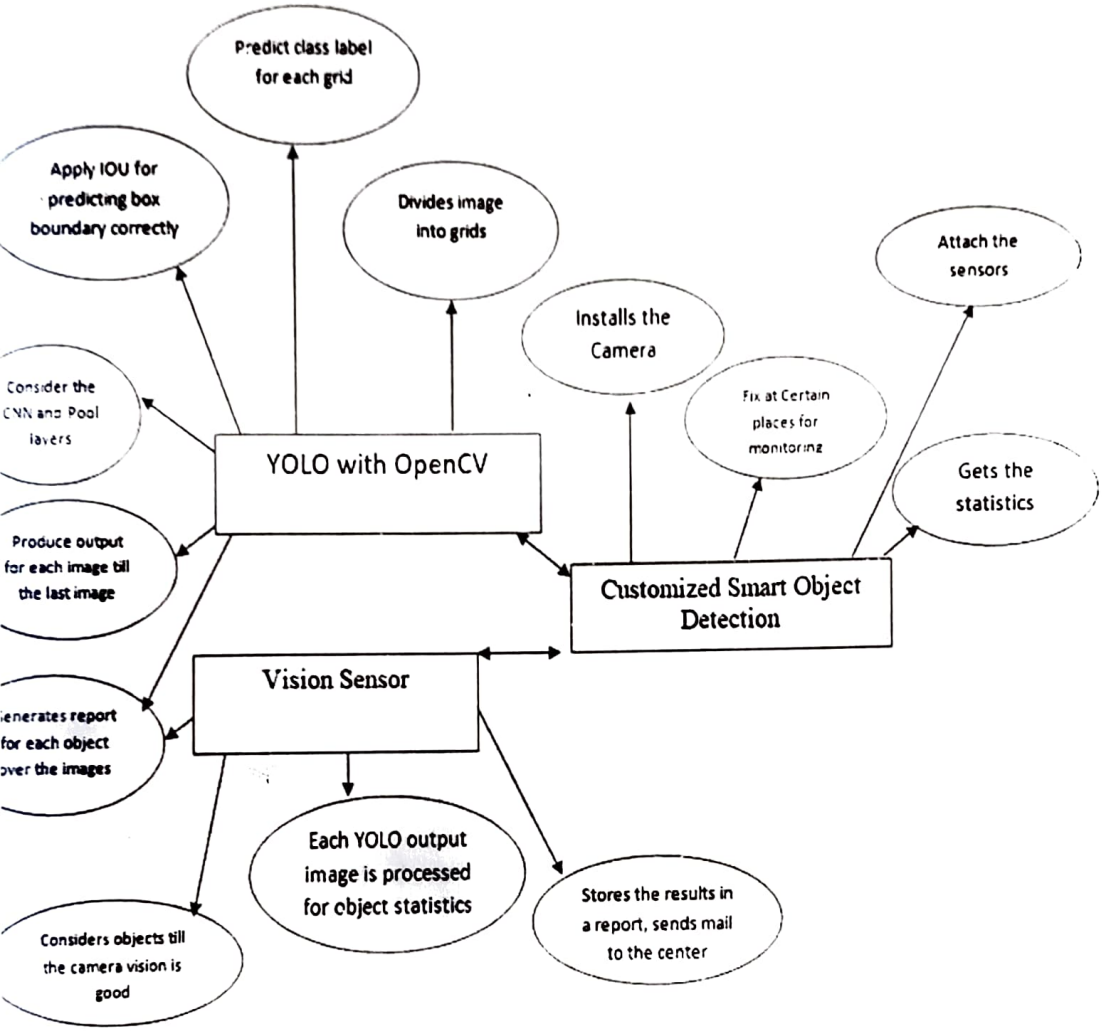
olution Neural Networks (CNN's) are used to differentiate the speech samples based on motion. Databases inclusive of RAVDEES and SAVEE are applied to prepare and ine CNN fashions. Kera's (Tensor Flow's high- degree API for building and training deep g knowledge of models) is used because the programming framework to put in force CNN ns. Seven exploratory arrangements of the present work are explained in this section.

Architecture Diagram

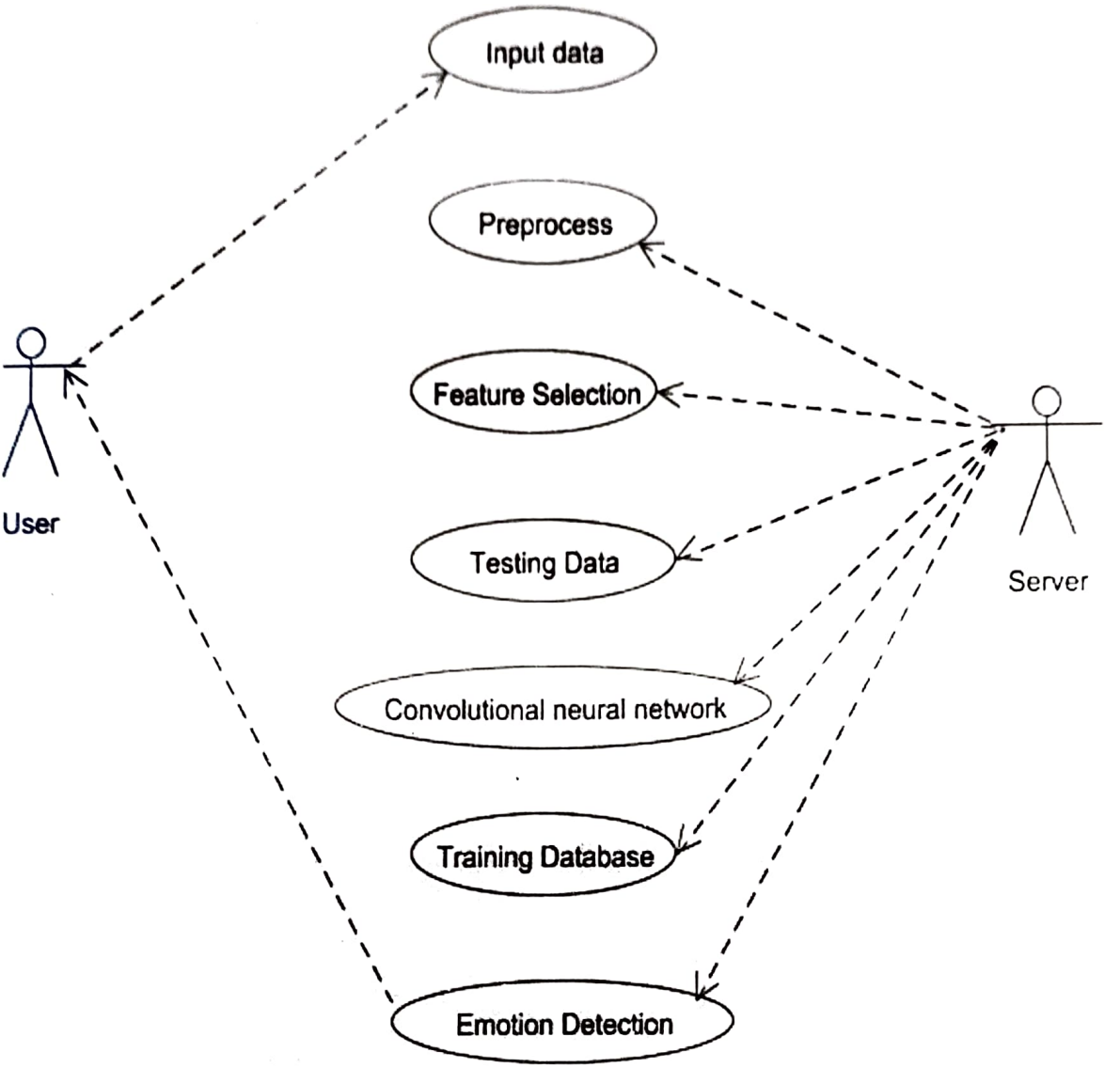


Diagrams

ER Diagram



Use Case Diagram



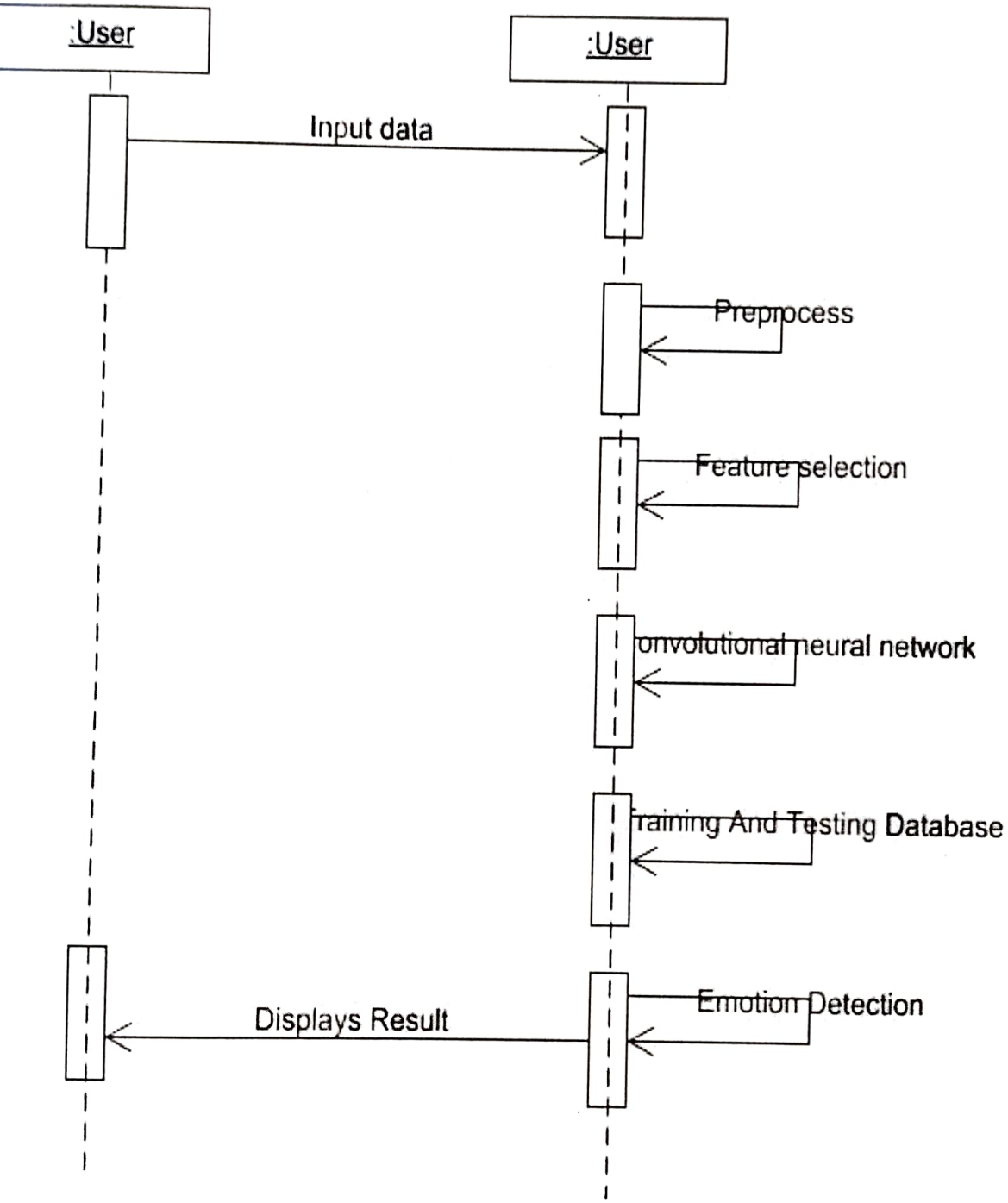
Use case Diagram is used to present a graphical overview of the functionality provided by a tem in terms of actors, their goals and any dependencies between those use cases.
e case diagram consists of two parts:

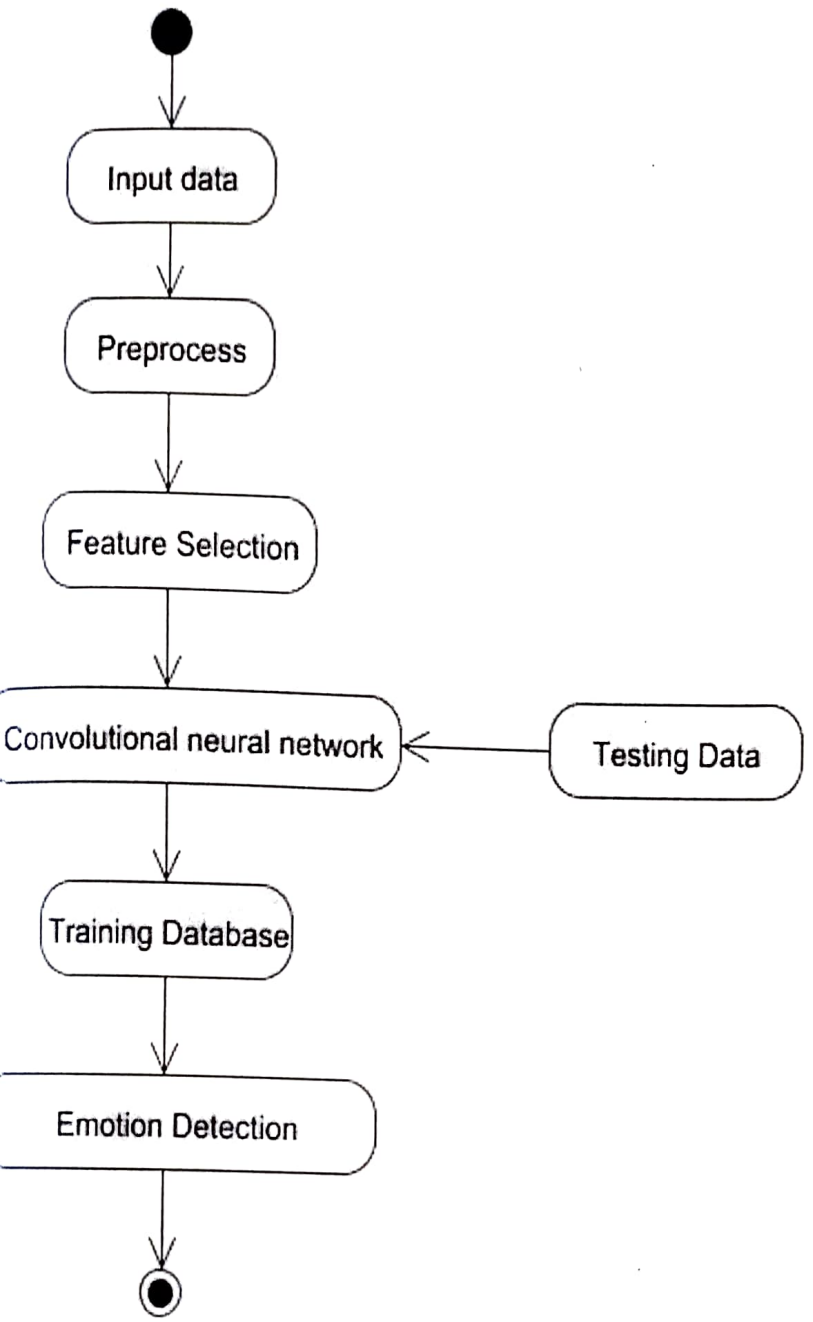
e case:

se case describes a sequence of actions that provided something of measurable value to an or and is drawn as a horizontal ellipse. Actor:
actor is a person, organization or external system that plays a role in one or more interaction h the system.

EQUENCE DIAGRAM

Sequence diagram is a kind of interaction diagram that shows how processes operate with one other and in what order. It is a construct of message Sequence diagrams are sometimes called ent diagrams, event sceneries and timing diagram.




Input data
Preprocess
Feature Selection
Convolutional neural network
Testing Data
Training Database
Emotion Detection

CODING AND TESTING

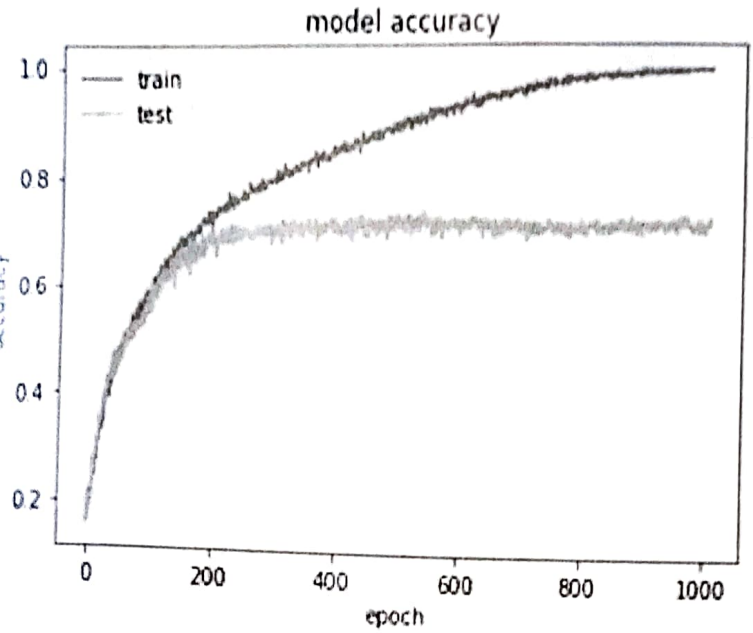
MOTIONS.PY:-

```
port numpy as numpy
port argparse import

m tensorflow.keras.models import Sequential
m tensorflow.keras.layers import Dense, Dropout, Flatten
m tensorflow.keras.layers import Conv2D from
nsorflow.keras.optimizers import Adam from
nsorflow.keras.layers import MaxPooling2D
m tensorflow.keras.preprocessing.image import ImageDataGenerator
port 'TF_CPP_MIN_LOG_LEVEL'  '2'

command line argument ap =
gparse.ArgumentParser()
.add_argument("--mode",help="train/display")
= ap.parse_args() mode = a.mode

f plot_model_history(model_history):
"""
Plot Accuracy and Loss curves given the model_history
"""
fig, axs = plt.subplots(1,2,figsize=(15,5))
summarize history for accuracy
axs[0].plot(range(1,len(model_history.history['acc'])+1),model_history.history['acc'])
s[0].plot(range(1,len(model_history.history['val_acc'])+1),model_history.history['val_acc'])
0].set_title('Model Accuracy')  axs[0].set_ylabel('Accuracy')  axs[0].set_xlabel('Epoch')
axs[0].set_xticks(np.arange(1,len(model_history.history['acc'])
),len(model_history.history['acc'])/10)
s[0].legend(['train', 'val'], loc='best')
# summarize history for loss
axs[1].plot(range(1,len(model_history.history['loss'])+1),model_history.history['loss'])
s[1].plot(range(1,len(model_history.history['val_loss'])+1),model_history.history['val_loss'])
s[1].set_title('Model Loss')  axs[1].set_ylabel('Loss')  axs[1].set_xlabel('Epoch')
axs[1].set_xticks(np.arange(1,len(model_history.history['loss'])
),len(model_history.history['loss'])/10)
s[1].legend(['train', 'val'], loc='best')
.savefig('plot.png')  plt.show()

Define data generators
in_dir = 'data/train'
'data/test'
```

```
ıum_train = 28709
ıum_val = 7178 batch_size
= 64 num_epoch = 50

rain_datagen = ImageDataGenerator(rescale=1./255) val_datagen
= ImageDataGenerator(rescale=1./255)

rain_generator = train_datagen.flow_from_directory(
rain_dir,        target_size=(48,48),
batch_size=batch_size,
olor_mode="grayscale",
lass_mode='categorical')

alidation_generator = val_datagen.flow_from_directory(
al_dir,
    target_size=(48,48),
atch_size=batch_size,
olor_mode="grayscale",
lass_mode='categorical')

Create the model model
Sequential()
ıodel.add(Conv2D(32, kernel_size=(3, 3), activation='relu', input_shape=(48,48,1)))
ıodel.add(Conv2D(64, kernel_size=(3, 3), activation='relu'))
ıodel.add(MaxPooling2D(pool_size=(2, 2))) model.add(Dropout(0.25))

ıodel.add(Conv2D(128, kernel_size=(3, 3), activation='relu'))
ıodel.add(MaxPooling2D(pool_size=(2, 2)))
ıodel.add(Conv2D(128, kernel_size=(3, 3), activation='relu'))
ıodel.add(MaxPooling2D(pool_size=(2, 2))) model.add(Dropout(0.25))

ıodel.add(Flatten())
ıodel.add(Dense(1024, activation='relu'))
ıodel.add(Dropout(0.5)) model.add(Dense(7,
ctivation='softmax'))

If you want to train the same model or try other models, go for this if mode
= "train":
odel.compile(loss='categorical_crossentropy',optimizer=Adam(lr=0.0001,
ge-6),metrics=['accuracy'])

model_info = model.fit_generator(
ain_generator,
    steps_per_epoch=num_train // batch_size,
ochs=num_epoch,        validation_data=validation_generator,
lidation_steps=num_val // batch_size)
```

```
  plot_model_history(model_info)
nodel.save_weights('model.h5')

 emotions will be displayed on your face from the webcam feed
elif mode == "display":    model.load_weights('model.h5')

  # prevents openCL usage and unnecessary logging messages
cv2.ocl.setUseOpenCL(False)

  # dictionary which assigns each label an emotion (alphabetical order)
 emotion_dict = {0: "Angry", 1: "Disgusted", 2: "Fearful", 3: "Happy", 4: "Neutral", 5: "Sad", 6:
Surprised"}

 # start the webcam feed
cap = cv2.VideoCapture(0)
while True
    # Find haar cascade to draw bounding box around face
et, frame = cap.read()      if not ret:          break
    facecasc = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
ray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)      faces =
acecasc.detectMultiScale(gray,scaleFactor=1.3, minNeighbors=5)

    for (x, y, w, h) in faces:
        cv2.rectangle(frame, (x, y-50), (x+w, y+h+10), (255, 0, 0), 2)
oi_gray = gray[y:y + h, x:x + w]
        cropped_img = np.expand_dims(np.expand_dims(cv2.resize(roi_gray, (48, 48)), -1), 0)
rediction = model.predict(cropped_img)          maxindex = int(np.argmax(prediction))
        cv2.putText(frame, emotion_dict[maxindex], (x+20, y-60),
v2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)

    cv2.imshow('Video', cv2.resize(frame,(1600,960),interpolation = cv2.INTER_CUBIC))
 cv2.waitKey(1) & 0xFF == ord('q'):          break

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

MODEL ACCURACY:



CONCLUSION

In conclusion, facial emotion detection is a growing field with a wide range of potential applications in areas such as psychology, human-computer interaction, and marketing. Existing systems for facial emotion detection have shown promising results, but have limitations in terms of accuracy, robustness, and computational efficiency.

The proposed system for facial emotion detection would leverage the latest advances in deep learning, computer vision, and artificial intelligence to improve upon the existing systems. The proposed system may use novel approaches such as GANs or attention mechanisms to improve accuracy and robustness, and incorporate multimodal approaches to provide more comprehensive and accurate information about the user's emotional state.

While the proposed system has the potential to provide significant improvements over the existing systems, further research and development are needed to develop a robust and reliable system that can be deployed in real-world applications. With ongoing advancements in AI and computer vision, it is expected that facial emotion detection will continue to be an active area of research and development in the years to come.

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