DETECTING OF EXPRESSION AND EMOTION OF FACE USING FED ALGORITHM ALONG WITH MLP CLASSIFIER

Major project report submitted
in partial fulfillment of the requirement for award of the degree of

Bachelor of Technology
in
Computer Science & Engineering

By

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June,2022

CERTIFICATE

It is certified that the work contained in the project report titled "DETECTING OF EXPRESSION AND EMOTION OF FACE USING FED ALGORITHM ALONG WITH MLP CLASSIFIER" by Yeluru Vaibhav (18UECS0953), G.Sai Prakash (18UECS0303), Pothedar.Shashank (18UECS0679) has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

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DECLARATION

We declare that this written submission represents my ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. Wealso declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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APPROVAL SHEET

This project report entitled ”DETECTING OF EXPRESSION AND EMOTION OF FACE USING FED ALGORITHM ALONG WITH MLP CLASSIFIER ” by Yeluru Vaibhav (18UECS0953), G.Sai Prakash (18UECS0303), Pothedar.Shashank (18UECS0679) is approved for the degree of B.Tech in Computer Science & Engineering.

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ABSTRACT

Facial effect analysis is an active research subject that tries to automatically estimate a person's emotions in order to create new sorts of human-computer interaction. However, there has historically been a disparity between what is done in psychology and what is done in computer vision. Current systems largely focus on face investigation while leaving the background intact, resulting in a plethora of superfluous and deceptive features that disrupt the CNN training process. The primary goal of "System for Detecting The Expression And Emotion Of Face Using FED Algorithm Along With MLP Classifier" is to investigate and propose facial affect analysis. The suggested research is to examine expressions and categorise the given image into fivefundamental emotion classes: displeasure/anger, sad/unhappy, smiling/happy, afraid, and surprised/astonished.

Keywords: Machine Learning, image processing, MLP Classifier, feature extraction

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AI	Artificial Intelligence
CNN	Convolutional Neural Network
CCTV	Closed Circuit Television
EV	Expressional Vector
FED	Face Emotion Detection
FRD	Face Recognition Detection
FERC	Facial emotion recognition using convolutional
KNN	K-Nearest Neighbor
MLP	Multilayer perceptron
PEs	Processing Elements
SVM	Support Vector Machine

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Chapter 1

INTRODUCTION

1.1 Introduction

Facial affect analysis seeks to develop new sorts of human–computer connections by allowing computers to better comprehend a person's emotional state in order to provide ad hoc assistance and interactions. Because they correspond to emotions, facial expressions are critical identifiers for human moods. Most of the time, a per- son's facial expression is a nonverbal manner of expressing emotion, and it can be used as actual proof to determine whether or not a person is telling the truth. While predicting these values from a face is natural for humans, it is highly challenging for computer-based systems, and automatic assessment of distinct emotions under real- istic situations is still a work in progress. We present a unique deep neural network architecture for analysing facial affect in naturalistic situations with good accuracy.

1.2 Aim of the project

The main goal of the System for Detecting The Expression And Emotion Of Face Using FED Algorithm Along With MLP Classifier" is to research and propose facial affect analysis in realistic situations with unparalleled accuracy. I propose a network architecture that identifies the user's face, predicts basic emotion categories, and classifies the user as happy, furious, or sad directly from real-time video. Another goal of this project is to develop robust technology for automatic facial emotion analysis that can be employed in 'humane' applications such as psychological and psychiatric research.

1.3 Project Domain

1.3.1 Machine Learning :

Machine learning is an application of artificial intelligence (AI) that provides sys- tems the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning techniques and algorithms focus on the development of computer systems that can easily access data and make it readily available for using it for improvement. The process of machine learning starts witha dataset. The primary aim is common for all processes, and that is to allow the computers to learn on their own without any kind of human input or assistance.

1.3.2 Machine Learning Method's

Machine learning algorithms have been categorized into two main subcategories- supervised and unsupervised.

Supervised algorithms require supervision by someone who has machine learning skills to provide input and receive the desired output. In addition to that, he/she will be involved in furnishing feedback about the accuracy. Once the model training is complete, the algorithm will be applied to new data.

Unsupervised algorithms do not require any training with the data. However, they do make use of an iterative approach. This approach is called Deep Learning (DL).

Unsupervised learning algorithms are also referred to as neural networks.These networks are used wherever the complexity is more and can perform more tasks than supervised learning systems. These neural networks progress by combing through Dataset for training and automatically identify correlations between variables present in the dataset. Once the model is trained, the algorithm can then use its associations to test the data.

Supervised machine learning algorithms are applied to the previously studied data in the past and then to new data. Such a system is able to provide outputs for any new

input once sufficient training is done. This algorithm also compares its output with the correct, intended output and finds discrepancies, and then modifies the model accordingly.

1.3.2 **Image Processing**

In imaging sciences, image processing is the most important part of the process. Most techniques require treating the image as a two-dimensional signal and then standard signal processing techniques are applied to it. However, images can also be processed as three-dimensional signals where the third dimension is time and it becomes the z-axis. Image processing is done to digital images, but can also be done for optical and analogous images.

The collection of images is known as 'imaging'. It is closely related to computer graphics and vision. In computer graphics, input images have to be made manually from physical models. Whereas in computer vision, high-level image processing aims to decipher the physical contents of an image.

1.4 Scope of the Project

The Technique, in conjunction with other information, could be used to more robustly identify and trace persons and their behavioral patterns across a range of channels (for example, phone, webcam) and use this information for targeting political or other goals. The proposed solution generalizes well and is appropriate for real-time applications in healthcare, psychology, rehabilitation, surveillance, and security .

1.5 Methodology

The initial step in the picture is processing process. It must be performed on digitised images in order to reduce noise and increase image quality. Background variables, such as illumination, head attitude, and face patterns associated with iden-

tification bias, typically alter face images. At this stage, the data is cleaned and pre-processed, and missing and null value records are removed. Following the detection of the face and eyes, the facial picture can be normalised as a fixed-size image utilising the localised eye positions. This module identifies traits such as pupil position, eye corners, lip boundaries, and so on. This is due to the fact that these character- istics are bound to change with age. This algorithm is trained on a large data setof different faces to estimate a person's age based on such factors. The randomized input is fed into the network, which is then trained for various hidden layers. It has been discovered that MLP with a single hidden layer performs better. The hidden layer has a variable number of Processing Elements (PEs).

Chapter 2

LITERATURE REVIEW

[1] Robust Li, et ai., Facial Expression Classification using CNN and Multi-Layer Percep- tron Network classifiers.

The Facial expressions are essential in human-to-human communication because they convey sentiment and meaning. Humans can recognize gestures and comprehend the feelings of others, while computers need massive computations to distinguish distinct expressions from their face. Machines that can interpret people's facial expressions can greatly aid humans. For example, if robots are capable of un- derstanding people's intentions through facial expression recognition, they may pro- vide more friendly service to humans. Furthermore, Facial Expression Recognition (FER) has promising applications in a variety of fields such as computer interfaces, health management.

[2] Ninad Mehendale,et ai., Facial emotion recognition using convolutional neural net- works (FERC).

The authors proposed a novel technique called facial emotion recog- nition using convolutional neural networks (FERC). The FERC is based on two-part convolutional neural network (CNN): The first-part removes the background from the picture, and the second part concentrates on the facial feature vector extraction. In FERC model, expressional vector (EV) is used to find the five different types of regular facial expression. Supervisory data were obtained set.

[3] Hivi Ismat Dino, .et ai., Facial Expression Classifica- tion Based on SVM, KNN and MLP Classifiers.

The presented method uses Viola- Jones algorithm for face detection. Histogram of Oriented Gradients (HOG) is used as a descriptor for feature extraction from the images of expressive faces. Princi-pal Component Analysis (PCA) applied to reduce dimensionality of the Features,to obtaining the most significant features. Finally, the presented method used three different classifiers which are Support Vector Machine (SVM), K-Nearest Neigh- bor (KNN) and Multilayer Perceptron Neural Network (MLPNN) for classifying the facial expressions and the results of them are compared. The experimental results show that the presented method provides the recognition rate with 93.53 percent- age when using SVM classifier, 82.97percentage when using MLP classifier and 79.97percentage when using KNN classifier which refers that the presented method provides better results while using SVM as a classifier.

[4] Abeer Ali Alnuaim, et ai., Human-Computer Interaction for Recognizing Speech Emotions Using Mul- tilayer Perceptron Classifier.

The emotions provide a valuable beginning point for demonstrating human feelings. While other theoretical models of emotion exist, the models employed most oftenare dimensional and definite ones . Categorical representation of emotions has been increasingly utilized in affective computing for practical reasons. For instance, a previous study implemented algorithms that distinguish eight distinct emotion types based on facial expressions. Oudeyer created such algorithms to generate and iden- tify five emotions using voice characteristics. According to Ekman and Friesen , six fundamental categorical emotions are universal, and their facial expressions are ex- hibited and recognized in all societies. ML paradigms play a significant role.

[5] R.Rizgar .,et ai., The Classification techniques' performance evaluation for facial expression recog- nition.

The performance evaluation for facial expression recog- nition , Facial exprestion recognition as a recently developed method in computervision is founded upon the idea of analazing the facial changes in which arewitnessed due to emotional impacts on an individual. This provides a performance evaluation of a set of super- vised classifiers used for facial expression recognition based on minimum features selected by chi-square. These features are the most iconic and influential ones that have tangible value for result dermination.

Chapter 3

PROJECT DESCRIPTION

3.1 Existing System

The Three different algorithms have been preferred based on the most widely used criteria. The algorithms are Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA), skin colour, wavelet and Artificial Neural Network (ANN).

3.2 Proposed System

There are two kinds of methods that are currently popular in developed face recognition pattern namely, Eigenface method and Fisherface method. Facial image recognition Eigenface method is based on the reduction of face- dimensional space using Principal Component Analysis (PCA) for facial features.

3.3 Feasibility Study

The feasibility of the project is analyzed in this phase and business proposals are put forth with a very general plan for the project and some cost estimates. During system analysis, the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential. Three key considerations involved in the feasibility analysis are:

3.3.1 Economic Feasibility

This study is carried out to check the economic impact that the system will have on the organization. The amount of funds that the company can pour into their search and development of the system is limited. The expenditures must be justified. Thus, the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

3.3.2 Technical Feasibility

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

3.3.3 Social Feasibility

The aspect of the study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employedto educate the user about the system and to make him familiar with it. His level of confidence must be raised so that he is also able to make some constructive criticism, which is welcomed, as he is the final user of the system.

3.4 System Specification

3.4.1 Hardware Specification

1. Microsoft Server enabled computers, preferably workstations
2. Higher RAM, of about 4GB or above
3. Processor of frequency 2.5GHz

3.4.2 Software Specification

Python 3.6 and Jupyter notebook

Chapter 4

METHODOLOGY

4.1 General Architecture

This diagram is nothing but a simple description of all the entities that have been incorporated into the system. The diagram represents the relations between eachof them and involves a sequence of decision-making processes and steps. You can simply call it a visual or the whole process and its implementation. All functional correspondences are explained in this diagram.

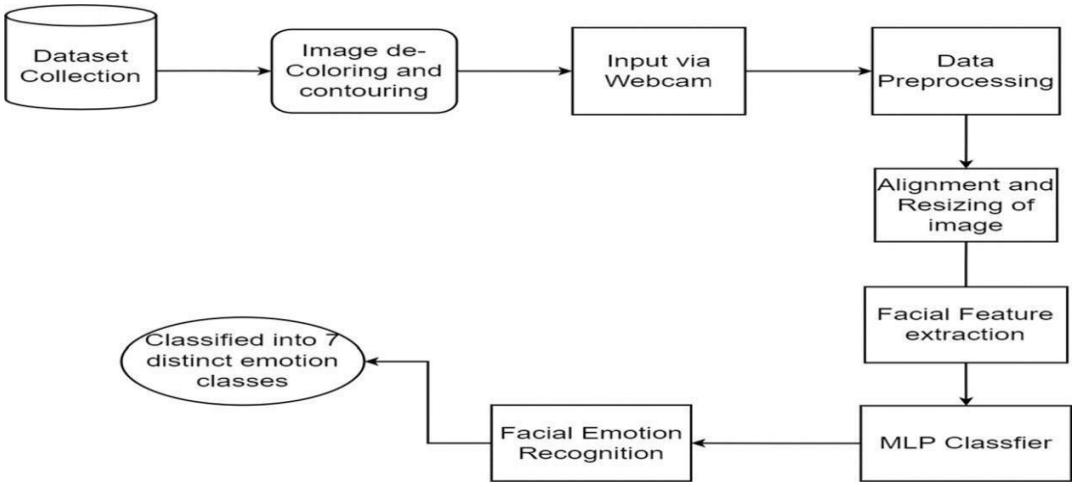

Figure 4.1: **General Architecture**

4.2 Design Phase

4.2.1 Data Flow Diagram

This is basically a contextual diagram, also referred to as a “context diagram”. It only represents the top level or the 0 Level in the whole process. it gives an abstraction kind of view and shows the whole system as a single process and its relationship to externalities.

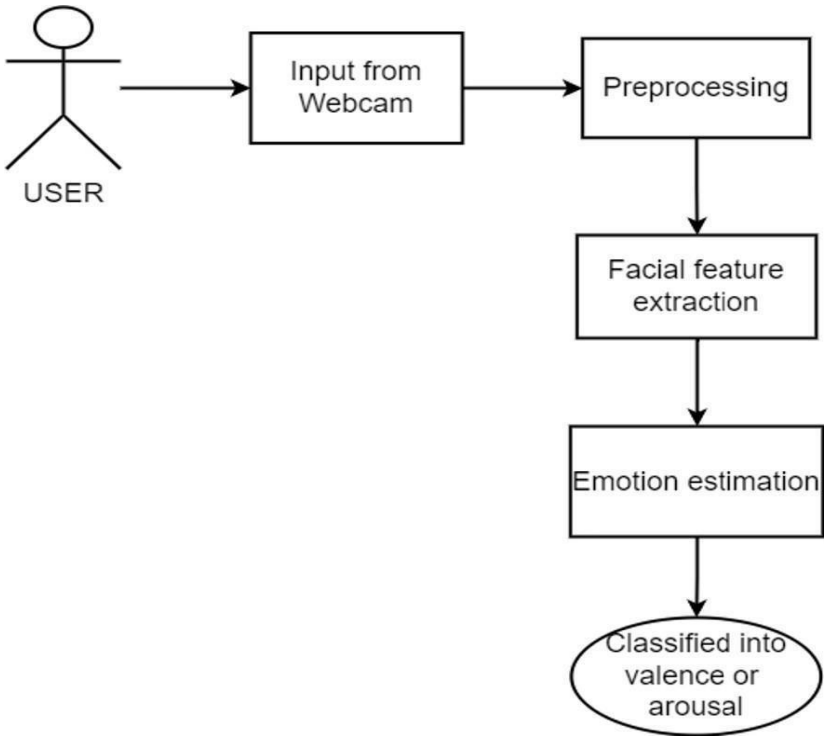

Figure 4.2: **Data Flow Diagram.**

4.2.2 Use Case Diagram

A UML use case diagram is the primary form of system/software requirements for a new software program underdeveloped.

Figure 4.3: **Use Case Diagram**

4.2.3 Class Diagram

Class diagram is a static diagram and it is used to model the static view of a system. The static view describes the vocabulary of the system.

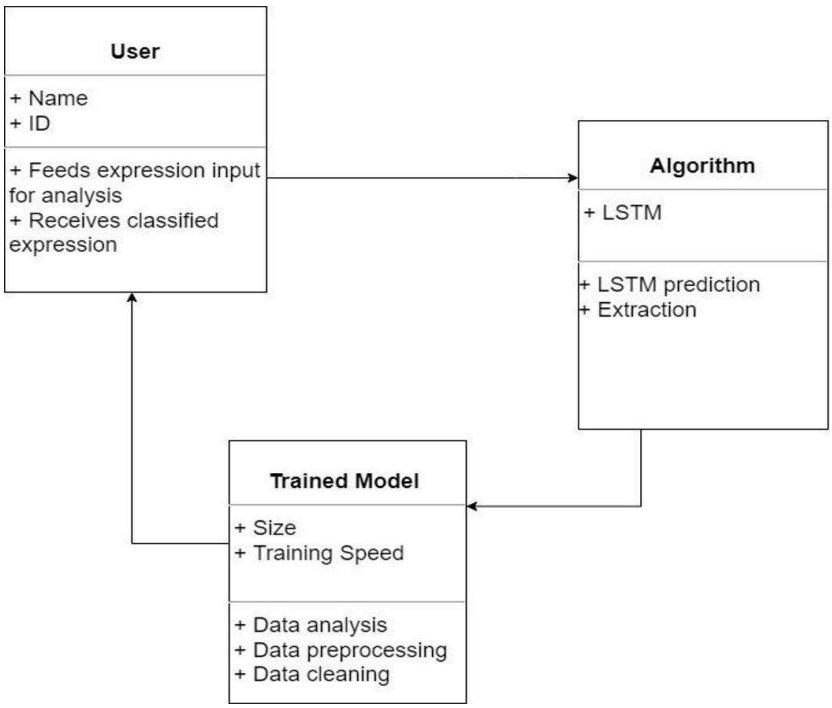

Figure 4.4: **Class Diagram**

4.2.4 Sequence Diagram

These are other kinds of interaction-based diagrams that show how all the operations are carried out. They capture the context of collaborations between objects and processes.

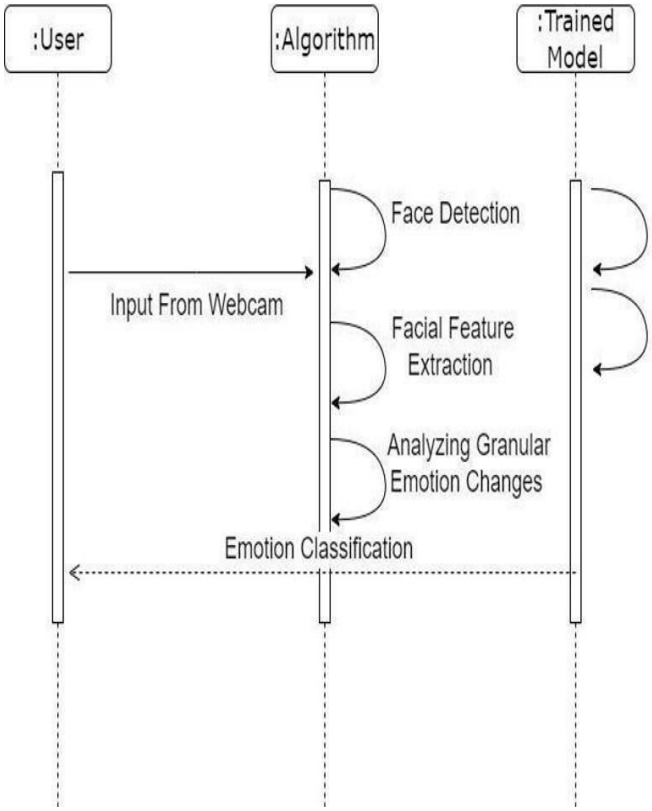

Figure 4.5: **Sequence Diagram**

4.2.5 Collaboration Diagram

Both sequence diagrams and collaborations diagrams show the same information in two different manners. It represents an inter-connected system of multiple objects so that object's architecture can be displayed efficiently. It is why it is also known as Communications Diagram.

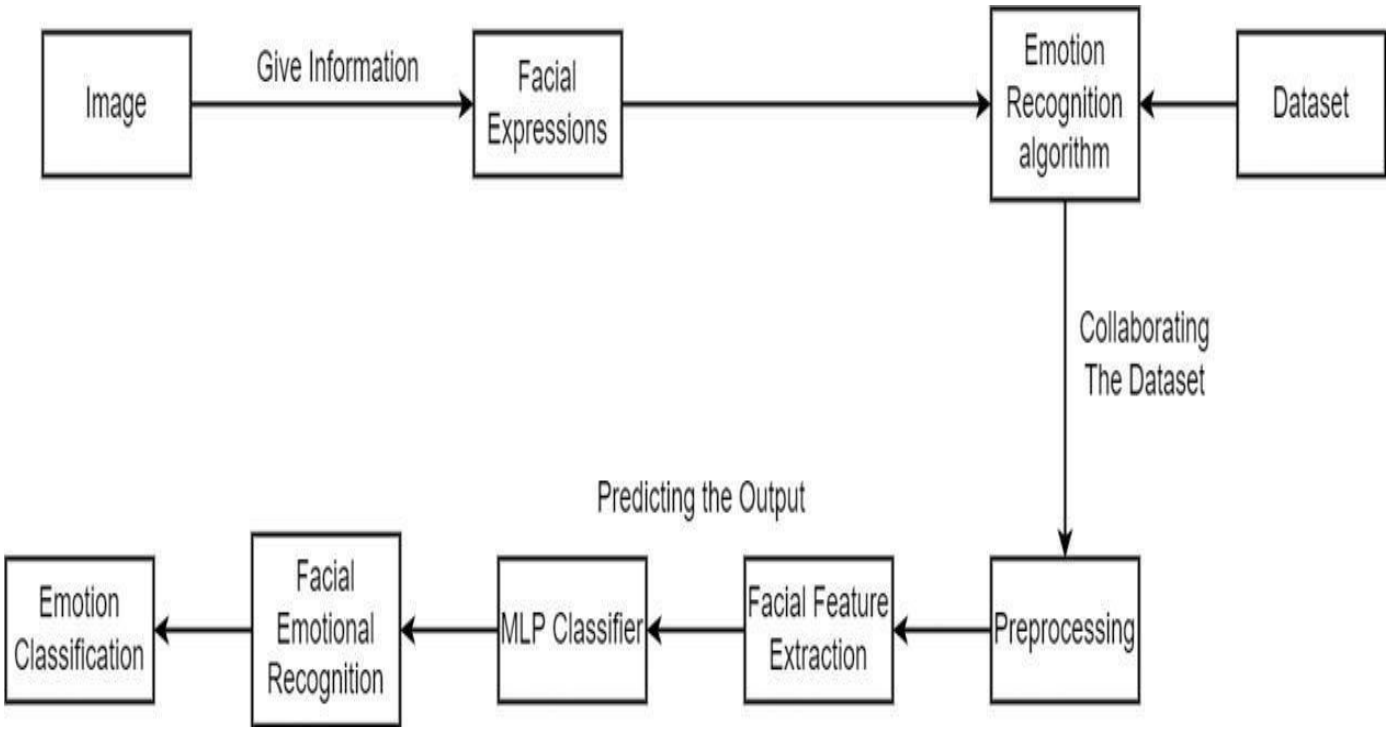

Figure 4.6: **Collaboration Diagram**

4.2.6 Activity Diagram

Activity diagram is another important behavioral diagram in UML diagram to describe dynamic aspects of the system.

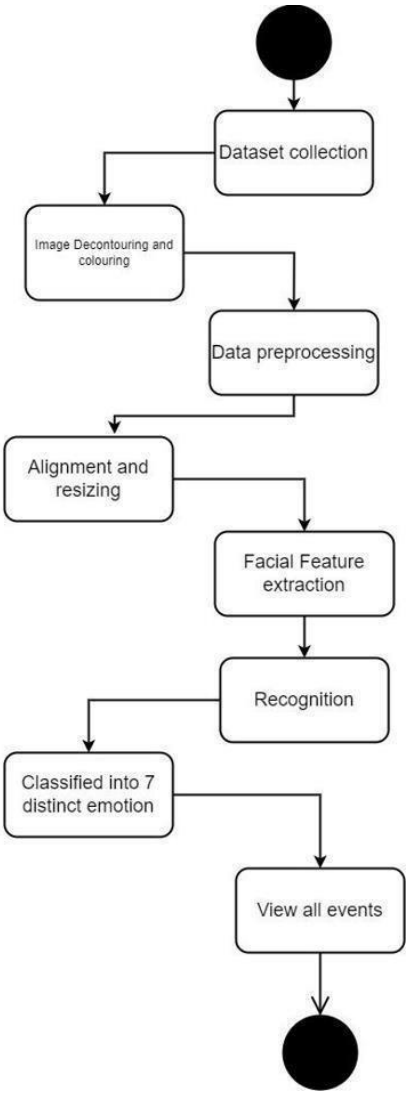

Figure 4.7: **Activity Diagram**

4.3 Algorithm & Pseudo Code

4.3.1 Algorithm :MLP

A fully connected multi-layer neural network is called a Multilayer Perceptron (MLP). The number of layers and the number of neurons are referred to as hyper-parameters of a neural network, and these need tuning. Cross-validation techniques must be used to find ideal values for these. The weight adjustment training is done via backpropagation. Deeper neural networks are better at processing data.

The reasonably straightforward. All statements showing ”dependency” are to be indented. we can use while, do, for, if, switch.

4.4 Module Description

4.4.1 Data Pre-processing

Data pre-processing comes under data mining and analysis. It deals with raw data and transforms it into a usable format that computers can readily put to use. In reality, raw data may contain a number of discrepancies, like errors and missing values, or lack of uniformity. Whereas, all machines and algorithms are trained to deal with tidied and similar data that is structured. This is why this module of data pre-processing is very crucial for the process.

As a result, alignment and normalization are the two most often used preprocessing approaches in face recognition, and they may aid in acquiring discriminant features. Faces were scaled to 100 80 pixels in size, which is the average size of faces identified in the target collection.

4.4.2 Data Cleaning

The data is cleaned and pre-processed at this stage, where missing and null value records are dropped. In our dataset, we cleaned all the null values and checked whether all the data types are valid. Missing values are also dealt with. Data cleaning also caters to noisy data (meaningless data). Such values cannot be interpreted bythe system. Binning method, Regression, and Clustering are done to denoise the dataset.

4.4.3 Data Transformation

As we have mentioned that computers cannot work with raw data, this stage of the module deals with the transformation of data into appropriate forms that are suitable for mining processes. Some common practices that are undertaken to transform data:
Normalisation: this is done in order to scale the data and generally between -1 to 1 or 0 to 1 in certain cases where negative values are not required.
Attribute selection: as per the models, attributes have been curated that help to classify data, and then the model can work with attributes and not the data directly.
Discretization: if there are raw numerical values that have to be converted into interval levels or even conceptual levels, then discretization is performed.
Concept hierarchy generation: just like in attribute selection, here attributes that were made are now further converted from lower to higher levels. For example, “cities” may be converted to “states”, or “states” may be converted to “countries”.

4.5 Data Reduction

The dataset that the systems deal with is huge. When you are working with a large amount of data, the process of analyzing becomes very hard and time-consuming. This is why the technique of data reduction can be put to use. Some steps that are included in the data reduction process:

1. Data Cube Aggregation: data cubes are made.
2. Attribute Subset Selection: only the most relevant attributes are put to use for study. The rest of the attributes are discarded. P-values and significance levels can be used to do the same.
3. Numerosity Reduction: this step stores the model instead of the dataset, like the regressed model and not individual data.
4. Dimensionality Reduction: this is done via encoding mechanisms. You have

an option to reduce the dimension via two paths. One allows you to retrieve the compressed data (Lossless reduction), while the other does not allow you to retrieve your data (Lossy reduction).

4.5.1 Facial Feature Extraction

Human characteristics are extremely sensitive to texture and skin tone, and the majority of the chosen features are positioned around the crucial locations for recog- nition, such as the brows, nose, cheekbones, and jaw-line. The detection, tracking, and normalization of the human face in an image series is required for automated va- lence or arousal measurement. Following the detection of the face and eyes, the facialpicture can be normalized as a fixed-size image utilizing the localized eye positions. This module identifies traits such as pupil position, eye corners, lip boundaries, andso on. This is due to the fact that these characteristics are bound to change with age. This algorithm is trained on a large data set of different faces to estimate a person's age based on such factors. The accuracy of the prediction depends on conditions such as lighting, head pose, etc.

4.5.2 Training the Dataset

Training data is a very large dataset used to teach machine learning models. In other words, a training set is a resource for computers to learn how to process infor- mation. Training data is used to teach predictive models that use machine learning algorithms to extract features related to a particular project or research goal. For supervised ML models, the training data is labeled. The data used to train the unsu- pervised ML model is unlabeled

Using MLP Classifier To Classify Discrete Emotions

A multilayer perceptron is a feedforward artificial neural network that hasall of its layers connected . The name MLP is ambiguous; it can refer to any

feedforward ANN, or it can refer to networks built of many layers of perceptrons (with threshold activation); see Terminology for further information. When there is only one hidden layer, multilayer perceptrons are referred regarded as ”vanilla” neu- ral networks.

An MLP has at least three layers of nodes: input, hidden, and output. Each node is a neuron with a nonlinear activation function, with the exception of the input nodes. For training, MLP employs backpropagation, a supervised learning approach. MLP differs from a linear perceptron in that it has numerous layers and activation that is non-linear.

In our model, Emotion estimation, the third component, recognises facial expres- sions in photos or videos and returns the probability distribution of each of the uni- versal emotions: happy, sorrow, anger, fear, surprise, disgust, and neutral. The ran- domised input is fed into the network, which is then trained for various hidden layers.

It has been discovered that MLP with a single hidden layer performs better. The hidden layer has a variable number of Processing Elements (PEs). To achieve actual learning and to minimise bias in the selection of specific starting connection weights, the network is trained three times with distinct random initialization of connection weights.

4.5.3 Steps to execute/run/implement the project

Install jupyter notebook package 64-bit version and choose the Python 3.6 ver- sion. This automatically installs Python and many popular data scientist/ML libraries (NumPy, Scikit-Learn, Pandas, R, Matplotlib), tools (Jupyter Notebook, RStudio) and hundreds of other open source packages for your future projects. For example, the Anaconda Jupyter Notebook is used for all experiments. OpenCV library is not

included though and we will install it separately as it is needed for real-time computer vision tasks.

Install necessary packages that is mentioned in requirements.txt file

Open your anaconda prompt and clone the repository git clone [repository name]

If you have not already created a new virtual environment.

The create aconda environment conda create n your env name python=3.7

Activate the new environment using anaconda prompt. activate your env name

python setup.py build ext inplace or try the following as alternative pip install e

Chapter 5

IMPLEMENTATION AND TESTING

Implementation is that stage of the project where the theoretical designs are turned out into a fully working system. Therefore, it is considered to be the most important stage in achieving a successful new system and in enabling the user, and giving him/her confidence that the new system will work and be highly efficient. The implementation stage includes careful planning, investigation of the problems of the existing system and its constraints on implementation, designing of methods to achieve a completely changed system, and evaluation of the changed methods.

The initial step in implementation was for a computer to recognise human emo - tions using a neural network. This project recognises all six universally accepted basic emotions, namely angry, disgust, fear, happy, sad, and surprise, as well as a neutral emotion. The performance of Multilayer Perceptron (MLP) and FED meth- ods is compared. A randomised grid search was used to validate all of the hyper- parameters. Our solution combines all of the preceding into a single, end-to-end trainable model that surpasses all previous work on automatic facial affect estima- tion by a wide margin. This technique, in conjunction with other information, could be used to more robustly identify and trace persons and their behavioural patterns across a range of channels (for example, phone, webcam) and use this information for targeting political or other goals.

5.1 Input and Output

5.1.1 Input Design

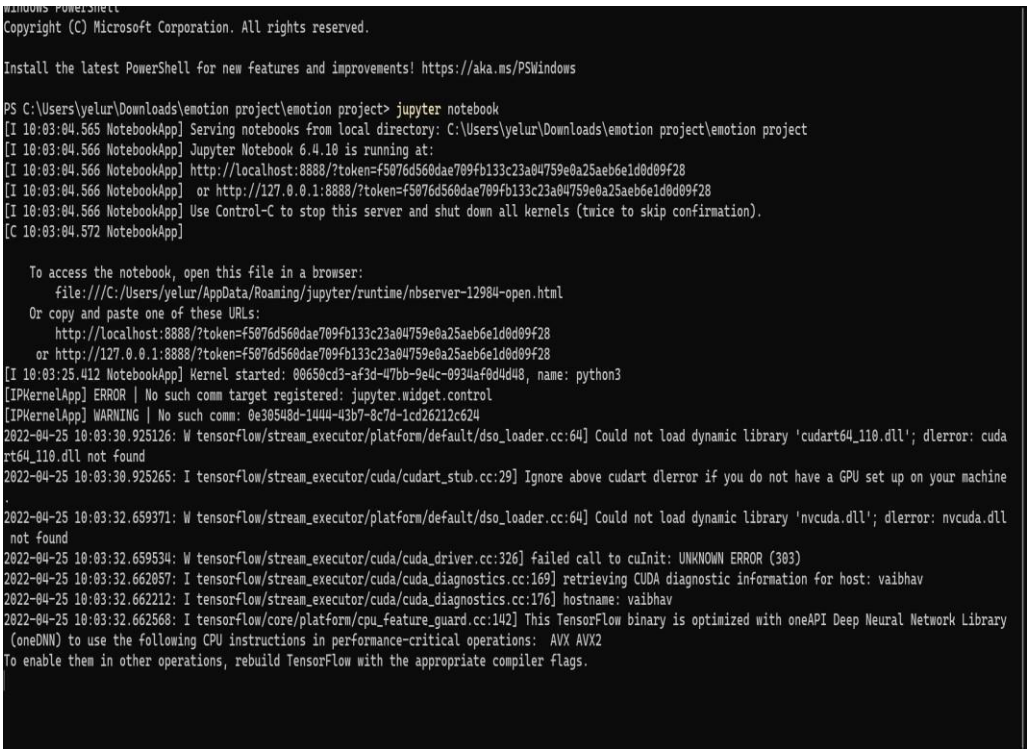

Figure 5.1: **Emotion Detection Input**

5.1.2 Output Design

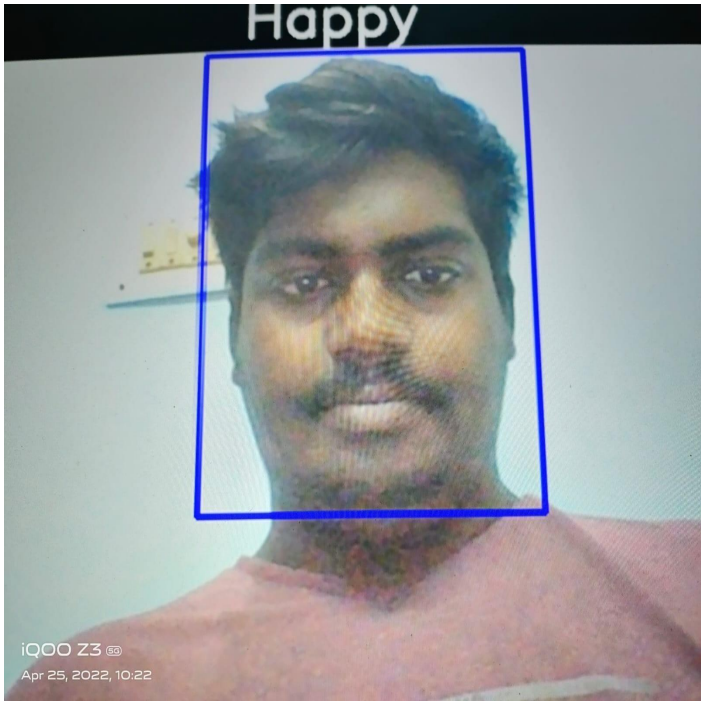

Figure 5.2: **Emotion Detection**

5.2 Testing

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies, and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of tests. Each test type addresses a specific testing requirement.

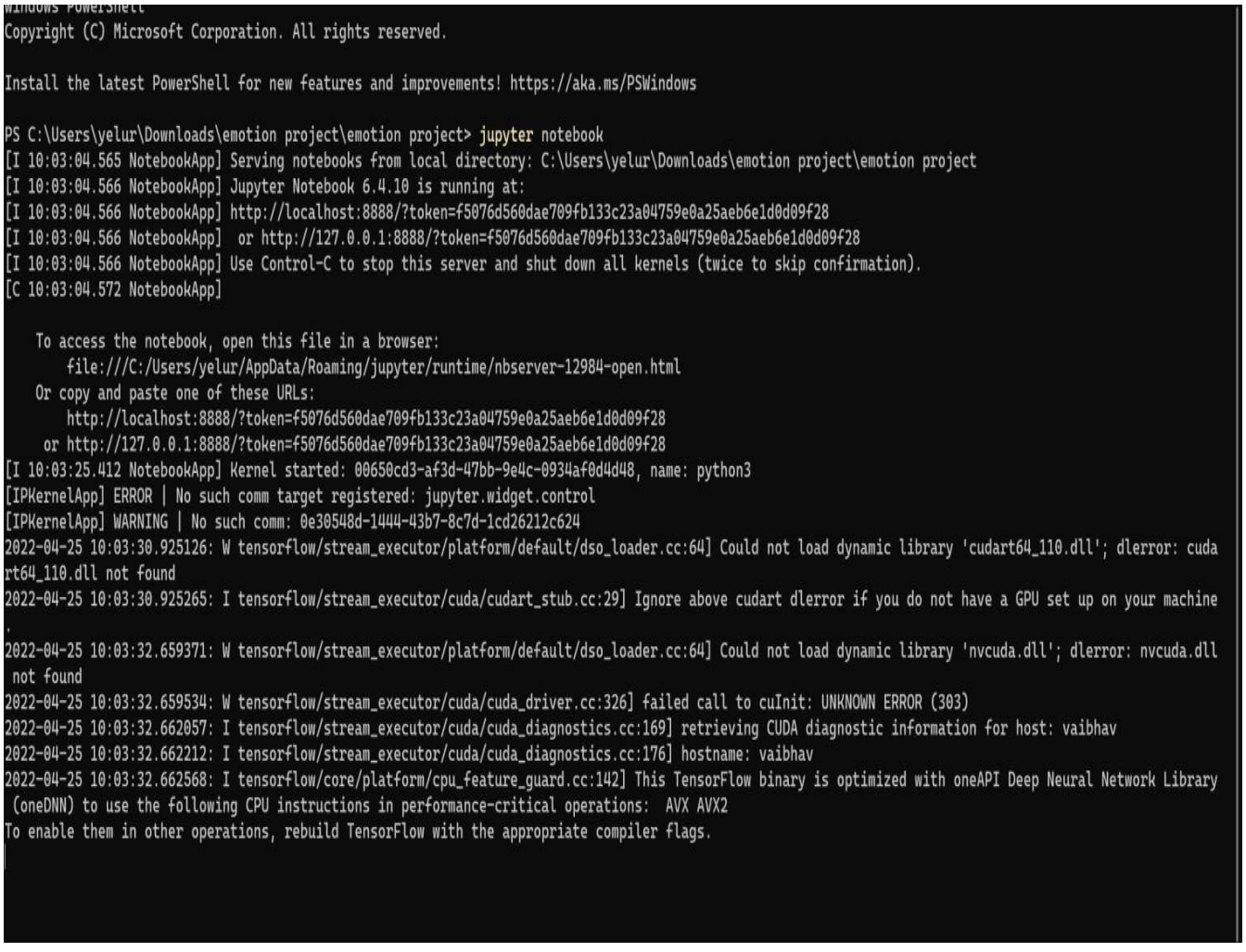

Figure 5.2: **Testing**

5.3 Types of Testing

5.3.1 Unit testing

Unit Testing is a type of software testing where individual units or components of a software are tested. The purpose is to validate that each unit of the software code performs as expected.

Input

```
In [2]: model = Sequential()

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

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

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

Figure 5.3: **Validate Unit Testing**

5.3.2 Integration testing

Integration testing is a level of software testing where individual units are combined tested as a group. The purpose of this level is to expose faults in the interaction between integrated units.

Input

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\yelur\Downloads\emotion project\emotion project> jupyter notebook
[I 10:03:04.565 NotebookApp] Serving notebooks from local directory: C:\Users\yelur\Downloads\emotion project\emotion project
[I 10:03:04.566 NotebookApp] Jupyter Notebook 6.4.10 is running at:
[I 10:03:04.566 NotebookApp] http://localhost:8888/?token=f5076d560dae709fb133c23a04759e0a25aeb6e1d0d09f28
[I 10:03:04.566 NotebookApp]  or http://127.0.0.1:8888/?token=f5076d560dae709fb133c23a04759e0a25aeb6e1d0d09f28
[I 10:03:04.566 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice to skip confirmation).
[C 10:03:04.572 NotebookApp]

    To access the notebook, open this file in a browser:
        file:///C:/Users/yelur/AppData/Roaming/jupyter/runtime/nbserver-12984-open.html
    Or copy and paste one of these URLs:
        http://localhost:8888/?token=f5076d560dae709fb133c23a04759e0a25aeb6e1d0d09f28
     or http://127.0.0.1:8888/?token=f5076d560dae709fb133c23a04759e0a25aeb6e1d0d09f28
[I 10:03:25.412 NotebookApp] Kernel started: 00650cd3-af3d-47bb-9e4c-0934af0d4d48, name: python3
[IPKernelApp] ERROR | No such comm target registered: jupyter.widget.control
[IPKernelApp] WARNING | No such comm: 0e30548d-1444-43b7-8c7d-1cd26212c624
2022-04-25 10:03:30.925126: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'cudart64_110.dll'; dlerror: cuda
rt64_110.dll not found
2022-04-25 10:03:30.925265: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do not have a GPU set up on your machine
.
2022-04-25 10:03:32.659371: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic library 'nvcuda.dll'; dlerror: nvcuda.dll
 not found
2022-04-25 10:03:32.659534: W tensorflow/stream_executor/cuda/cuda_driver.cc:326] failed call to cuInit: UNKNOWN ERROR (303)
2022-04-25 10:03:32.662057: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:169] retrieving CUDA diagnostic information for host: vaibhav
2022-04-25 10:03:32.662212: I tensorflow/stream_executor/cuda/cuda_diagnostics.cc:176] hostname: vaibhav
2022-04-25 10:03:32.662568: I tensorflow/core/platform/cpu_feature_guard.cc:142] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
 (oneDNN) to use the following CPU instructions in performance-critical operations:  AVX AVX2
To enable them in other operations, rebuild TensorFlow with the appropriate compiler flags.
```

Figure 5.4: **Integration Testing**

5.1.1 System Testing

It is a type of software testing whereby the system is tested against the functional requirements/specifications. Functions are tested by feeding them input and examining the output. Functional testing ensures that the requirements are properly satisfied by the application. This type of testing is not concerned with how processing occurs, but rather, with the results of processing. So, it tries to execute the test cases and compare the results and check the accuracy.

5.1.2 White Box Testing

White box testing is a software testing method in which the internal structure of the item is known to the tester. The tester chooses inputs to exercise paths through the code and determines the appropriate outputs.

```
In [2]: model = Sequential()

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

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

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

Figure 5.5**: Internal Structure Testing**

5.1.3 Black Box Testing

Black box testing also known as behavioural testing is a software testing method in which the internal structure of the item being tested is known to the tester.

In [3]:
```
model.load_weights('model.h5')
cv2.ocl.setUseOpenCL(False)
emotion_dict = {0: "Angry", 1: "Disgusted", 2: "Fearful", 3: "Happy", 4: "Neutral", 5: "Sad", 6: "Surprised"}
cap = cv2.VideoCapture(0)
while True:
    ret, frame = cap.read()
    if not ret:
        break
    facecasc = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    faces = facecasc.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)
        roi_gray = gray[y:y + h, x:x + w]
        cropped_img = np.expand_dims(np.expand_dims(cv2.resize(roi_gray, (48, 48)), -1), 0)
        prediction = model.predict(cropped_img)
        maxindex = int(np.argmax(prediction))
        cv2.putText(frame, emotion_dict[maxindex], (x+20, y-60), cv2.FONT_HERSHEY_SIMPLEX, 1, (255, 255, 255), 2, cv2.LINE_AA)

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

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

Figure 5.6: **Black Box**

Chapter 6

RESULTS AND DISCUSSIONS

6.1 Efficiency of the Proposed System

dimensionality to improve the presentation.

a. Cost-effective and the data collected is accurate.

b. The performance is high because the proposed system deals with a trained model.

c. Real-time monitoring is done so that can be operated anywhere and also conveniently.

6.2 Comparison of Existing and Proposed System

1. Facial Emotion Recognition (from real-time or static images)is the process of mapping facial expressions to identify emotions such as disgust, joy, anger, surprise, fear, or sadness - or compound emotion such as sadly angry - on a human face with image processing software.

2. Face recognition CCTV systems can significantly accelerate operators' efforts by enabling them to add a reference photo provided by the missing child's parents and match it with past appearances of that face captured on video. Police can use face recognition to search video sequences (aka video analytics) of the estimated location and time the child has been declared missing.

3. Face recognition CCTV can be used to enable police to track and identify past criminals suspected of perpetrating an additional infraction. Police can also take preventive actions. By using an image of a known criminal from a video or an external picture (or a database), operators can detect matches in live video and react

before it’s too late.

6.3 Sample Code

```
import numpy
import_argparse
import matplotlib.pyplot as plt
import cv2
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout, Flatten
from tensorflow.keras.layers import Conv2D
from tensorflow.keras.optimizers import  Adam
from tensorflow.keras.layers import MaxPooling2D
from tensorflow.keras.preprocessing.image import ImageDataGenerator
model = Sequential()
model.add(Conv2D(32, kernel size=(3, 3), activation=’relu’, inputshape = (48, 48, 1)))
model.add(Conv2D(64, kernel size=(3, 3), activation=’relu’))
model.add(MaxPooling2D(pool size=(2, 2)))
model.add(Dropout(0.25))
model.add(Conv2D(128, kernel size=(3, 3), activation=’relu’))
model.add(MaxPooling2D(pool size=(2, 2)))
model.add(Conv2D(128, kernel size=(3, 3), activation=’relu’))
model.add(MaxPooling2D(pool size=(2, 2)))
model.add(Dropout(0.25))
model.add(Flatten())
model.add(Dense(1024, activation=’relu’))
model.add(Dropout(0.5))
```

```
model.add(Dense(7, activation='softmax'
))
```

Output

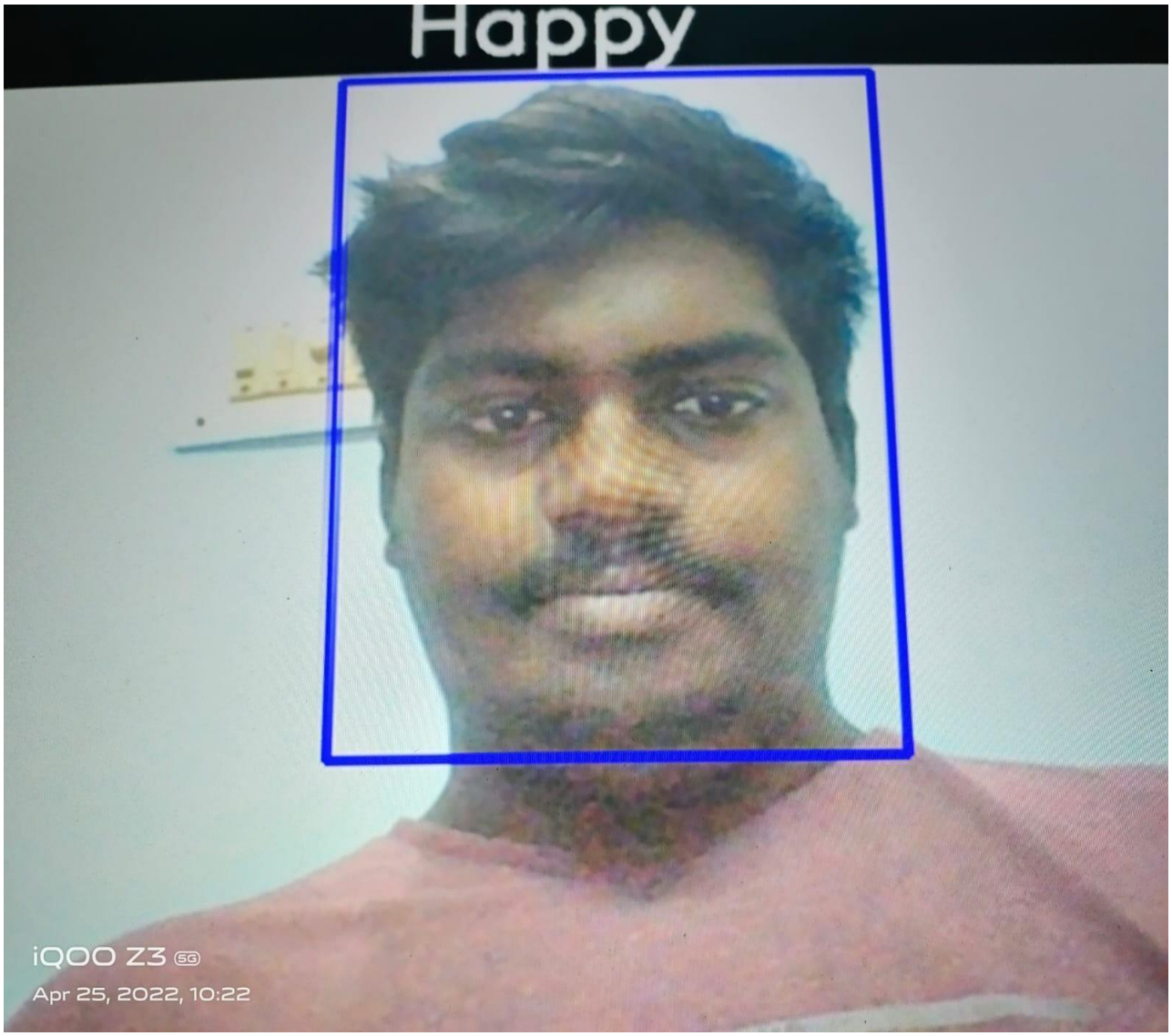

Figure 6.1: **Emotion Detection 1**

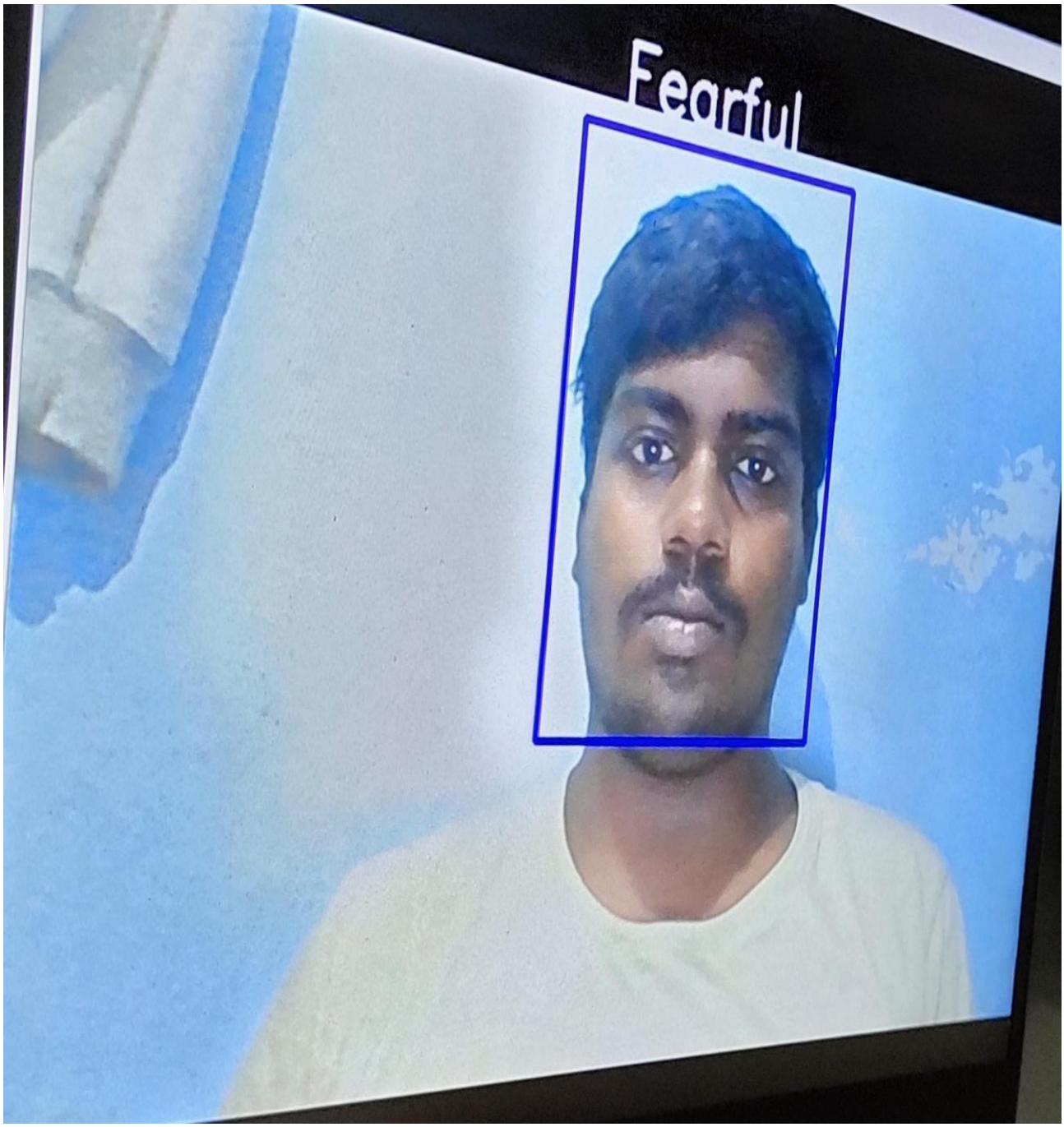

Figure 6.2: **Emotion Detection 2**

Chapter 7

CONCLUSION AND FUTURE ENHANCEMENTS

7.1 Conclusion

We studied an MLP-based approach to facial affect analysis in naturalistic situations with an exceptional level of accuracy in this project. We validated the significance of facial geometry information for this task, which is normally stored by the placement of fiducial landmarks on the face. The necessity of the attention mech- anism in focusing on the most relevant region of the image for the target emotion estimate job was then emphasised. When compared to previously employed state- of-the-art methods, the proposed system has demonstrated exceptional performance in face recognition systems, with a high accuracy rate and a substantially faster speed up rate. It also outperforms previous models for emotion detection and categoriza- tion in terms of performance and estimation rates.

7.2 Future Enhancements

In the future, we can test the proposed strategy with alternative machine learning algorithms to improve accuracy using our own novel dataset that is now being collected.

Chapter 8

PLAGIARISM REPORT

Curiginal

Document Information

Analyzed document	major.pdf (D136029114)
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Submitted by	Sivakumar
Submitter email	drsivakumarv@veltech.edu.in
Similarity	6%
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Sources included in the report

SA	**Vel Tech Rangarajan Dr.Sagunthala R&D Inst. of S&T / Facial emotional recognition using FED.pptx** Document Facial emotional recognition using FED.pptx (D134537258) Submitted by: drsivakumarv@veltech.edu.in Receiver: drsivakumarv.veltec@analysis.urkund.com	11
SA	**Vel Tech Rangarajan Dr.Sagunthala R&D Inst. of S&T / S copy final report.pdf** Document S copy final report.pdf (D106974105) Submitted by: drthangamariappanl@veltech.edu.in Receiver: drthangamariappanl.veltec@analysis.urkund.com	2
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SA	**Vel Tech Rangarajan Dr.Sagunthala R&D Inst. of S&T / MAJOR_2022 (1).pdf** Document MAJOR_2022 (1).pdf (D135860954) Submitted by: vvidhya@veltech.edu.in Receiver: vvidhya.veltec@analysis.urkund.com	1

Figure 8.1: **PLAGIARISM REPORT**

Chapter 9

SOURCE CODE & POSTER PRESENTATION

9.1 Source Code

```
import numpy as np
import argparse
import matplotlib.pyplot as plt
import cv2
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout, Flatten
from tensorflow.keras.layers import Conv2D
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.layers import MaxPooling2D
from tensorflow.keras.preprocessing.image importImageDataGenerator
model = Sequential()

model.add(Conv2D(32, kernel size=(3, 3), activation='relu', input shape=(48,48,1)))
model.add(Conv2D(64, kernelsize=(3, 3), activation='relu'))
model.add(MaxPooling2D(pool size=(2,2)))
model.add(Dropout(0.25))

model.add(Conv2D(128,kernelsize=(3, 3), activation='relu'))
model.add(MaxPooling2D(pool size=(2, 2)))
model.add(Conv2D(128,kernelsize=(3, 3), activation='relu'))
model.add(MaxPooling2D(pool size=(2,2)))
model.add(Dropout(0.25))

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

model.load weights('model.h5')
cv2.ocl.setUseOpenCL(False)
emotion_dict = {0: "Angry", 1: "Disgusted", 2: "Fearful", 3: "Happy", 4: "Neutral", 5: "Sad", 6: "
    Surprised"}
cap = cv2.VideoCapture(0)
while True:
    ret, frame = cap.read()
```

```
    if not ret:
        break
    facecasc = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    faces = facecasc.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)
        roi_gray = gray[y:y + h, x:x + w]
        cropped_img = np.expand_dims(np.expand_dims(cv2.resize(roi_gray, (48, 48)), -1), 0)
        prediction = model.predict(cropped_img)
        maxindex = int(np.argmax(prediction))
        cv2.putText(frame, emotion_dict[maxindex], (x+20, y-60), cv2.FONT_HERSHEY_SIMPLEX, 1, (255,
            255, 255), 2, cv2.LINE_AA)

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

cap.release()
cv2.destroyAllWindows()


}
```

9.2 Poster Presentation

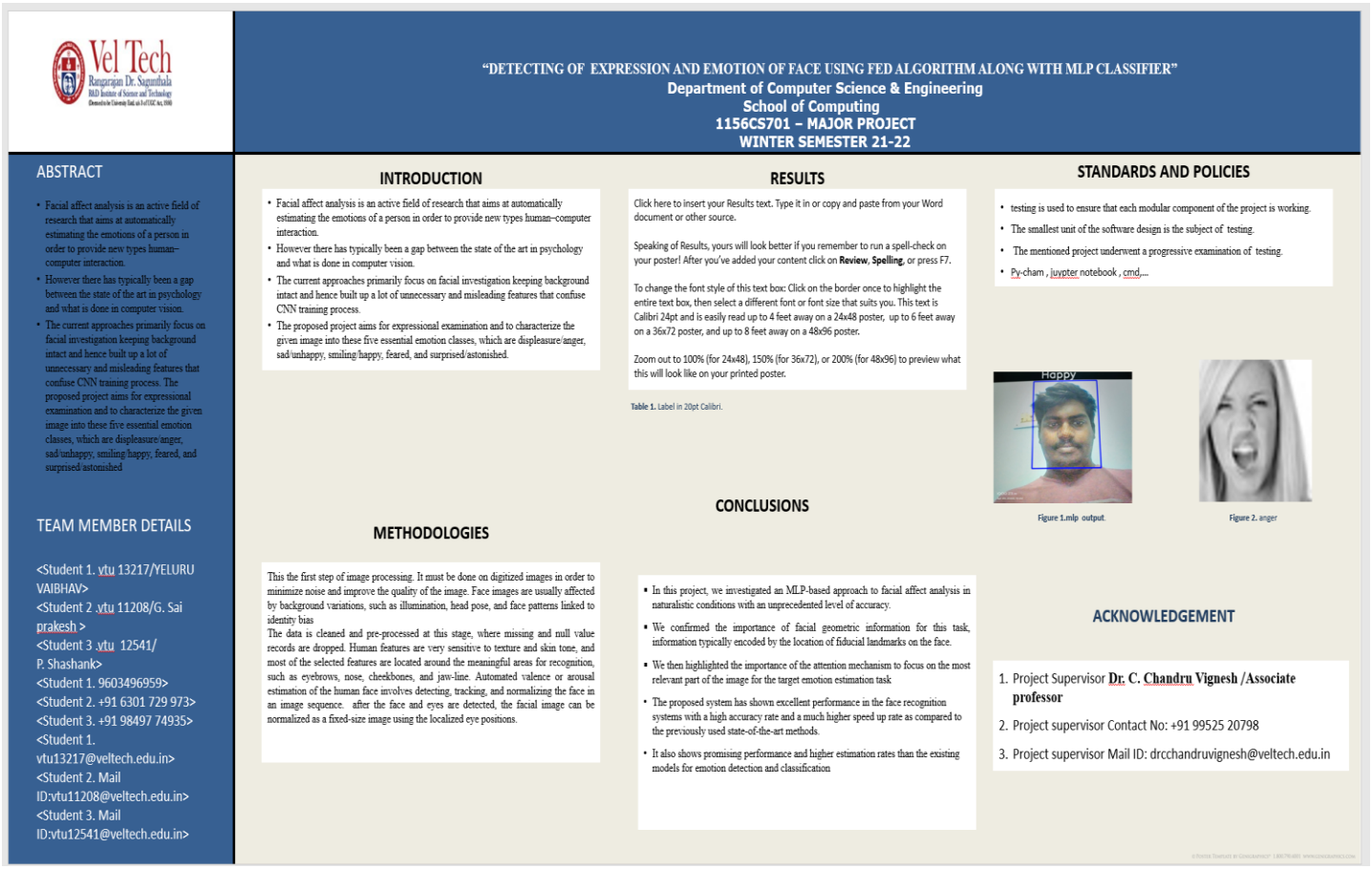

Figure 9.1: **Poster Presentation**

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