TECHNO ENGINEERING COLLEGE BANIPUR

PROJECT TITLE

Emotica.AI

(Emotion Detection & Classification System)

Team Members

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1. Abstract

In this era the rampant growth of wireless technology and Mobile devices is creating a great impact on our lives. The digital economy requires services to be created in nearly real time – while continuously listening to the customer. Managing and analyzing the data collected about products from customers becomes hectic. Successful companies usually collect feedback data regarding customer behavior in a sensible manner, understand their customers and engage in constant interaction with them. But when it comes to small business owners it is very difficult for them to analyze whether their customers are really satisfied or not. It's not even an easy task to keep a record of each and every customer' feedback on a daily basis. It is also frustrating when you do not get clear feedback whether the product was satisfactory or not. It is not a problem to collect data, but it is very difficult to analyze it and it is time-consuming. To utilize the data they collect and analyze customer feedback quickly, companies require automation of customer feedback processing.

To proceed with the problem and through much research we come to the solution, if an emotion detection system can overcome this situation in real time. Emotion detection plays an important role in interpersonal relationships. People express their emotions directly or indirectly through their speech, facial expressions, gestures or writings and Now AI has harnessed the power of Learning and it can treat every object the way humans do.

Our goal is to develop a real time implementation of emotion detection system with better accuracy and make it more reliable for business.

2. Introduction

1. Description

Facial expressions in humans are one of the most important and powerful tools for communication. According to research, the verbal component of the message only has 7% of the total significance on the effect of the message in communication, 38% of the total significance in tone and 55% in facial emotions.

There are seven basic emotions and they are angry, sad, happy, surprise, fear, disgust and neutral. Identifying human emotions is not easy because it varies from person to person.

The research on emotion recognition has increased significantly in the past two decades. Various factors have to be taken into account while developing an emotion recognition system. A general emotion detection process has four stages, which are - Face detection, Preprocessing, Feature extraction and Face recognition. Viola-Jones(VJ) algorithm is used to extract features for identifying emotions.

Large corporations make huge investments to get feedback and surveys. Such corporations can easily benefit by monitoring customer behavior to their products or staff service by using emotion recognition systems. This can give them proper data to improve their products and services and optimize their business model accordingly**.**

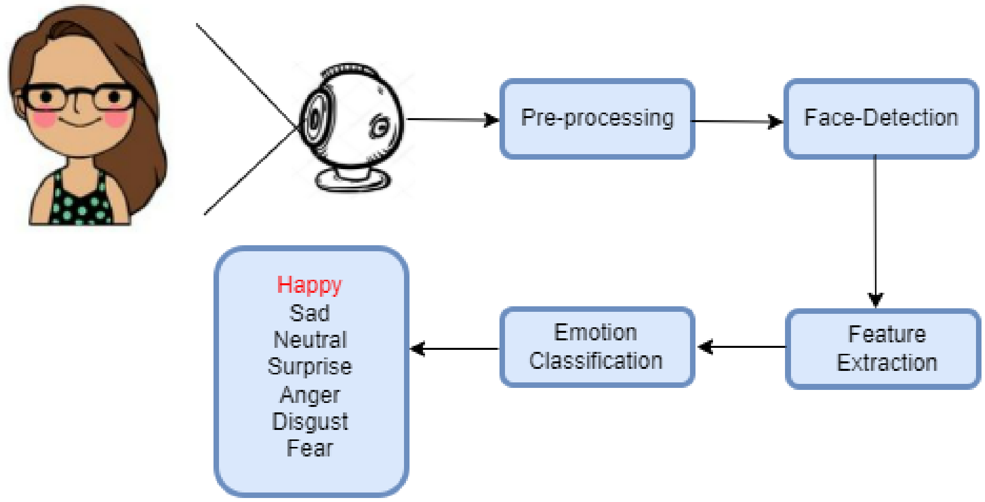
2. Overview

Since the dawn of the AI era, emotion & its detection using this technology became one of the crucial as well as important fields of study. The technology evolved a lot with all its dependencies & so emerged its need & applications.

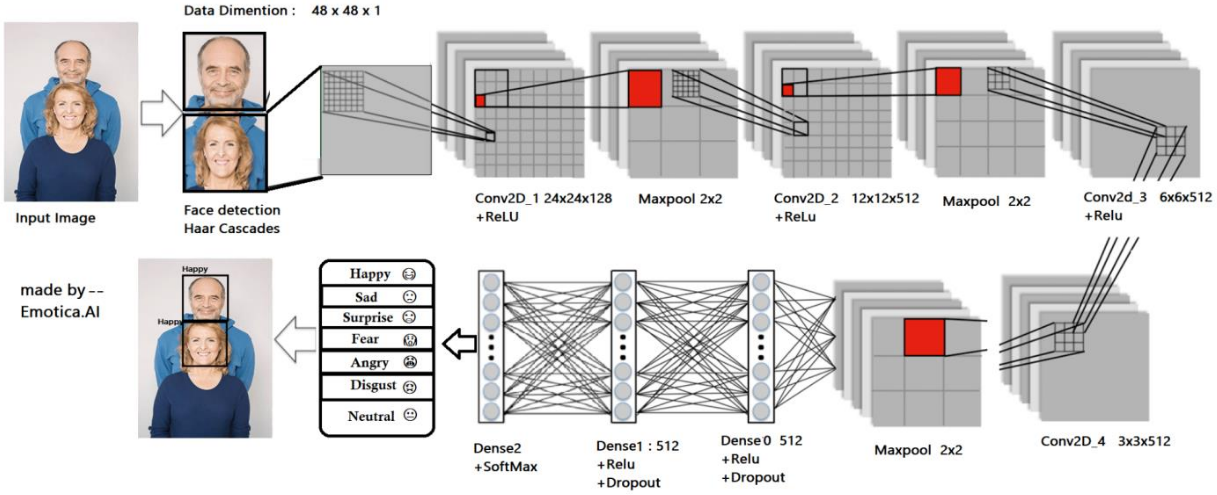
Emotica.AI is a real-time emotion recognition system that uses CNN(Convolutional Neural Network) for deep learning of the nodes, which tends to improve the real-time review and feedback systems with time .

To keep up with both the efficiency & accuracy, our system focuses on the priorities of image classification following the micro-expressions & facial contours for precise calculations.

3. Block Diagram



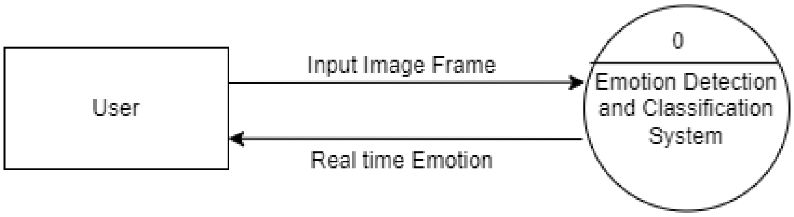
Training and validation:



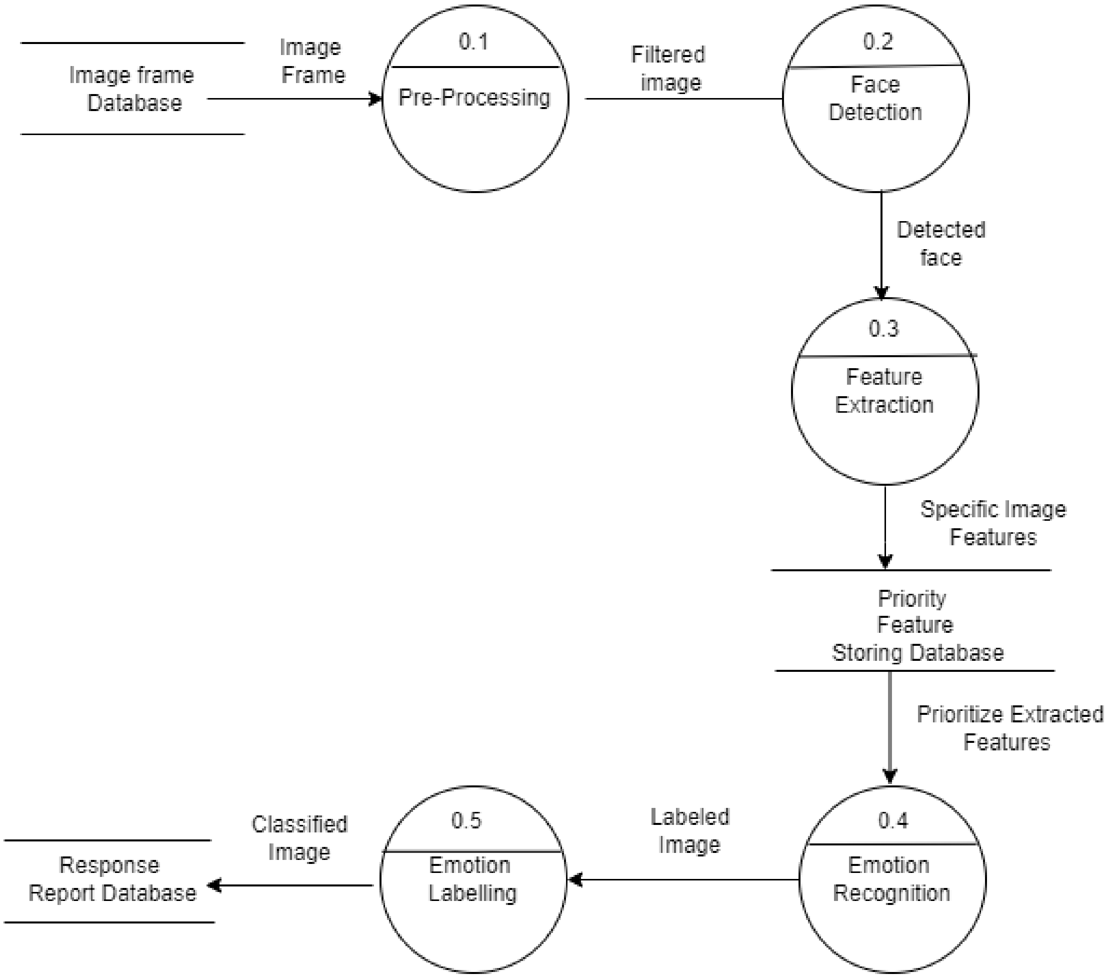
3. Design

1. DFD

Level 0

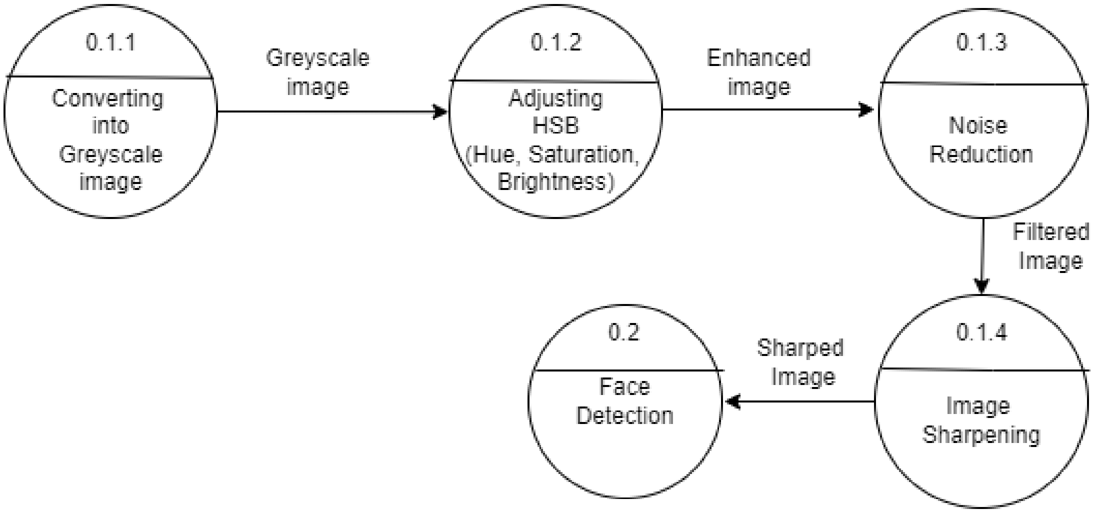


Level 1

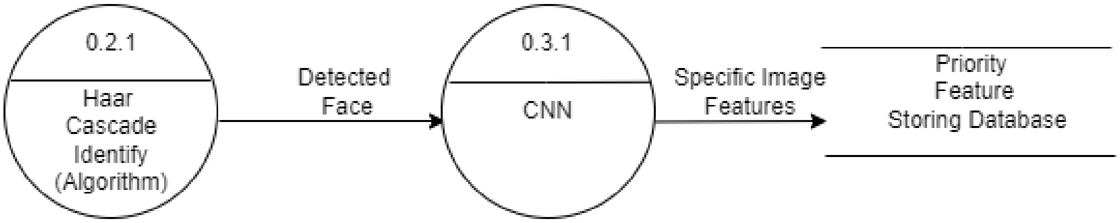


Level 2

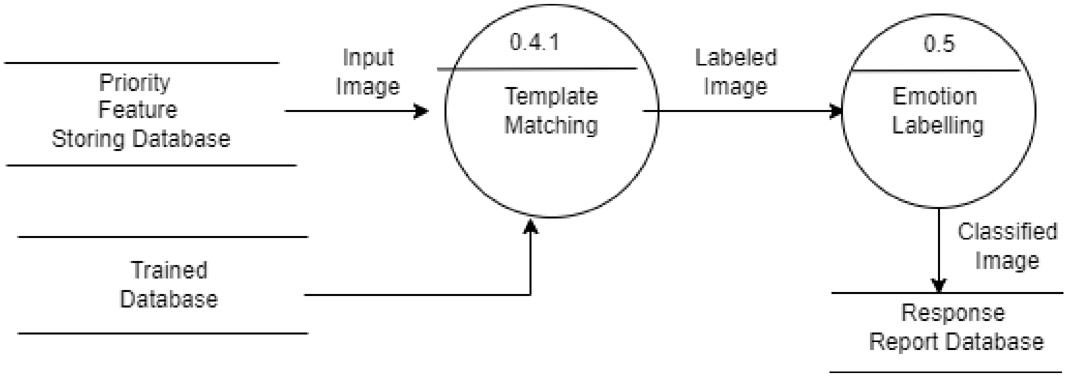
Pre-Processing



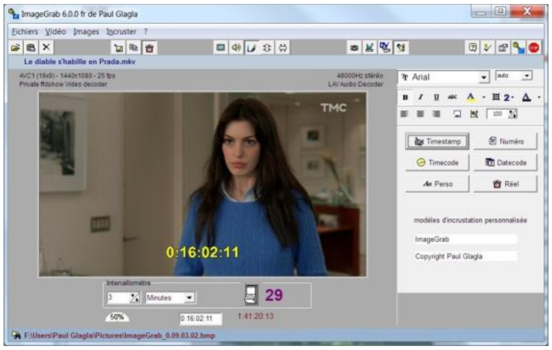
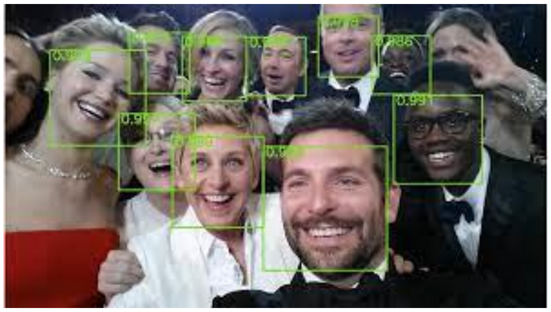
Face Detection & Feature Extraction

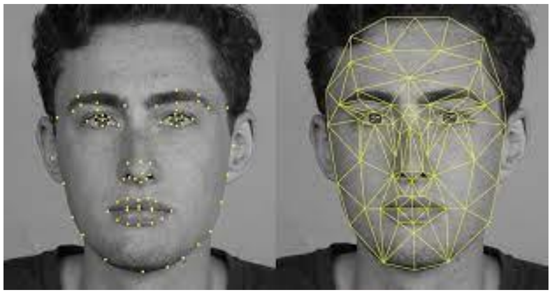
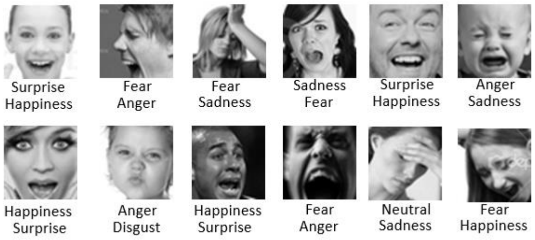
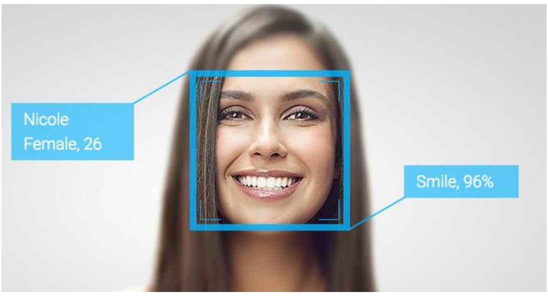

0.2.1
Haar Cascade Identify (Algorithm)
Detected Face
0.3.1
CNN
Specific Image Features
Priority Feature Storing Database

Emotion Recognition & Classification



2. Data Dictionary

Field Name	Description	Example
Image Frame	Extracted picture frame from video	 ImageGrab 6.0.0 fr de Paul Glagla Fichiers Vidéo Images Incruster ? Le diable s'habille en Prada.mkv AVC1 (16x9) - 1440x1080 - 25 fps Private ffdshow Video decoder 48000Hz stéréo LAV Audio Decoder TMC 0:16:02:11 Arial auto 100 Timestamp Numéro Timecode Datecode Perso Réel modèles d'incrustation personnalisée ImageGrab Copyright Paul Glagla Intervallomètre 3 Minutes 29 50% 0:16:02:11 1:41:20:13 F:\Users\Paul Glagla\Pictures\ImageGrab_0.09.03.02.bmp
Filtered image	Grayscale image	
Detected face	Image containing detected faces	

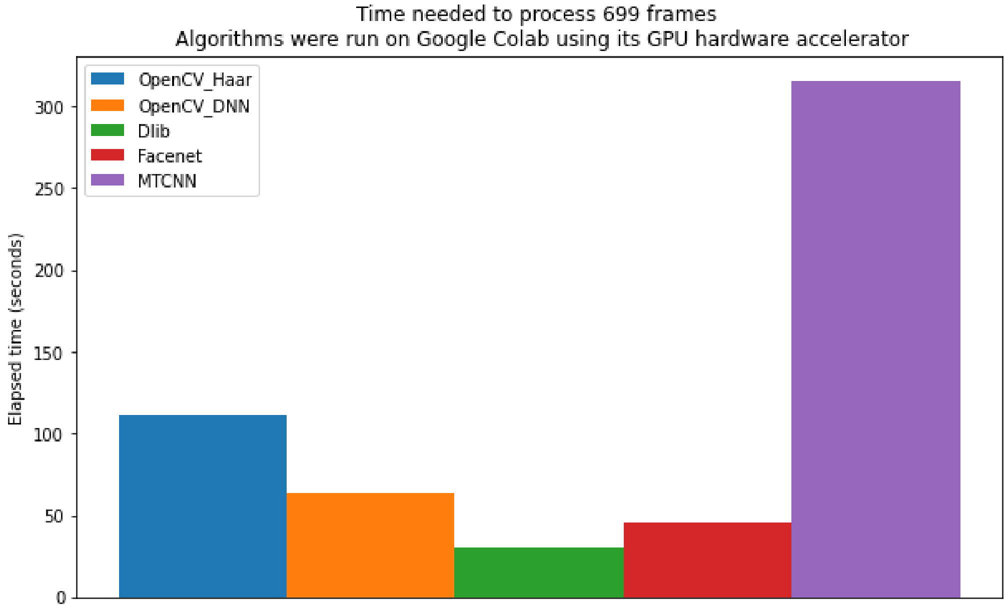
Feature Extracted Image	Image containing various extracted features from face, e.g. eyes, eyebrows, cheeks, lips, etc	
Labeled Image	Image containing single or multiple labeled emotions.	 Surprise Happiness Fear Anger Fear Sadness Sadness Fear Surprise Happiness Anger Sadness Happiness Surprise Anger Disgust Happiness Surprise Fear Anger Neutral Sadness Fear Happiness
Classified image	Image classified and tagged with proper emotion	

4. Experimental Results

1. Artificial intelligence techniques are applied to identify patterns in the data. We used a lot of AI techniques to determine the emotion of a person and then collected the data. We further extended our research and used those data to solve real-life problems.

A. Face detection

We tested some algorithms on a single video and the outcomes were like this :

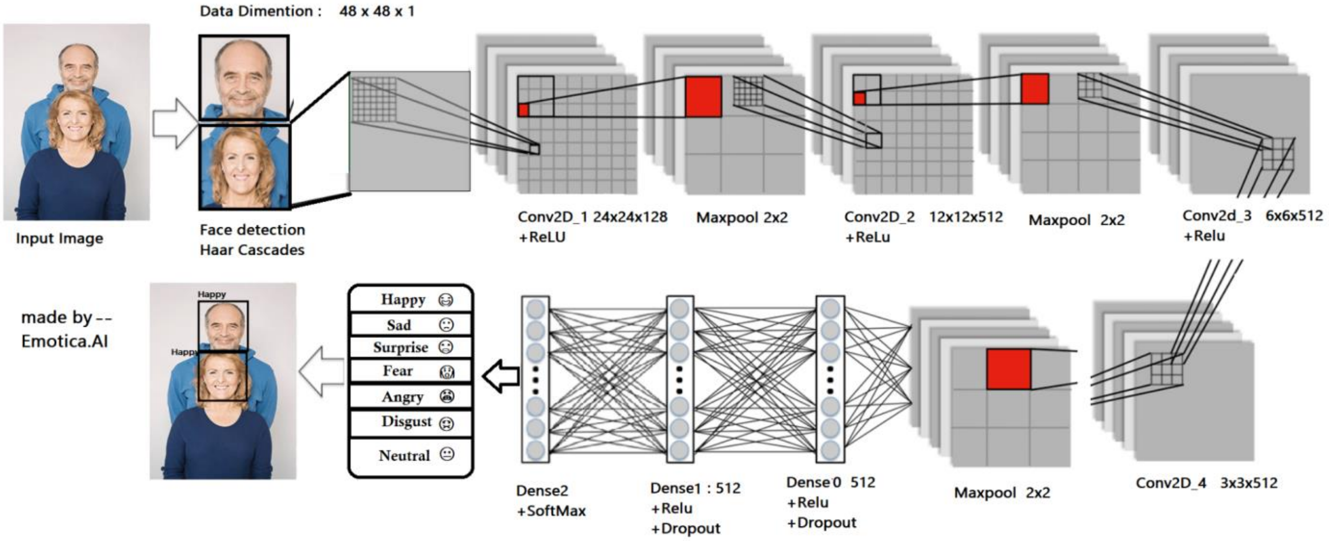


Here we have selected the Haar cascade identifier algorithm to detect faces in our project . We have more powerful techniques available for face detection but we are considering our stakeholders using normal PCs which are available in the market. Therefore this simple algorithm for face detection uses minimum computational power.

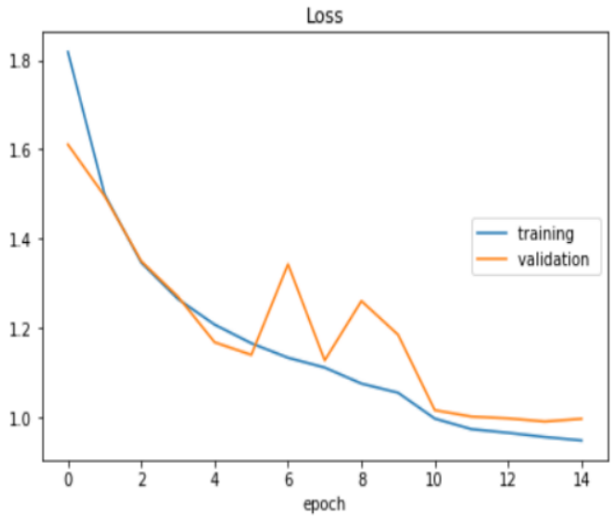
B. Emotion Classification

Emotion classification is as important as feedback meant to you. We came across many emotion classification mechanisms and we chose the best possible mechanism for your problem.

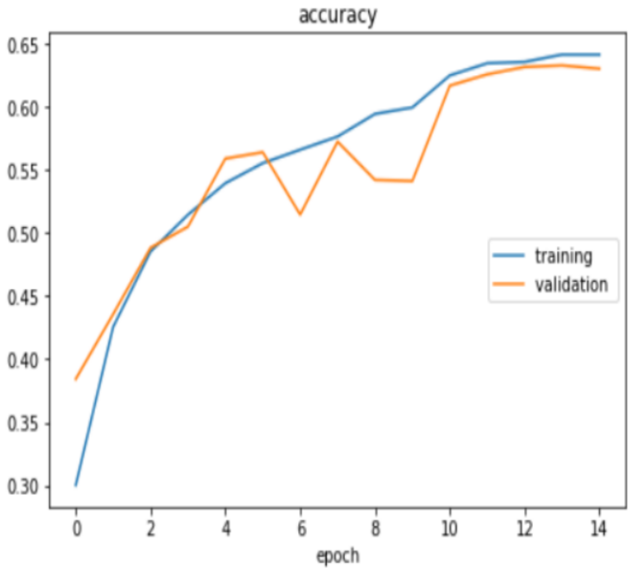
Hence, we are using a model trained in CNN(Convolutional Neural Network) for this purpose :



Accuracy score for loss and validation:

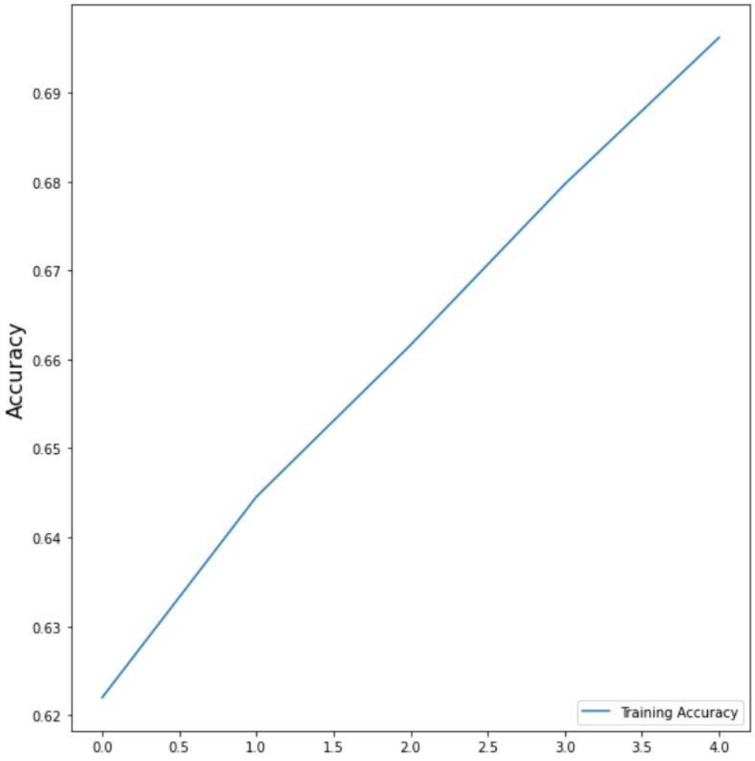


1.Loss per epoch

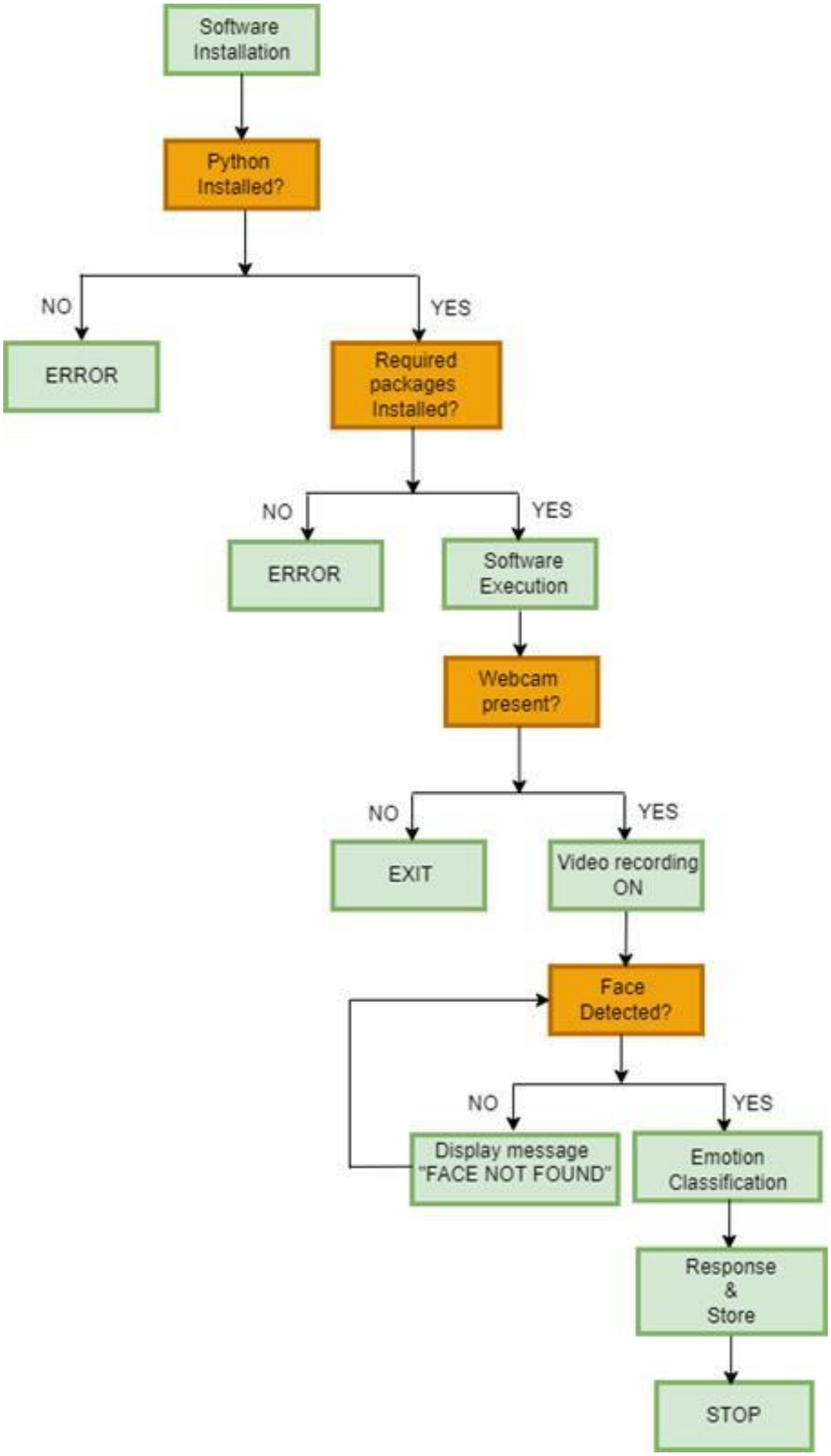


2.Accuracy per epoch

Overall accuracy:



2. Decision Tree



3. Decision Table

CONDITION	CONDITION ENTRIES

Python installed	**Y**	**Y**	**Y**	**Y**
Python packages	**N**	**Y**	**Y**	**Y**
Camera available	**-**	**N**	**Y**	**Y**
Face Detected	**-**	**-**	**N**	**Y**

ACTION	ACTION ENTRIES

Error	✓	✗	✗	✗
Exit	✗	✓	✗	✗
Successfully Run	✗	✗	✓	✓

5. Conclusion

Emotica.AI is an important improvement in the area of customer feedback system .The proposed work is used to identify facial emotions from the real-time video and classify different emotions. In Emotica.AI, Haar-Cascade Algorithm is used to detect the face and to extract the features then for final emotion recognition, each facial emotion is predicted and classified using a trained model with CNN. Accuracy of this model is around 69~71% is achieved for seven emotions on a real -time basis.

6. Future Scope

The market for Facial Expression Recognition(FER) technologies is estimated to grow from $19.5 billion in 2020 to $56 billion by 2024.

Uses for Expression Recognition

Deep Fake Detection

With increase in deep fake technology and videos, spread of misinformation is becoming rampant.
In 2019, the Computer Vision Foundation partnered with UC Berkeley, Google, and DARPA to produce a system claimed to identify deepfake manipulations by analyzing facial expressions in the targeted subjects.

Medical Research into Autism

Patients suffering from autism spectrum disorder (ASD), where they have developmental and long-term difficulties in evaluating facial emotions can be helped to improve their emotion recognition skills.
Even children can be diagnosed with autism and already a project has
used machine learning to develop an app to identify children for autism by running the subject's facial reactions to a movie through a behavioral coding algorithm in order to identify the nature of their responses.

Automotive Industry

Automotive is another industry where emotion detection and recognition technologies are in high demand.
A number of cars trained by machine learning already have emotion recognition included. Such systems can understand if a driver is not looking at the road, is making a hands-on phone call or if the driver is falling asleep and can give appropriate alerts/warnings and make changes to the
autonomous driving system.

Facial Emotion in Interviews

A candidate-interviewer interaction is susceptible to many categories of judgment and subjectivity, which may make it hard to determine whether a candidate's personality is a good fit for the job. Identifying what a candidate is trying to say involves multiple layers of language interpretation, cognitive biases and the context that lies in between.Emotica.AI can measure the candidate's facial expressions to help assess their moods and personality traits. Employee morale can also be perceived using this technology by holding and recording interactions on the job. In the Human Resources (HR) field, this tool can be useful for recruiting strategies and potentially to help design HR policies that bring the best performance out of employees.

7. Reference

https://www.semanticscholar.org/paper/Human-Face-Expression-Recognition-Majumdar-Avabhrith/0c6ae7bf7a82e216d8ac55b01a0ca9fbdbf8cfc5/figure/1
https://ejmcm.com/article_2727_0ee2ff3a947a883d78c6e1132b510e0f.pdf
https://ieeexplore.ieee.org/abstract/document/4412815
https://www.scitepress.org/Papers/2015/54805/
https://www.mdpi.com/1424-8220/13/11/15549

8. APPENDIX

#Sourcecode

```
#Importing libraries

import numpy as np
from keras.models import load_model
import cv2
import tkinter as tk
from keras.preprocessing import image
from keras.preprocessing.image import img_to_array
from tkinter.constants import BOTTOM, LEFT, RIGHT, TOP,X
from tkinter import Button, Image, Label,PhotoImage,messagebox
from PIL import Image,ImageTk
from numpy.core.fromnumeric import size
from datetime import datetime
from numpy.lib.shape_base import column_stack
import pandas as pd
import time

#Stop function
def stop():
    cam.release()
    root.destroy()


#Start function
def start():


    startButton.place_forget()
    Accuracy.place(x=1310,y=100)

    # Setting filename to local system time
    today = datetime.now().strftime("%Y_%m_%d-%I_%M_%S_%p")
    curdate = str(today)
    path = curdate+".xlsx"

    array = list()

    #Setting up camera properties
    cam.set(cv2.CAP_PROP_FRAME_WIDTH,1920)
    cam.set(cv2.CAP_PROP_FRAME_HEIGHT,1080)
    # cam.set(cv2.CAP_PROP_FPS,60)
    face_classifier = 
cv2.CascadeClassifier(r'haarcascade_frontalface_default.xml')
    classifier =load_model(r'model.h5')

    emotion_labels = ['Angry','Disgust','Fear','Happy','Neutral', 'Sad', 
'Surprise']

    while True:
        ret,frame = cam.read()
        frame =cv2.flip(frame,1)

        gray = cv2.cvtColor(frame,cv2.COLOR_BGR2GRAY)

        faces = face_classifier.detectMultiScale(gray)

        #Probability view


        canvas = np.ones((250,300, 3), dtype="uint8")*255

        i=0
        for (x,y,w,h) in faces:
            #Putting rectangle around face

            cv2.rectangle(frame,(x,y),(x+w,y+h),(255,255,255),1)
            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)

                # Setting prediction accuracy in canvas

                prediction = classifier.predict(roi)[0]
                label=emotion_labels[prediction.argmax()]
                array.append(label)
                label_position = (x,y-10)
        cv2.putText(frame,label,label_position,cv2.FONT_HERSHEY_SIMPL
EX,0.7,(255,255,255),1)
        emotion_probability = np.max(prediction)

        for (i, (emotion, prob)) in enumerate(zip(emotion_labels,
prediction)):
        #Probability viewer
          text = "{}: {:.2f}%".format(emotion, prob * 100)
          w = int(prob * 300)
          cv2.rectangle(canvas, (0, (i * 35) + 5),(w, (i * 35) +
35), (0,255, 0), -1)
          cv2.putText(canvas, text, (10, (i * 35) +
23),cv2.FONT_HERSHEY_SIMPLEX,0.7,(0,0,0),1)


      else:
        cv2.putText(frame,'No
Faces',(30,80),cv2.FONT_HERSHEY_PLAIN,1,(0,255,0),2)

      #Writing frames
      img=cv2.cvtColor(frame,cv2.COLOR_BGR2RGB)
      frame1 = ImageTk.PhotoImage(Image.fromarray(img))
      CamFrame['image']= frame1
      frame2=ImageTk.PhotoImage(Image.fromarray(canvas))
      Accuracy['image']=frame2
      root.update()

    #Saving data in excel
    df = pd.DataFrame(array)
    df.to_excel(excel_writer = path)



cam = cv2.VideoCapture(0)
if cam is None or not cam.isOpened():
    messagebox.showerror('error', 'Camera not found!')
    time.sleep(3)
    stop()

#GUI
root = tk.Tk()
root.iconbitmap("icon.ico")
root.title("Emotica.ai")
root.geometry("1600x900")
root.config(bg='white')
```

```
Label(root,text="Emotica.AI",font=("Sans Sherif",15,"bold"),bg="white",fg
="black").place(relwidth=1,relheight=0.05)
#frame = LabelFrame(root,bg="white")
#frame.pack()


CamFrame= Label(root)
Accuracy = Label(root)
#Buttons
startButton = Button(root,height=1, width=20, text
="Start",font=("calibri",20),bg='white',fg='blue',relief='ridge',command =
start)
stopButton  = Button(root,height=1, width=20, text
="Stop",font=("calibri",20),bg='white',fg='red',relief='ridge', command =
stop)

#Placing buttons
CamFrame.place(height=720,width=1280, x=20, y=100)
startButton.place(x=1320,y=600,height=60,width=230)
stopButton.place(x=1320,y=700,height=60,width=230)

root.mainloop()

cam.release()
cv2.destroyAllWindows()
```