FACE AND EMOTION RECOGNITION

A PREPRINT

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ABSTRACT

Over the years, humans have successfully(almost), developed models to identify a person and his emotions from a photograph. This made us think about developing a model that could do the same but, for a video. In this project, we aim to identify people and their emotions from a video. To achieve these tasks, we will be making use of the supervised learning approach.

1 Introduction

Our Face and Emotion recognition model, identifies the person in a live video in different angles. It also recognizes the emotions that the person wants to showcase. We have covered 7 basic emotions- happiness, sadness, surprise, anger, disgust, fear, neutral. On a live video we can obtain these results.

2 Data Set

Here, we used two data sets. For face identification, we collected data set ourselves. First, we segregated the images into face images and backgrounds. We cleaned the data set by keeping only those images which are relevant i.e. kept only the face images. Then, we cropped the images to bring them to the same size. We either collected these images via our webcam or from social networking sites.
We captured the images from various angles to improve the accuracy viz. profile face, frontal face, with specs, without specs. For the expression identification, we used two datasets. We generated a dataset on our own of images 112×92 and we downloaded a generated dataset from [1].

3 Face Recognition

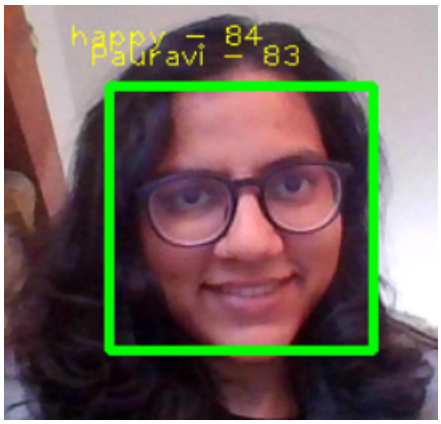
For the face detection and identification of a person, we use the Haar cascade classifiers. Each Haar feature of the face is calculated and using the Adaboost, we generate a strong classifier using a series of weak classifiers. Since, numerous such weak classifiers are combined to train and predict, they are called Haar cascade classifiers.

In the face recognition part, we covered 4 basic cases.
1) Frontal face detection
2) Profile face detection
3) Detection of face with or without specs.
4) Detection of face on a photograph or a device.

3.1 Frontal Face detection

In this case, we detect the face of a person, given labels. The classifier file used in this case is

`haarcascade_frontalface_default.xml`



(a) Frontal Face identified.

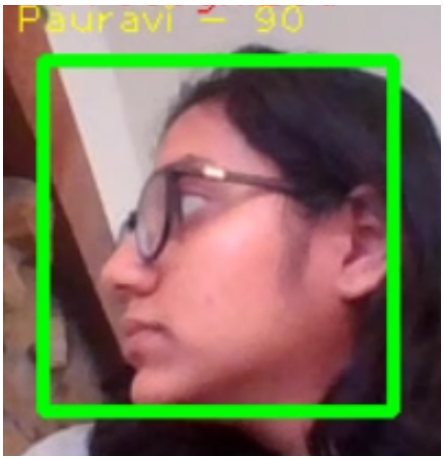
Figure 1: Face Detection and Identification

3.2 Profile Face detection

In this case, we detect the profile face of a person. We used the profile face classifer to achieve this. Although the classifier has a basic limitation that it can detect only profile faces facing right, we made changes in a way to incorporate the detection on the profile face facing left side. The classifier file used in this case is

`haarcascade_profileface.xml`

(a) Left profile



(b) Right profile

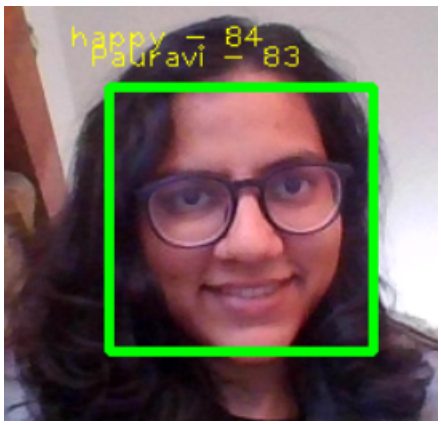
Figure 2: Profile Face Identification

3.3 Face detection with or without specs

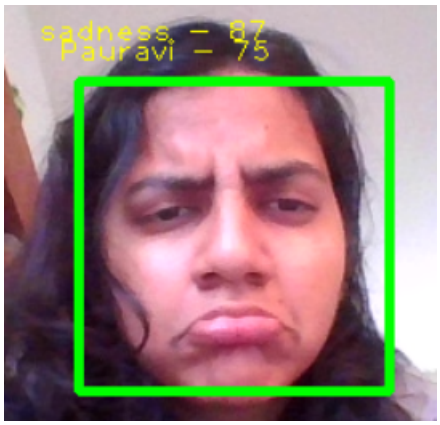
In this case, we detect the face of a person with or without specs. For this, we collected the with and without specs images of people who have specs and trained our model on that data to improve the accuracy.

3.4 Face detection on a device of photograph

We also trained the model to detect images on a device or on a photograph.



(a) Pauravi with Specs.



(b) Pauravi without Specs.

Figure 3: Face Identification with and without spectacles.

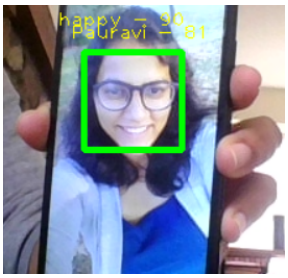


Figure 4: Face Identification on a mobile device

4 Expression Identification

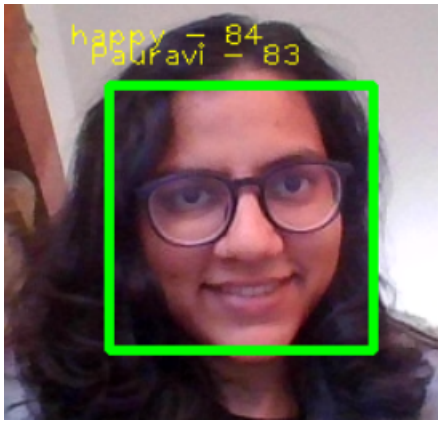
Here, we train our model to identify seven basic emotions of a person. Using the datasets, we trained our model using the LBPH Classifier.
We targeted basic 7 types of expressions.
1) Happiness
2) Sadness
3) Surprise
4) Anger
5) Neutral
6) Disgust
7) Fear

5 Problems Faced in preparing the model

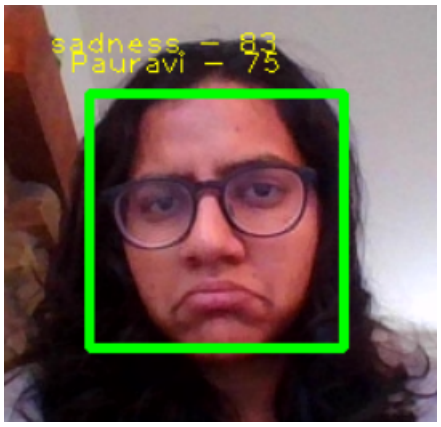
We faced the following issues while developing our model.

5.1 Left side facing people not detected

Only right side facing profile faces detected. This was because the haar cascade classifier file has all the haar features that detect only the right profile faces. Thus, when the person turns to left, he/she is not recognized. We solved this issue by flipping the images while predicting. This way when a person looked to the left he/she was detected.

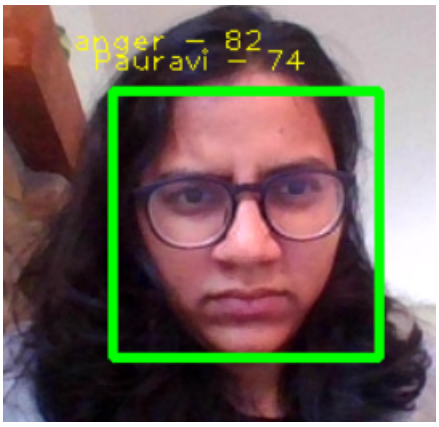


(a) Happy expression identified.

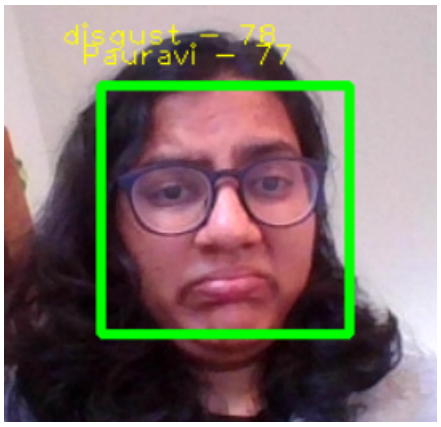


(b) Sad expression identified.

Figure 5: Expression recognition - happy and sad

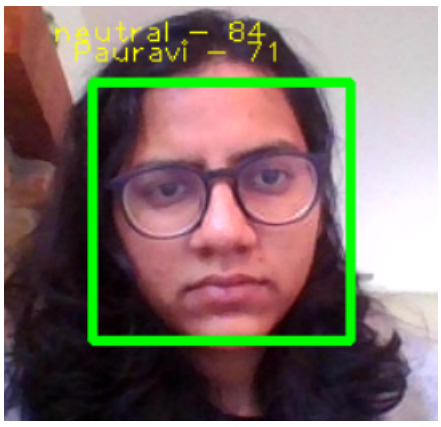


(a) Anger expression identified.

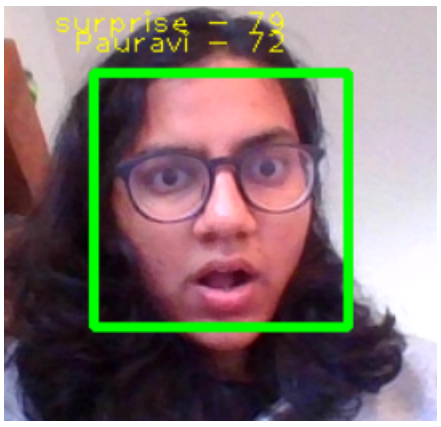


(b) Expression of disgust.

Figure 6: Expression recognition - anger and disgust

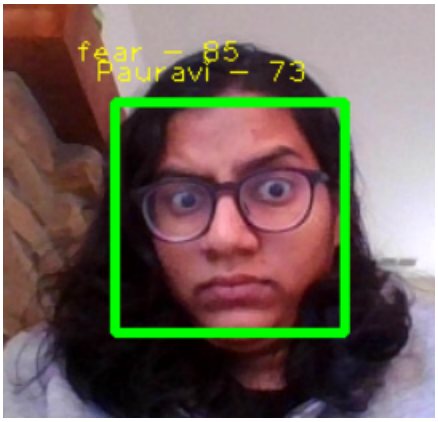


(a) Neutral Expression identified



(b) Surprise Expression identified

Figure 7: Expression recognition - neutral and surprised



(a) Expression recognition - fear

Table 1: Data Set Accuracy across different models

DataSet Name	Training accuracy	Testing Accuracy (μm)	Live Data Accuracy
CK Dataset (image size 112x92) Fisher Face Model	1	0.80	0.55
CK Dataset (image size 112x92) LBPH Face Model	1	0.50	0.70
CK Dataset (image size 350x350) Fisher Face Model	1	0.63	0.40
CK Dataset (image size 350x350) LBPH Face Model	1	0.30	0.40
Jaffe Dataset [3] (image size 112x92) LBPH Face Model	1	0.76	0.72
Custom Dataset (image size 112x92) LBPH Face Model	1	0.80	0.70

5.2 Photo size hit and try

We tried identifying the best size to crop our photos to, in order to achieve maximum accuracy in detecting emotions. After choosing different sizes of photos like 350*350, 48*48 and 112*92, we observed that 112*92 sized photos gave us the best accuracy.

5.3 Varying expressions

We observed that different people have different range of emotions and the datasets that we used at the start had many people showing the same emotion differently. We realized that, having multiple people in the training data set for emotions gives a very low accuracy on the testing dataset. Thus, we created our dataset using one or two people and collected their expressions for all the 7 emotions. This model yeilded more accuracy on the live video. The various datasets and their accuracy is given in the table below.

References

[1] Cohn-Kanade (CK and CK+) database http://www.consortium.ri.cmu.edu/ckagree/

[2] S L Happy, Anjith George, and Aurobinda Routray. *A Real Time Facial Expression Classification System Using Local Binary Patterns.*

[3] The Japanese Female Facial Expression (JAFFE) Database https://zenodo.org/record/3430156