FACE EMOTION DETECTION

BY

Monirul Islam Akash
ID: 182-15-11766
Email: monirul15-11766@diu.edu.bd

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Dr. Md Zahid Hasan
Associate Professor & Coordinator MIS
Department of CSE
Daffodil International University

Co-Supervised By

Mr. Md. Sadekur Rahman
Assistant Professor
Department of CSE
Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

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APPROVAL

This Project titled "FACE EMOTION DETECTION", submitted by Monirul Islam Akash, ID No: 182-15-11766 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on January 24, 2023.

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I hereby declare that, this project has been done by me under the supervision of Dr. Md Zahid Hasan, Associate Professor & Coordinator MIS, Department of CSE Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

Dr. Md Zahid Hasan
Associate Professor & Coordinator MIS
Department of CSE
Daffodil International University

Co-Supervised by:

Mr. Md. Sadekur Rahman
Assistant Professor
Department of CSE
Daffodil International University

Submitted by:

Monirul Islam Akash
ID: 182-15-11766
Department of CSE
Daffodil International University

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ABSTRACT

Today, "Face Emotion Detection" is very popular and important task nowadays. Many companies can use this system to understand consumer's emotion after launching a product. It is also used to detect if the employees are happy or sad with the facilities they are given from the company. This field has immense possibilities and can open new ways to human machine cooperation. As an outcome the interest of perceiving the human expression accurately is expanding day by day. There are various types of methods that can recognize the facial expression. In our thesis project I have built the system of recognizing facial expression using HTML5, CSS3, Bootstrap, and JavaScript programming Languages. I have used a JavaScript API that is face-API js and got 97.81% accuracy for our system.

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CHAPTER 1

Introduction

1.1 Introduction

The processing of images is an example of an additional invention that has been made. This industry has a great deal of potential right now. This location offers a plethora of potential opportunities. Image analysis allows it to recognize various expressions contained inside pictures. There are several different locations that each have massive doors that are not locked. Many approaches to facial recognition technology Extensions of this field include the capacity to target control of numerous applications based on a person's spirit, the ability to examine the mental condition of another individual using an emotion detection system, and temperature management. For the purpose of making our lives simpler. If this technology for detecting emotions can accurately measure a person's mental state, it could pave the way for mood-based functionality to be included in smart home robots. Either he or she is right about this. Modify the parameters in the same way that you would change the lighting or the climate.

Our objective is to design a system that can identify feelings with a higher degree of precision than the options that are now available. I reviewed the papers of other projects with similar topics in order to gain a greater comprehension of the models and methodologies that were used by those projects, as well as the level of accuracy that was achieved by those projects. Because of this, I am able to determine the ways in which the system can be enhanced.

Expressions on a person's face are able to clearly indicate not just their emotional state, but also their cognitive activity, their goals, their personality, and even their psychopathology. In addition to this, it serves as a mode of communication in the context of interpersonal interactions. Over the course of the most recent several decades, a significant amount of research and development has taken place. In spite of the major achievements that have been made, effectively identifying facial expressions can be challenging due to the complexity and variety of human faces.

People can communicate their goals and thoughts in a nonverbal manner using a variety of nonverbal signals, such as gestures, facial expressions, and unconscious language. This approach has the potential to be a very useful instrument for nonverbal communication because of its adaptability. It is necessary for the system to correctly recognize or otherwise extract face emotions from photographs. Because of the system's potential uses in a wide number of fields, including lie detection, medical evaluation, and human-computer interactions, it has garnered a lot of attention from researchers and industry professionals. In 1978, Dr. Ekman developed the "FACS," which stands for facial action coding system. In 2002, Dr. Ekman revised the method. It's a common method used in the study of people's expressions on their faces. A smile and an upward tilt of the corners of the mouth are two facial expressions that may be employed to communicate happiness. In a manner analogous to how even minute distinctions within an emotion might differentiate it from others in the field of research on automated emotion detection, topics such as the portrayal and classification of static or dynamic aspects of different face pigmentation variations are being investigated.

Image processing is a growing industry, which is another element that is driving expansion. This area is starting to show signs of having great potential. This location offers a plethora of potential opportunities. Emotion detection is one of the many components that are involved in the processing of images. There are a few doors that are propped wide open. Various Emotion Detection Techniques Temperature management, human-machine connection, the capacity to target specific applications based on a person's mood, emotion detection systems that can comprehend a person's mental state, and other upgrades that will make our lives easier are all possible. If we are able to gain a comprehensive understanding of a person's psychology by utilizing this emotion detection technology, then we will be able to create the framework for intelligent home robots that can adjust to the mood of the user. Adjust the settings for your options in the same manner that you would the temperature and the lighting.

Our objective is to design a system that can identify feelings with a higher degree of precision than the options that are now available. In order to have a more profound comprehension of the models, and methodologies utilized, as well as the level of accuracy that was achieved, several project documents dealing with comparable difficulties were investigated and reviewed. This enables us to draw conclusions about how the system could function in a more effective manner.

1.2 Motivation

Maintaining the security of data or physical assets in today's networked society is becoming increasingly vital and complex. Crime rates in countries such as Nepal are rising. There are no applications that can track someone's movements automatically. Because facial expressions change while performing different tasks, I could easily identify fraudsters if I could track people's expressions automatically. As a result, I decided to create a system for detecting facial emotions. I was interested in this topic after reading a few research in this sector. The papers outlining their strategy for developing accurate and reliable face emotion detection systems have been made available.

A person's mood is greatly influenced by their emotions. The six universal emotions were joy, grief, wrath, fear, surprise, disgust, and contempt. It stresses the four main emotions of happiness, sadness, anger, and neutrality, according to studies. When criminals are caught on camera, their emotions can be used to identify them. The Alarm Trigger System, for example, could be useful if someone is concerned. Emotion detection systems can be utilized as supplements in programs that recommend music or other sorts of security cameras.

As a result, I have a strong incentive to create a system that can monitor a person's activities and recognize facial expressions.

1.3 Objectives

Our research aims to create a system that can accurately and swiftly identify any person's facial expressions, regardless of age, gender, skin tone, or nationality.

The cause of the feeling the process of recognizing someone's emotions is called detection. Both spoken language and facial expressions can be used to detect emotions. This study's major objective is to infer human emotions from facial expressions. The foundation for real-time HIS applications can be set by accurately identifying facial expressions of emotion. Humans are very adept at recognizing the emotions of others. Because real-time applications rely on automatic face expression recognition, it is essential. In particular, pre-trained CNN-based functions provide superior graphics. Performance might be enhanced by pre-trained CNN-based features that capture the most important components. I recommend employing pre-trained models to take use of deep learning models without having access to enormous datasets. For feature extraction and classification, a deep neural network model (VGG16) that has already been trained was used.

1.4 Expected Outcomes

This project's major purpose is to improve face and emotion detection while correctly detecting human faces. Facial expressions reflect joy, grief, surprise, fear, fury, disdain, and neutrality. The system can reliably recognize facial expressions in the shortest amount of time, regardless of age, gender, ethnicity, or nationality.

1.5 Project Management and Finance

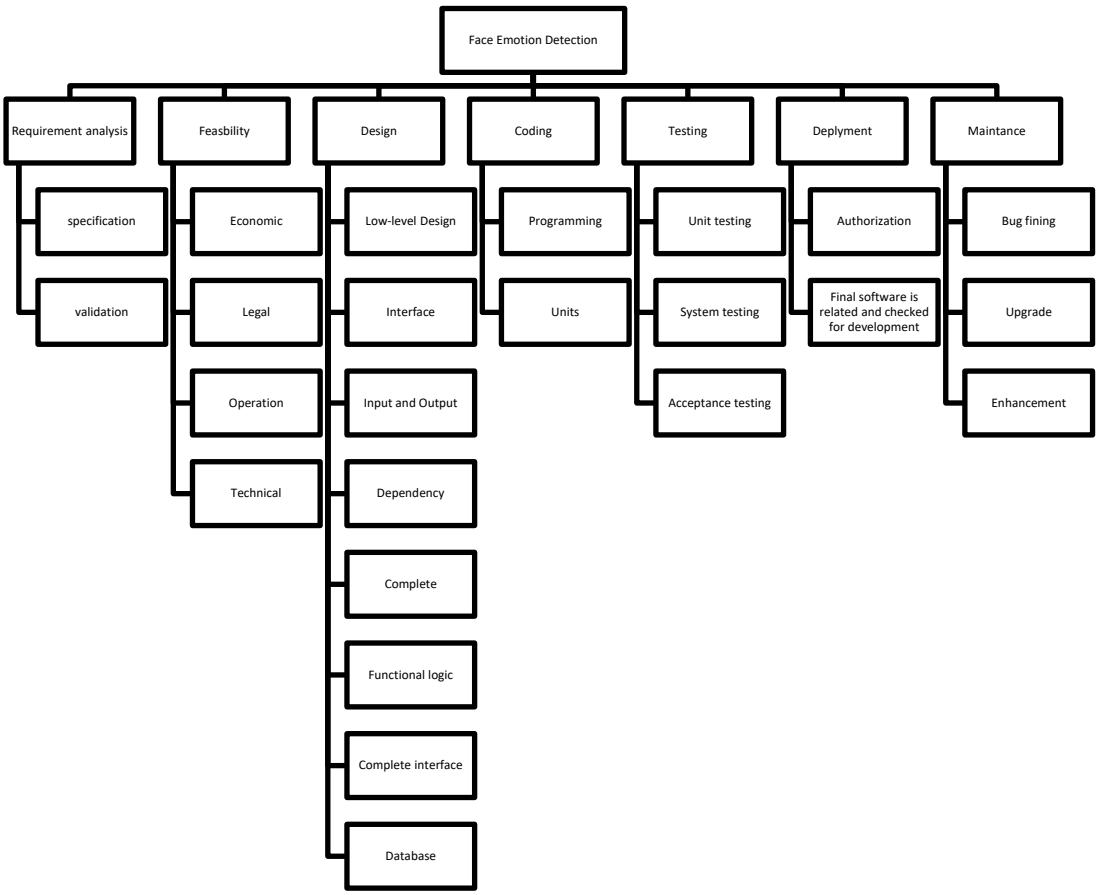


Figure 2.5.1: Project Management and Finance

I had almost no charges because this product required web programming. I simply needed our laptop or desktop to complete the job. As a result, I just had to pay for travel while collaborating with other team members, incurring no additional costs. These costs are not included since they are unrelated to the project.

1.6 Report Layout

This report has been structured in such a way that experiencing the report will provide a complete overview of the system, including how the system operates and the findings of the research. The standard template for thesis reporting that was provided by DIU has been followed by this report.

CHAPTER 2

Background

2.1 Terminologies

Facial expressions can reveal a person's mental state, mental activity, goal, character, and psychopathology. A facial expression is one or more positions of the muscles that lie just beneath the surface of the skin of the face. It is a form of communication in which no words are used. It is the result of moving one or more of the face muscles. The resulting change in appearance is attributable to each individual's unique face development. Facial expressions of human are classified into 7 basic emotions: happy, sad, surprise, fear, anger, disgust, and neutral.

2.2 Related Works

I read various publications and concluded the models and procedures they employed, as well as their end outcomes.

2.2.1 Face spoofing detection using LDP-Top

This study's author devised a simple and effective strategy for dealing with spoofing known as higher-level locally derived models from three orthogonal planes (LDP-TOP). There are three essential steps in this method. Before being submitted to the face detector, each image is converted to grayscale. The regions are then geometrically changed. After that, the LDP operator is applied to the three orthogonal planes intersected by the XY, XT, and YT axes, where T is the frame sequence. The discovered graphs are then inserted in chronological sequence. The final stage is to classify. SVM was used to classify the retrieved pictures (Support Vector Machine). The next step is to check to see if the entry has been changed. To recognize and normalize the faces, the Viola-Jones technique was utilized.

2.2.2 Face Emotion Detection using image processing techniques and neural networks

They emphasize two crucial characteristics of this composition. The first two are Facial Expression Detection and Face ID. For face detection, the traditional method was used. To define the face area, they first eliminated the face area and then cleaned the area around the eyes, lips, and brows. Then they take different aspects of that particular face. They exploited these properties to generate a set of vectors. They developed a revolutionary method for identifying visual emotions. This method consists of four steps. The four types are model-based, feature-based, appearance-based, and knowledge-based.

To find human faces as rapidly as possible, the author used the AdaBoost classifier and the cascade classifier. Following feature extraction, a neural network approach is applied. This article's testing result was 92.8%, and the accuracy of face detection is 97.4%. To detect emotions, SimNet was employed. SimNet is a fuzzy logic and artificial neural network hybrid. SimNet was used, which contains two hidden layers. There are twenty neurons in each stratum. Their technique specifies 20 properties for hidden classes. The emotion recognition experiment in this research was 96.2% successful.

2.2.3 Face Detection Algorithm

Versatile boosting, often known as the AdaBoost algorithm, is a boosting method that can be used in machine learning as a whole. The process of reassigning weights to each occurrence, with higher weights going to cases that were mistakenly classified, is known as versatile boosting. Boosting is a strategy used to lessen directed learning's tendency and unpredictability. It is based on the premise that learners progress in stages. For the elementary, however, each subsequent learner is picked from a pool of former students. In other words, weak students become strong. The AdaBoost calculation, with one exception, follows the same formula as boosting.

Let me begin by explaining how boosting works. During the information coaching time, it generates 'n' call trees. The improperly categorized record that was contained inside the first model is given precedence as a direct consequence of the development of the initial

call tree and model. The only records that are used as input for the second model are these ones.. I'll keep going till I have decided what kind of base learners I want to construct. Remember that all boosting tactics permit record repetition.

Model 1,2…,n are individual models

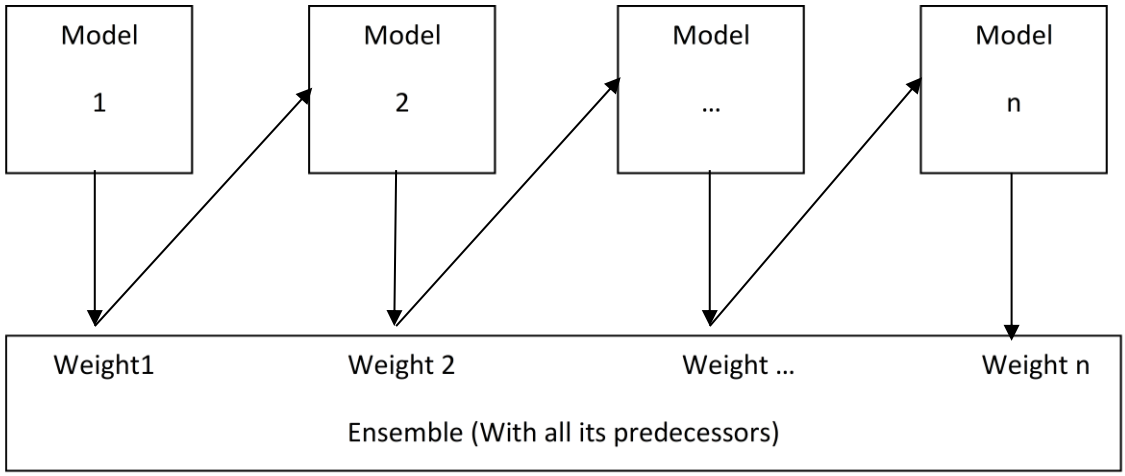


Figure 2.2.3: AdaBoost algorithm model

Step one – making the primary Base Learner:

The algorithmic software generates the primary learner by beginning with the primary feature, feature 1, and employing the primary stump, f1. It will yield a similar variety of stumps because to the amount of alternatives. Because the dataset only has three alternatives, the following example will provide three stumps. These stumps will sprout three call trees. This method is known as the stumps-base learner model. The algorithmic software only considers Gini and Entropy while selecting a base learner from the three models. Gini or Entropy should be computed in the same manner as call trees. The fundamental foundation learner is the cheapest stump. Because the dataset below has only three properties, it will produce three stumps. Three decision trees will be constructed. The number beneath the leaves indicates how many records were successfully and incorrectly

classified. The Gini or Entropy index is built using these records. The stump with the lowest Gini or Entropy value is chosen as the foundation learner. Take stump one as having the lowest entropy index. As a result, feature 1, also known as stump 1, will be our first basic learner.

The second step is to compute the overall error

The total error is the sum of all errors identified in the classified sample weights record. Total Error (TE) equals 1/5 in our scenario because there is just one error.

The performance of the stump will be evaluated next.

The performance of the Stump is calculated by the following formula:

Stump's performance is equal to ln ([1-TE]/TE) / ln (1/2).

In this scenario, the total error and natural log are applied.

The algorithmic rule generated three decision trees, commonly referred to as stumps. Any stumps generated by the algorithm can be supported by the check dataset. After passing through the first stump, it only yields one output. The output becomes one again after passing through the second stump. It produces nothing after passing through the third stump. The AdaBoost algorithmic rule, like random trees, distributes the majority of votes among the stumps. There is just one potential outcome in this case. This is how the output with check knowledge is usually set up.

2.2.4 A Face Emotion Detection System using Convolutional Neural Network

For this project, the developer created a Face Emotion Detection system using a convolution neural network (CNN). This system's CNN model is built on the LeNet Architecture. The Kaggle face expression dataset is used in this work, which includes seven different facial expression traits such as amazement, fear, disdain, wrath, and neutral. On the test dataset, the system achieved a precision of 0.57 and an accuracy of 56.77%.

2.2.5 Facial Emotion Detection using Min-Max Similarity Classifier

This study's author created a fast and accurate facial emotion recognition algorithm in order to eliminate inter-class pixel conflict during classification. The proposed method leverages pixel normalization in addition to the closest neighbor classifier's effective attribute outlier suppression to reduce intensity offsets caused by a Min-Max measure.

For testing and training purposes, this Min-Max classification approach uses a single image to represent each person's emotion. Cross-validation is done thirty times to ensure that the detection system is statistically stable and that every image in the JAFFE database is evaluated at least once. The average results of the cross-validation trials can be used to estimate the system's overall expression detection accuracy.

Using the JAFFE database, the Min-Max classification technique enhances detection performance, with values ranging from 92.85% to 98.57%.

2.2.6 Improving the Classification Accuracy of Emotion Detection using Facial Expressions

The authors of this study recommend utilizing a neural network and PCA to recognize facial expressions. The accuracy of neural network classification using PCA for attribute selection is investigated in this study. Their strategy is broken down into four parts. Classification, expression detection, attribute selection, and image processing are examples of these. Scaling and rendering are used in this image processing example to prepare the face for emotion recognition. Following the completion of the procedure's protocols, the

facial image was employed as input. They used the PCA approach to extract attributes. For each image, Eigen faces are produced. From these Eigen faces, the system generates Eigenvectors. For classification, a neural network with back propagation was used. They discovered that the approach was 86% accurate after examining the results.

2.3 Comparative Analysis

Face detection is the process of automatically recognizing a specific human from a digital image by analyzing the characteristics of that person's face. Face detection, image processing, and face identification are the three components of the face detection approach. Face detection recognizes faces in photos using computer learning. Scaling and image rendering are used during picture processing to get the face ready for recognition. The practice of determining the identity of a face by applying mathematical approaches to the pixel values or features in an image's facial region is known as face identification. Crowd surveillance, video content indexing, personal identity (such as a driver's license), matching mug pictures, access security, and other applications are among the most beneficial. I believe that a computer's ability to recognize human facial expressions will greatly aid the development of such technologies. Recently, there has been a lot of discussion on how computers can read human facial expressions. For more than 40 years, the major focus has been extensive research on face detection. It is currently one of the most prominent subtopics in face science [1-4]. Face Detection technology has the potential to identify a person. Thanks to breakthroughs in photo analysis and pattern recognition, conversational and emotional face cues may now be identified and classified automatically. The goal of this work is to review the literature on automated face-expression recognition in facial images and image sequences. The three essential difficulties in facial expression analysis are face detection in a facial image or image sequence, facial expression data extraction, and facial expression categorization. Our goal is to study the difficulties of designing and deploying an automatic face emotion recognition system.

2.4 Scope of the Problem

Many sectors, including biometric security and human-computer interface, use emotion detection. By modeling the human brain with a variety of supervised and unsupervised machine-learning methodologies, I can learn more about artificial intelligence or machine intelligence. By 2024, it is expected that emotion recognition software would be installed on 1.3 billion devices. Face detection software in mobile phones is already used by organizations such as iProov and MasterCard to check payments and do other advanced authentication tasks. Emotion recognition algorithms are extremely sensitive to postural changes. When a person tilts their head or shifts their point of view, their facial expression changes. Face identification is a difficult computer operation, despite its apparent simplicity. It's tough because all faces have physical characteristics, such as two eyes above a nose above a mouth.

2.5 Challenges

Identifying a person's mood from their face is a common practice in modern times. Because it was difficult for us to achieve a high level of precision in this project, I relied heavily on models. All of the models that had the potential to attain a high level of accuracy were utilized, while those that did not were discarded.

CHAPTER 3

Requirement Specification

3.1 Workflow of the model

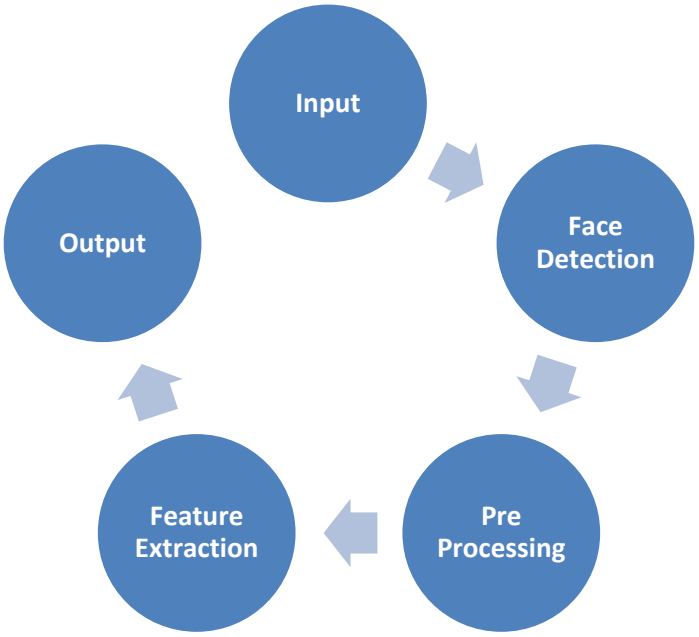


Figure 3.1.1: Total workflow of the model

In this particular instance, the input from the camera is utilized, face detection is utilized to ascertain whether or not a human face is visible, the input is preprocessed, feature extraction is carried out, and the output is displayed through the application of emotion classification.

3.2 Feasibility Analysis

The viability of a proposed system is investigated in a feasibility study. It is approximated as a percentage and is based on the anticipated profit that the company will make from software development. An investigation into the practicability of anything is carried out in order to ascertain whether or not certain software products meet the requirements for enhancement, implementation, system commitment to the company, and other factors.

3.2.1 Technology readiness

The technologies of the system, including its hardware and software as well as those associated to its creation, are investigated and assessed in the technical feasibility studies. A feasibility analysis takes into account a variety of factors, including the technical knowledge of the technical team, the practicality of using existing technology, the simplicity or complexity of maintaining and updating the chosen technology, as well as a number of other factors. The "Face Emotion Detection System," HTML5, CSS3, and JavaScript were used in its construction. Due to the fact that these technologies are currently so widely available on the market, everyone involved in the project's development has access to at least one of them. The project is undeniably technological as a direct result of this.

3.2.2 Financial viability

Use the business case as a guide as you evaluate the project's benefits and costs. a thorough breakdown of all development expenditures, including those required for the final product, such as the following: B. In order to determine whether or not it will have a beneficial impact on the economy, factors like the cost of design and development, ongoing costs, and the required resources in terms of both hardware and software are assessed. Take into account the cost of developing a facial recognition system. When we have achieved enough progress, we will be able to offer our technology to businesses who require it and adapt it to suit their requirements. Currently, we merely have to pay for domains and hosting; however, as more accurate emotion identification algorithms become popular and domain prices rise, our profits will soar. The data that was previously provided indicates that this strategy is financially feasible.

3.2.3 Functionality in Operation

A statistic that assesses how well a proposed solution addresses the issue and makes use of the gaps found during the scope defining stage is known as operational feasibility. The following factors were taken into account while assessing the project's technological viability:

- A face image will be recognized and recorded by the technology.
- Following the capture of the photograph (note which category).

3.2.4 Timeline Possibility

A key factor in deciding how quickly a project will be finished is how realistic the timetable is. The system's ability to do tasks ahead of schedule has demonstrated that the timeframe is reasonable.

3.3 Face Detection Models

In this project we use five Models. They are –

- SSD mobilenetv1 model
- Tiny Face Detector
- Sixty-Eight Point Face Landmark Detection Model
- Face Detection Model
- Face Emotion Detection Model

3.3.1 SSD Mobile net V1

For facial recognition, this application makes use of a Single Shot Multibit Detector (SSD) based on MobileNetV1. The neural network will first recognize each face in a photo, then provide its bounding boxes and probability for each face. This face identifier promotes high exactness in face bounding box distinction over effective derivation to produce the most accurate results. The quantized SSD mobilenetv1 model takes up around 6.2 MB of space. The WIDERFACE dataset was used to train the face localization model.

3.3.2 Tiny Face Detector

When compared to SSD Mobile net V1 Face Recognizer, Tiny Face Detector is a real-time face Detection engine that is more effective, more compact, and requires fewer resources. As a direct consequence of this, it is slightly less accurate when identifying infant faces. This template is extremely responsive on both mobile devices and the web. It need to be your face detector for customers who are constantly on the move and have a limited spending budget. The file that contains the quantized small face detector model is only 190 KB in size. A one-of-a-kind dataset consisting of around 14,000 photographs taken using inflatable boxes were utilized during the training process for the Emotion Detection algorithm. The results obtained by our method and our facial landmark detection are superior to those obtained by SSD Mobile Net V1 overall. Our method is superior to SSD Mobile net V1 in all aspects, with the exception of the construction of a model to predict bounce boxes covering all facial component foci. In this model, which is a scaled-down version of the Tiny Yolo V2, the conventional Yolo spool has been replaced by a deep split table spool. Due to the Yolo's full integration, it is simple to adjust it to work with a variety of input frame sizes; however, this comes at the sacrifice of power supply precision (induction time).

3.3.3 Sixty-Eight Point Face Landmark Detection Model

A 68-point face landmark detector that is portable, quick, and accurate are all included in this kit. In comparison, the file size of Face Landmark 68 is 350 kb, whereas the file size of Face Landmark 68 Tiny is only 80 kb. Both models make use of convolutions that have distinct depths and blocks that are firmly related to one another. In order to train each model, 68 landmark points were extracted from 35k different facial pictures.

3.3.4 Face Detection Model

A framework somewhat similar to ResNet-34 has been developed by Face Detection in order to evaluate face descriptors (vectors with 128 variables) extracted from random face photos. It is what gives a person their distinctive facial features. The model possesses

additional sets of faces in addition to the set that was utilized for training purposes. This indicates that you are able to make use of your model to locate individuals that resemble you. To determine the degree of similarity between two random faces, you can either compute their Euclidean distance or make use of a different classifier of your choosing. Two networks that are similar to neural networks are the Face Recognizer Net in Face Detection.js and the network in the Face Detection model dlib. Both of these networks can be found in Face Detection. The model was able to correctly recognize faces with the projected accuracy of 99.38% when using Davis King's LFW (Face Labeled in Nature) benchmark. The face detection model has an average size that can be measured of 6.2 megabytes.

3.3.5 Face Emotion Detection Model

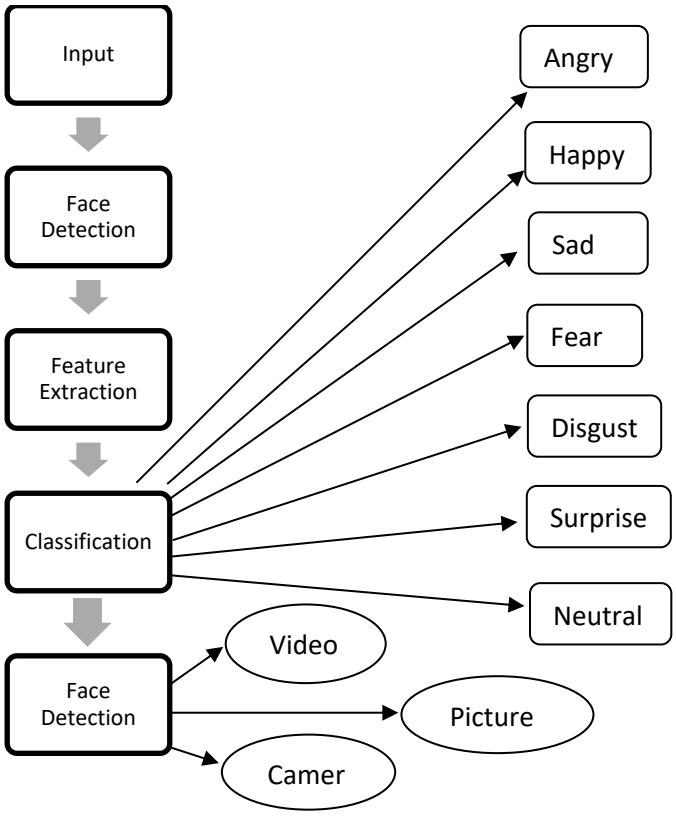
The simplified approach for detecting emotions in the face enables fast and precise performance. The model takes up around 310 kilobytes of storage space and features convolutions that are depth-wise divisible in addition to closely connected blocks. Images obtained from web sources and publically available datasets were utilized during the training process. It is essential to have an understanding of the fact that wearing glasses may make it more difficult to make correct predictions.

3.4 System Design and Diagram

3.4.1 System Design

The design of the system itself provides insight into the system's overarching architecture, which may be viewed. In this part, we will devote a considerable amount of our attention to discussing the layout of the system.

3.4.2 System Diagram



3.4.2.1: System Diagram of Face Emotion Detection

Before attempting to recognize faces by means of feature extraction, we will first determine whether the image input (which may have originated from our camera directly or from a photo) contains a face. This may take place directly or indirectly. This section will categorize seven different expressions. There are many other ways to express oneself, such as being happy, sad, disgusted, fear, angry, surprised, or neutral.

3.5 System Flowchart

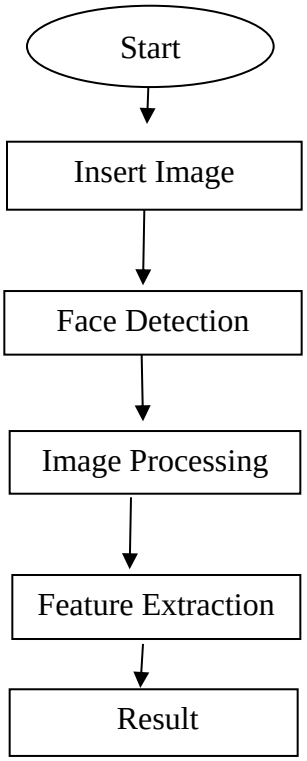


Figure 3.5.1: Flowchart of Face Emotion Detection

CHAPTER 4

Design Specification

4.1 Font-end Design

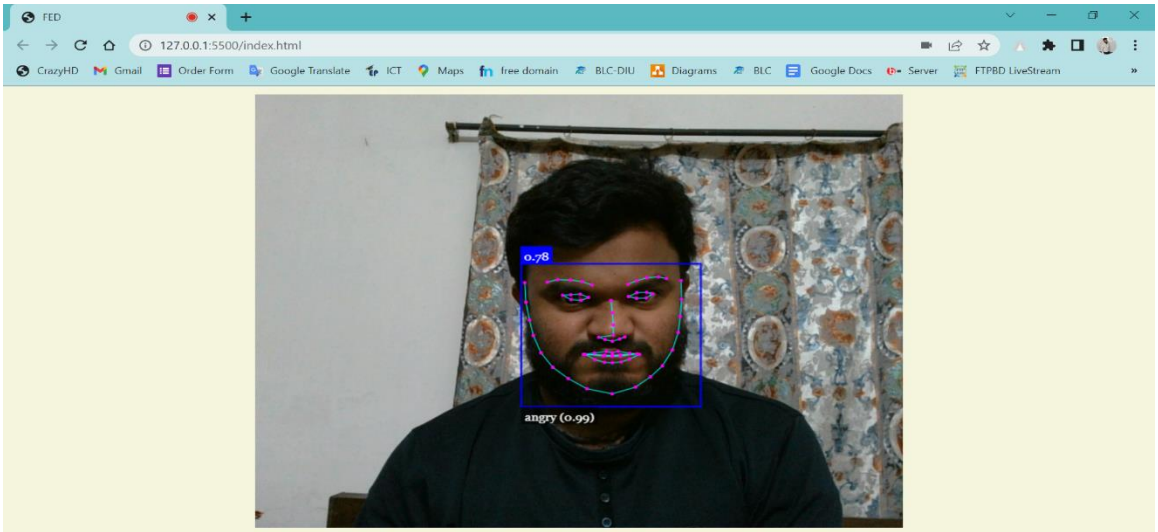


Figure 4.1.1: Font-end (emotion-angry)

When we operate the system, there will be a camera component that is operational. When a user logs into our system, they will see precisely this representation of our site on their screen.

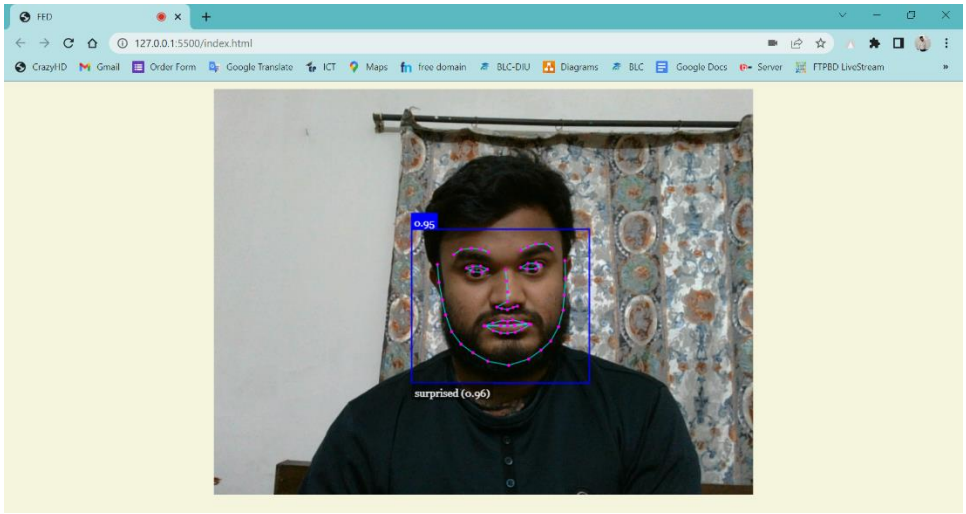


Figure 4.1.2: Font-end (emotion-surprise)

When the camera function is active, the system will recognize various facial expressions if they are being shown by a human subject. This is an image of someone's face reacting in surprise.

4.2 Back-end Design

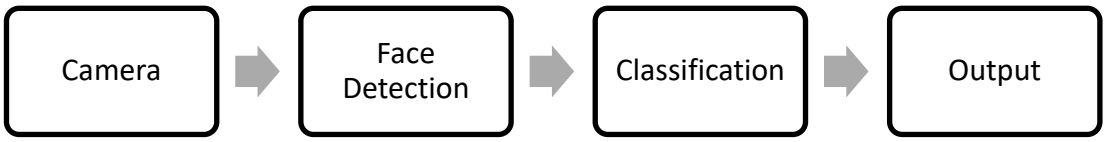


Figure 4.2.1: Back-end

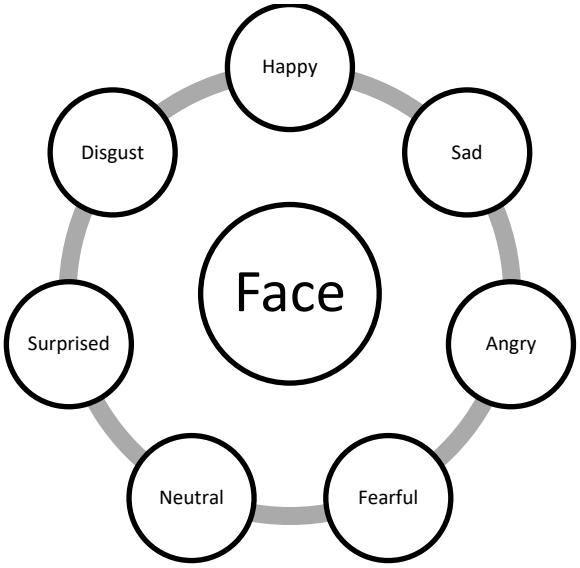


Figure 4.2.2: Face Expression

4.3 Interaction Design & User Experience

Users will be able to recognize their own faces and the expressions on those faces by utilizing our technology. We were able to collect data from individuals who, for various reasons, tried to read the emotions of other people based on their facial expressions. Many of these individuals undertook this endeavor simply for pleasure.

4.4 Implementation Requirements

The following lists the system's specific details :

Hardware Requirement (minimum):

1. Processor:
    - 2.5 GHz (min) with 4 cores CPU and additionally supports multithreading.
2. GPU:
    - 2 GB of GPU VRAM
3. Memory:
    - Minimum 2 GB RAM.

4. Storage:
    - At least 20 GB of free space on the SSD or HDD.
5. Software Requirement:
    - Linux - Ubuntu 15.02.1 LTS or higher (Operating System)
    - Windows - Windows 10 or higher (Operating System)
    - Visual studio code
6. Required Programming Languages:
    - HTML5
    - CSS3
    - Bootstrap
    - JavaScript

CHAPTER 5

Implementation and Result

5.1 Testing Implementation

5.1.1 Responsive Web Design

HTML and CSS are used in responsive web design, which causes a website to automatically resize, expand, conceal, or shrink itself so that it appears appropriately formatted on all devices (desktops, laptops, mobiles and tablets). With adaptive designs, the size of the text and the visuals may be rapidly adjusted to meet any screen size. In responsive web design, media queries are frequently used to modify the text and images that are shown. Media queries are used to deliver various styles depending on the size of the user's screen.

5.1.2 Web Development Languages Used

In order to construct my Face Emotion Detection system, I made use of a variety of computer languages, including HTML5, CSS3, Bootstrap, and JavaScript.

5.1.3 Server

A piece of hardware or software that regulates who can access which shared resources or assets on a network. Microsoft Internet Information Services (IIS), Apache, Internet Information Services (IIS), and Nginx are currently the most widely used servers. In order to complete our project, we utilized a VS Code Live server.

5.1.4 Application Programming Interface (API)

Numerous standards, strategies, procedures, and ordering are used when producing code or coordinating the use of multiple frameworks. These are all necessary components. The creation of GUI (Graphical User Interface) elements is simplified by APIs, which also enable apps to make service requests to and get responses from other programs. They are compatible with desktop computers as well as mobile devices. This particular endeavor made use of face-api.js, which is a JavaScript API for Face Detection in the Browser that was created on top of the tensorflow.js core. It does it by employing a few convolutional neural networks in order to recognize the face. This application programming interface (API) works on mobile devices as well as the web.

5.1.5 face-API js

Face-api.js was developed by Vincent Mühler. The face recognition functionality of the JavaScript package is provided by the browser. The Tensorflow.js core API was utilized in its creation. It is possible to identify and recognize faces, as well as obtain information about a person's age, gender, and facial expressions. The technique known as convolutional neural network, or CNN, is utilized here. CNN was designed specifically for use on mobile and web platforms.

5.2 Test Result

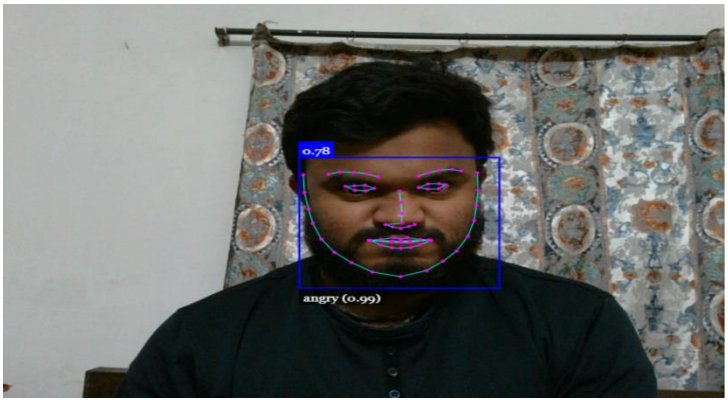


Figure 5.2.1: Angry

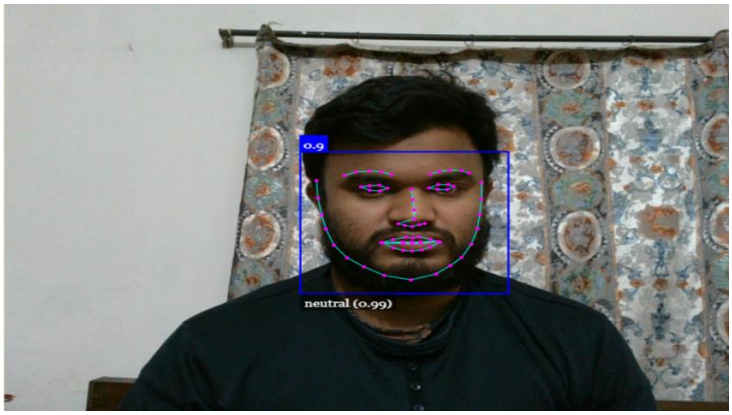


Figure 5.2.2: Neutral

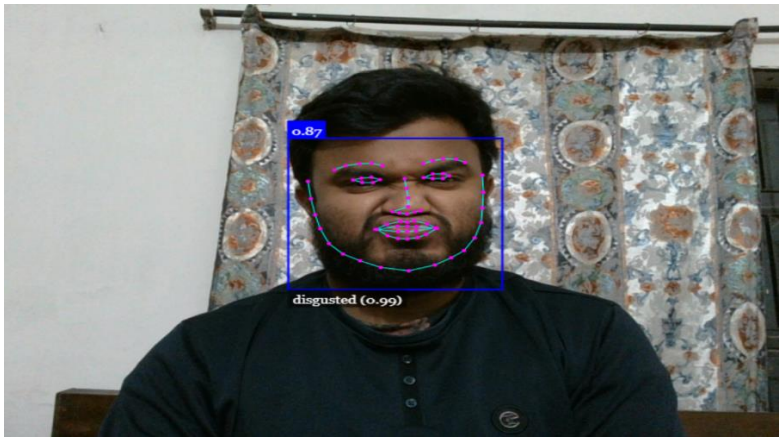


Figure 5.2.6: Disgusted

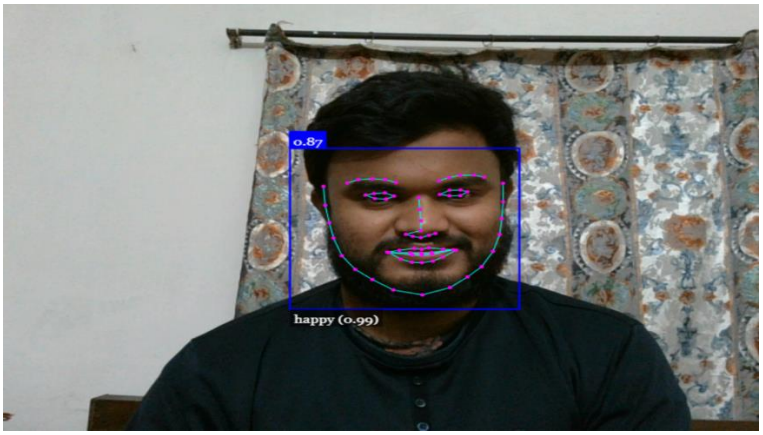


Figure 5.2.3: Happy

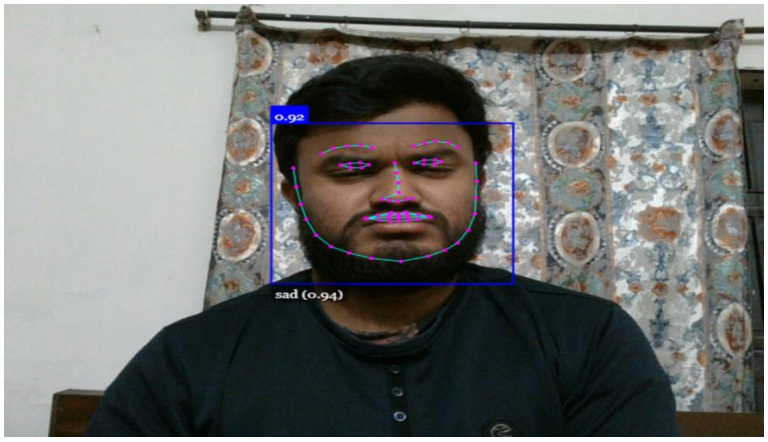


Figure 5.2.3: Sad

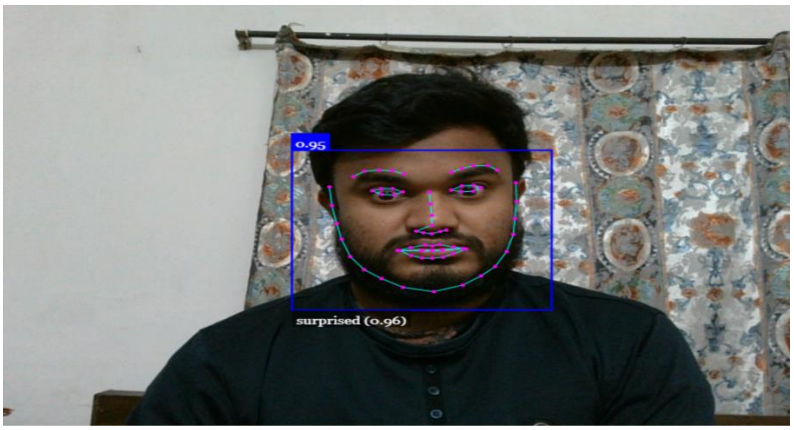


Figure 5.2.4: Surprised

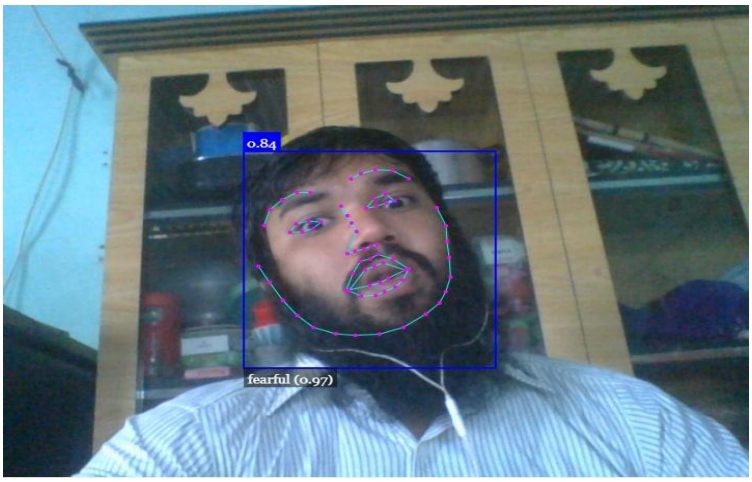


Figure 5.2.7: Fearful

5.3 Test Reports

The software launches in a new tab within the browser. The software has a button labeled "Open Camera" that you can use. When you press the button, either the webcam on your computer or the camera on your smartphone will begin to record video. To analyze a subject's emotional state, users have to position the camera so that it is pointing directly at their face. The results will be displayed as text underneath the subject's face, along with an approximate percentage of the total. Anger (99.27%), despair (96.32%), and happiness (99.00%) are some of the emotions that have been detected. The live camera is able to identify each of the six different facial expressions, including joy, sadness, anger, fear, amazement, disgust, and neutrality.

Table 5.3.1: Table of Emotion Detection's Result

Serial	Expression	Input	Correct Result	Incorrect Result
1.	Neutral	200 times	192 times	8 times
2.	Happy	200 times	190 times	10 times
3.	Sad	200 times	179 times	21 times
4.	Surprised	200 times	182 times	18 times
5.	Angry	200 times	167 times	33 times
6.	Disgusted	200 times	140 times	60 times
7.	Fearful	200 times	111 times	89 times

In the table 5.3.1 we can see the list of the Emotion Detection output result.

CHAPTER 6:

Impact on Society, Environment and Sustainability

6.1 Impact on Society

Emotion detection has a number of applications that are beneficial to society, including reducing the amount of unneeded labor and human interaction, improving safety and security, and finding criminals. There are occasions when it is beneficial to contribute to medical research.

Because of this project, we will have the chance to gain a deeper understanding of the mental health of individuals. Our facial recognition technology is able to determine whether or not a person is hopeless, whereas happiness indicates that they have a healthy mind. We are in a position to recommend psychotherapy for the individual if we are aware that they are experiencing mental depression. In addition, we are able to offer appropriate care and get additional knowledge regarding the mental health of our children whenever someone expresses concern. As a consequence of this, it is a fair argument to assert that the system will be to society's advantage and is essential to its functioning.

6.2 Impact on Environment

We can quickly extract characteristics about a person's expression from a photograph by using our method. These features can be found in a photograph. In addition, if we are able to recognize a snapshot of a person right away, we can gain insight into the person's genuine face expression. Our strategy would be pointless in an adversarial environment because the natural world is in a constant state of flux. When there is danger present, it is nearly impossible to make out the features of a human face. In order for our technology to function properly, we want an environment that is peaceful. Only by recognizing someone's face can we determine how they are now feeling. Our technology would not operate as effectively or generate different results in high-movement locations because the interior and outdoor environments are very different from one another. As a consequence of this, our endeavor is affected by the surrounding environment.

6.3 Ethical Aspects

In recent times, research has been done to determine whether or not emotion detection algorithms are effective and useful in the identification of identity fraud. In other instances, police officers made up charges against innocent persons, claiming that those people were a part of a disturbance. According to privacy campaigners located all over the world, a great number of individuals still hold firm beliefs regarding the manner in which identities should be preserved and protected. The top six ethical concerns with emotion detection technology include racial bias and misinformation, racial discrimination in law enforcement, privacy violations, a lack of informed consent and transparency, mass surveillance, data breaches, and insufficient access to legal assistance.

- **Racial prejudice due to biased testing**
- **Police prejudice based on race**
- **Data Safety**
- **A lack of transparency and freely given, fully informed consent**
- **Data breach and inadequate legal protection**

6.4 Sustainability Plan

In the project, I used a range of pre-trained algorithms. I plan a strategy for the type of algorithm we'll require. We had to utilize a number of methods to determine which model did what because we were combining multiple models. Five different model kinds of our technology were investigated to see if they could be used with our system. Some of these models include the Face Detection Model, the Face Emotion Detection Model, and the Face Emotion Detection Model. We also used the tiny face model to recognize multiple faces at once.

There are several jobs, such as employing Face Emotion Detection models to detect faces and facial expressions.

CHAPTER 7

Conclusion & Future Scope

7.1 Discussion & Conclusion

In this study, I offer an approach to the classification of facial expressions. The processes of face recognition and emotion extraction can be utilized in a variety of contexts, including but not limited to robotic vision, video surveillance, digital cameras, safety, and human-computer interface. This research was conducted with the intention of developing a system for Face Emotion Detection that made use of computer vision in order to enhance the challenging feature extraction and classification capabilities of face emotion detection.

The face is the most fundamental part of the human body, and since it contains distinguishing traits, it plays an even more important role in a person's sense of identity than any other part of the body. Many strategies and pieces of technology are being used in different parts of the world with the goal of improving the dependability and precision of face detection. This cutting-edge technology is also utilized in the fields of forensics, transportation, and security, as well as the medical field, wherever higher precision is required. However, as was said earlier in the article, the development of emotion detection technology is hindered by a number of challenges. These challenges include those that are caused by a variety of emotions, including joy, sadness, fury, and others.

7.2 Scope for Further Developments

Over the past decade, research and development into technologies that can detection face emotion has made significant strides. The detection of spontaneous emotions has taken precedence over the analysis of posted emotions at this point. Errors in face registration, quick processing times, and high correct detection rates (CDR) can produce encouraging results; furthermore, the functionality of our system has the potential to be significantly enhanced. The system functions independently and is capable of interacting with an image stream. It is able to identify unconstrained facial expressions of various emotions. When I apply my method, digital cameras are only capable of capturing subjects that are grinning

when we take their pictures. Identification procedures that are not dependent on a person's outward appearance to be successful. When someone walks into a room in a house, they have the ability to change the channel on the television and turn the lights on and off. The method provides a tool for medical professionals to employ in assessing the degree to which a deaf patient is sick or in pain. A user's mental state can be recognized and monitored using our technology, which can also be utilized in convenience stores and shopping malls to collect feedback from customers, improve business operations, and optimize business processes.

Emotion detection is used in a wide variety of fields, including biometric security and human-computer interface, among others. The existence of machine intelligence, also known as artificial intelligence, can be demonstrated by mimicking the behavior of the human brain through the use of a number of supervised and unsupervised machine-learning strategies.

The FED approach that has been developed is superior to the ways that are already in use. Deep neural characteristics are superior to those that are drawn by hand when it comes to describing a face's mood. The performance of face detection, which may simply crop the face, has significantly improved. Deep features, as opposed to produced features, more accurately depict a person's face characteristics. The performance of the system may be greatly improved in the near future by the application of categorization based on deep neural networks.

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