VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI-590018, KARNATAKA.

A PROJECT REPORT ON

"FACIAL EXPRESSION ANALYSIS OF CHILDREN SUFFERING FROM AUTISM USING DEEP LEARNING"

By

Ms. Bhyravi M R	**4BD16IS015**
Ms. Brunda H V	**4BD17IS023**
Ms. Chaitra K M	**4BD17IS025**
Mr. Piyush Choudhary	**4BD17IS059**

Submitted in the partial fulfillment of the requirement for the award of degree

in

INFORMATION SCIENCE AND ENGINEERING

UNDER THE GUIDANCE OF

Mr. Sheik Imran M. Tech
Assistant Professor

Mr. Dhananjaya G M M.Tech
Assistant Professor

2020-2021

Department of Information Science and Engineering,
Bapuji Institute of Engineering and Technology,
Davangere -577004

VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI - 590018, KARNATAKA

BAPUJI INSTITUTE OF ENGINEERING AND TECHNOLOGY
DAVANGERE – 577004, KARNATAKA, INDIA.

Department of Information Science and Engineering

CERTIFICATE

Certified that the project work entitled **"Facial Expression Analysis of Children Suffering from Autism using Deep Learning"** carried out by **Ms. Brunda HV, USN:4BD17IS023, Ms. Chaitra KM, USN:4BD17IS025, Ms. Bhyravi MR, USN:4BD16IS015, Mr. Piyush Choudhary, USN:4BD17IS059**, a bonafide student of this institution in partial fulfillment for the award of **Bachelor of Engineering in Information Science and Engineering of the Visvesvaraya Technological University**, **Belagavi** during the year 2020-2021. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report deposited in the departmental library. The Project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

…….	…….
Dr. Poornima B. Ph.D. HOD	**Dr. H. B Aravind** Ph.D. Principal
…….	…….
Mr. Sheik Imran M. Tech Assistant Professor	**Mr. Dhananjaya G M** M. Tech Assistant Professor

External Viva:

Name of Examiners:	**Signature with Date**
1)	**…….**
2)	**…….**

Acknowledgement

Salutation to our beloved and highly esteemed institute "**Bapuji Institute of Engineering and Technology**" for having well qualified staff and labs furnished with necessary equipment.

We express our sincere thanks to the **Guide Mr.Sheik Imran** and **Mr. Dhananjaya GM** and **Project Coordinators Mrs. Anitha G** and **Ms. Rekha B.H** for giving constant encouragement, support and valuable guidance throughout the course of the project, without whose stable guidance this project report would not have been achieved.

We express whole hearted gratitude to **Dr. B. Poornima HOD of IS&E**. We wish to acknowledge her help who made the task easy by providing with her valuable help and encouragement.

We would like to thank our beloved **Principal, Dr. H. B. Aravind** and the **Director Prof. Y. Vrushabhendrappa** of this institute for giving us the opportunity and guidance to work for the project.

We would like to extend our gratitude to all Staff of Information Science and Engineering department for the help and support rendered to us. We have benefited a lot from the feedback, suggestions given by them.

We would like to extend our gratitude to the family members and friends especially for their advice and moral support.

BHYRAVI M R **4BD16IS015**
BRUNDA H V **4BD17IS023**
CHAITRA K M **4BD17IS025**
PIYUSH CHOUDHARY **4BD17IS059**

Department of Information Science and Engineering

VISION

"To be the **center of excellence** by adopting technological **innovation** in **academics** and **research** to develop competent **man power** for emerging needs of **society** and **Industries."**

MISSION

M1: To provide **Quality education** to meet the challenges of technological changes to succeed in their **professional career** and **higher education.**

M2: To inculcate the culture of **research, innovation** and **entrepreneur skills** among the students**.**

M3: To groom our students with the quality of **team spirit, leadership skills** and **ethical values**, to share and apply their knowledge for the **benefit of the society.**

COURSE OUTCOMES

Sub. Code	Course Outcomes
17ISP85.1	Identify an issue and derive problem related to society, environment, economics, energy and technology
17ISP85.2	Formulate and Analyze the problem and determine the scope of the solution chosen.
17ISP85.3	Determine, dissect, and estimate the parameters, required in the solution.
17ISP85.4	Evaluate the solution by considering the standard data / Objective function and by using appropriate performance metrics.
17ISP85.5	Compile the report and take part in present / publishing the finding in a reputed conference / publications
17ISP85.6	Attempt to obtain ownership of the solution / product developed.

LIST OF PROGRAM OUTCOMES

PO Code	Short Description	Full Description
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and

		engineering sciences.
PO3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

LIST OF PROGRAM SPECIFIC OUTCOMES

PSO Code	Full Description
PSO1	**Problem Solving Skills -** Ability to apply **standard principles** and **practices** of Information Technology to propose **feasible ideas** and **solutions** to computational tasks using **appropriate tools** and **Techniques.**
PSO2	**Knowledge of Information Technology – Analyze, Design, Develop** and **Test** the computer based software in the areas related to **Algorithms, Networks, Cloud Computing, Web, Data Science and IoT.**
PSO3	**Profession and Research Ability –** Inculcate the knowledge to **excel** in **IT profession**, **Entrepreneurship** and **research** with **Ethical standards**.

ABSTRACT

People can accurately identify a common face and understand a facial expression in a single glance. However, children with autism spectrum disorder (ASD) often have problems communicating with their parents, teachers, and other kids. In this paper, we present an innovative system to recognize facial expressions in children with ASD during playtime. Children are observed while playing or using their tablets or laptops while the researchers track the child's facial expressions. We are using Convolutional neural network(CNN) algorithm in deep learning , which tracks facial landmarks via web-cam or Dataset as input, which gives rise to robust our system by recognizing facial expressions.

CONTENTS

CHAPTER 1:

INTRODUCTION

1.1 DESCRIPTION

People can accurately identify a standard face and understand face expression during a single glance. However, children with Autism Spectrum Disorder (ASD) often have problems communicating and socializing.

It is difficult for them to interact with their parents, teachers and the other kids. Also they do not express their emotion and also they are unaware of others feelings too. An innovative system to recognize facial expressions from human faces that is captured in real time from which children with ASD can learn others emotions.In this project a web application is produced which captures the human face and predicts the real time facial expression.

Emotions are expressed in a variety of ways, such as facial expressions, voices, physiological signals, and text Among them, physiological signals contain significant data about emotions . Physiological signals change rapidly depending on changing emotions.

In psychological theory, emotional states of a person can be classified into six main categories: surprise, fear, disgust, anger, happiness and sadness. Automatic extraction of these emotions from the face images can help in human computer interaction as well as many other applications.

Facial Expression Recognition (FER) predicts the emotion percentage for each standard six emotion and shows the highest percentage of them.The emotions evolved in human face have a great influence on decisions and arguments about various subjects Machine learning algorithms and especially deep neural network can learn complex features and classify the extracted patterns. In our project, a deep learning based framework is proposed for human emotion recognition. The proposed framework uses Convolutional Neural Network (CNN) for classification.

1.2 PROBLEM STATEMENT

There are many methods to recognize the type of Facial Expression being expressed by autistic children, but the output ultimately depends on the accuracy of the algorithm and there is another case needed to be considered, if the algorithm predicts the probabilities of different expressions equally it is difficult to decide the right expression.

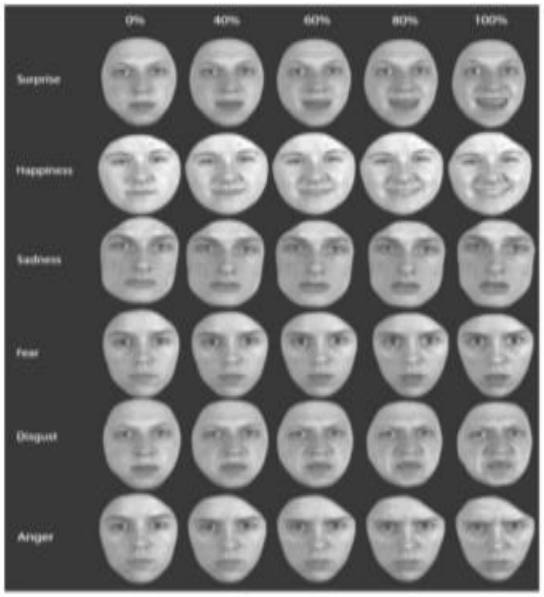
The accuracy need to be improved in order to correctly classify the expression.This can be done using Convolational Neural Network (CNN)

1.3 OBJECTIVES

- Our proposed system takes dataset as input for creating a learning Model which will be used for classification.

- After creating learing model ,live image or image from device wil be taken Feature Extraction happens using LBP

- Then It will be classified into five classes Happy, Sad, Neutral, Fear, Anger and class of image will be compared with Learning model and the output will be anyone of 5 classes



1.4 EXISTING SYSTEM

1. **"A Review on Facial Expression Based Behavioral Analysis Using Computational Technique for Autistic Disorder Patients":** Within recent decades the chances of a child being diagnosed with autism spectrum disorder have increased dramatically. Individuals with autism disorder have markedly different social and emotional actions and reactions than non-autistic individuals. It is a chronic disorder whose symptoms include failure to develop normal social relations with other people, impaired development of communicative ability, lack of imaginative ability, and repetitive, stereotyped movements

2. **"Real Time Face Expression Recognition of Children with Autism":** People can accurately identify a common face and understand a facial expression in a single glance. However, children with autism spectrum disorder (ASD) often have problems communicating with their parents, teachers, and other kids. In this paper, we present an innovative system to recognize facial expressions in children with ASD during playtime. Children are observed while playing or using their tablets or laptops while the researchers track the child's facial expressions

1.5 PROPOSED SYSTEM

Our Proposed system helps the autistic child to get their Facial Expression by feature Extraction using LBP(Local binary Pattern) and classification using Convolutional neural network algorithm in deep learning

Our proposed system will be capable of recognising five models which are considered universal among all walks of cultures. Mainly being fear, happy, sad, Neutral, Anger.

CHAPTER 2

LITERATURE SURVEY

2.1 RELATED BACKROUND STUDY

2.1.1 A Review on Facial Expression Based Behavioral Analysis Using Computational Technique for Autistic Disorder Patients

Within recent decades the chances of a child being diagnosed with autism spectrum disorder have increased dramatically. Individuals with autism disorder have markedly different social and emotional actions and reactions than non-autistic individuals. It is a chronic disorder whose symptoms include failure to develop normal social relations with other people, impaired development of communicative ability, lack of imaginative ability, and repetitive, stereotyped movements. There exist numerous techniques associated to detect autism disorders in children. Facial expression-based method is an effective technique frequently used by medical experts to detect the emotional patterns of autistic children. Our paper reviews this technique to determine the behavioral analysis of autistic children. Comparative analysis of existing techniques is undertaken to select the most optimal technique of autism detection.

Autism Spectrum Disorder is a wide spreading disease which is becoming a matter of awareness in recent times. ‘Spectrum’ refers to the wide variety of challenges faced by the autistic child. The proportion of the male population suffering from autism is comparatively more than that of females. The autistic disorder needs to be identified earlier so that it can create a roadmap for early treatment. Parents and care providers play an important role in the detection of the challenges faced by the autistic child. They share an intimate relationship with these children and are aware of their behavioral patterns. Autistic based disorder does not occur due to lack of affection from parents rather it may cause due to genetic risk or other environmental factors. It may also happen because of advanced aging of parents, illness during pregnancies, complications during birth, the crisis of oxygen supply in the brain while birth or premature babies. Early diagnosis is possible if parents remain very alert and attentive towards the behavior of their children

2.1.2 Real Time Face Expression Recognition of Children with Autism

People can accurately identify a common face and understand a facial expression in a single glance. However, children with autism spectrum disorder (ASD) often have problems communicating with their parents, teachers, and other kids. In this paper, we present an innovative system to recognize facial expressions in children with ASD during playtime. Children are observed while playing or using their tablets or laptops while the researchers track the child's facial expressions. We have implemented an Active shape Model (ASM) tracker, which tracks 116 facial landmarks via web-cam input, the tracked landmark points are used to extract face expression features using a Support Vector Machine (SVM) based classifier which gives rise to robust our system by recognizing seven expressions rather than only six expression as in the most of face expression systems. The proposed system is applied to Child Affective Face Expression CAFE set, and we obtained 93% classification accuracy. In addition, another experiment has been carried out in which children performed all 7 expression classes. General success rate for 4 classes of this experiment has been observed as 100%

2.1.3 Emotion Recognition Using Convolutional Neural Network with Selected Statistical Photoplethysmogram Features

Emotion recognition research has been conducted using various physiological signals. In this paper, we propose an efficient photoplethysmogram-based method that fuses the deep features extracted by two deep convolutional neural networks and the statistical features selected by Pearson's correlation technique. A photoplethysmogram (PPG) signal can be easily obtained through many devices, and the procedure for recording this signal is simpler than that for other physiological signals. The normal-to-normal (NN) interval values of heart rate variability (HRV) were utilized to extract the time domain features, and the normalized PPG signal was used to acquire the frequency domain features. Then, we selected features that correlated highly with an emotion through Pearson's correlation. These statistical features were fused with deep-learning features extracted from a convolutional neural network (CNN).

CHAPTER 3

REQUIREMENT SPECIFICATION

"A System Requirement Specification" gives full explanation about the activities of the system which is to be developed. It includes a set of use cases this can also be called as functional requirements. Use case illustrates all the communications between user and the system.

3.1 FUNCTIONAL REQUIREMENT

This project mainly focuses on Facial Expression of Children suffering from autism Designing and implementing a Machine learning model for predicting the Facial Expressions of children suffering from autism

Our developed system must focus on facial expression of children suffering from autism by classifying into five classes fear, happy, sad, Neutral, Anger.

3.2 NON-FUNCTIONAL REQUIREMENT

Non-functional requirements are requirements that are not directly concerned with the specified function delivered by the system. They may relate to emergent system properties such as reliability, response time and store occupancy. Some of thenonfunctional requirements related with this system are hereby below:

Reliability:

Reliability based on this system defines the evaluation result of the system, correct identification of the facial expressions and maximum evaluation rate of the facial expression recognition of any input images.

Ease of Use:

The system is simple, user friendly, graphics user interface implemented so any can usethis system without any difficulties.

Security:

All security precautions are taken to make the product more reliable.Our system uses image as dataset so that only authorized user can access the data.

3.3 HARDWARE REQUIREMENTS

- Processor : Intel core i5
- Processor speed : 3GHZ
- Ram memory : 2GB(4 GB recommended)
- Hard Disk Space : 20 GB (min.)
- Web-camera

3.4 SOFTWARE REQUIREMENTS

- Software : Environment anaconda
- Operating System : Windows 10
- Backend :Python Programming Language

CHAPTER 4

SYSTEM DESIGN

4.1INTRODUCTION

Software design includes the complete designing phase of the prediction, outlier detection and removal project using various diagrams like system architecture which shows the inputs give to the system and output obtained from the system in pictorial form, module description Gives a clear scenario in detail about the sub functionalities of system, use case diagram, activity diagram.

4.2MODULE DESCRIPTION:

Modules used in our project are,

1.Face Capturing Module: In this phase we are capturing the faces of people for future processing using web camera or external web camera. Without capturing the image none of the process can be done and there is no chance of detecting the emotions.

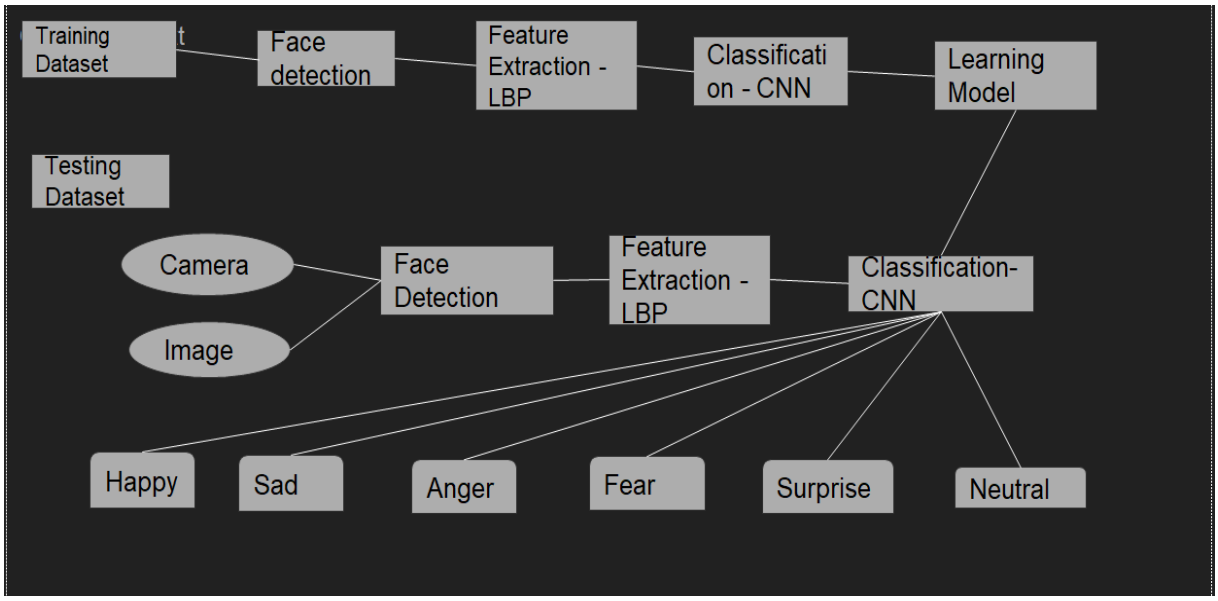
2. Preprocessing Module: After capturing images, we will preprocess the images. In this phase we will convert the color images to gray scale images.

3. Training Module: In this phase we will prepare a dataset that is binary array of all captured images. The captured images will store in .YML file, which stores all facial data. .YML file helps us to speedup processing of the captured images

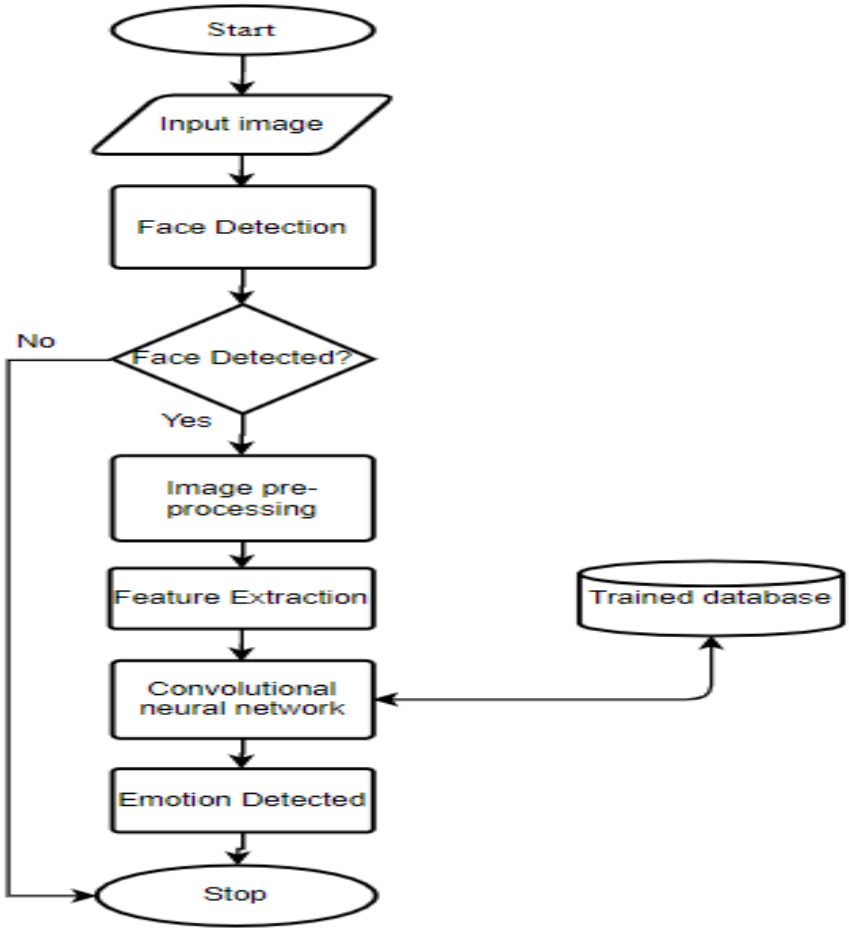
4. Face Recognition Module: The initial step of face recognition process is to train the facial data to the host system.Using the web camera of the computer system, 60 distinct images of the face is taken. In this module we will recognize the faces using LBPH algorithm. LBPH is an acronym for local binary pattern histogram. It will recognize the faces with the face ID and NAME that are all previously stored.

5. Face Expression Recognition Module: Facial expression recognition software is a technology which uses biometric markers to detect emotions in human faces. It extracts and analyzes information from an image it is able to deliver unfiltered, unbiased, emotional response or data.

4.3 SYSTEM ARCHITECTURE



4.3FLOW DIAGRAM



CHAPTER 5

IMPLEMENTATION

5.1 ALGORITHM

1. **Input:** If the image consists of 32 widths, 32 height encompassing three R, G, B channels, then it will hold the raw pixel([32x32x3]) values of an image.
2. **Convolution:** It computes the output of those neurons, which are associated with input's local regions, such that each neuron will calculate a dot product in between weights and a small region to which they are actually linked to in the input volume. For example, if we choose to incorporate 12 filters, then it will result in a volume of [32x32x12].
3. **ReLU Layer:** It is specially used to apply an activation function elementwise, like as max (0, x) thresholding at zero. It results in ([32x32x12]), which relates to an unchanged size of the volume.
4. **Pooling:** This layer is used to perform a downsampling operation along the spatial dimensions (width, height) that results in [16x16x12] volume.
5. **Locally Connected:** It can be defined as a regular neural network layer that receives an input from the preceding layer followed by computing the class scores and results in a 1-Dimensional array that has the equal size to that of the number of classes.

5.1.1 PSEUDOCODE

- **Code for getting input data :**

```
def getData(path):
 anger = 0
 fear = 0
 sad = 0
 happy = 0
 surprise = 0
 neutral = 0
 df = pd.read_csv(path)
 X = [] y = []
 for i in range(len(df)):
 if df.iloc[i]['emotion'] != 1:
 if df.iloc[i]['emotion'] == 0:
```

```
if anger <= 4000:y.append(df.iloc[i]['emotion'])
 im = df.iloc[i]['pixels']
 im = [int(x) for x in im.split()]
 X.append(im)
 anger += 1
 else:pass
 if df.iloc[i]['emotion'] == 2:
 if fear <= 4000:
 y.append(df.iloc[i]['emotion'])
 im = df.iloc[i]['pixels']
 im = [int(x) for x in im.split()]
 X.append(im)
 fear += 1
  else:  pass
 if df.iloc[i]['emotion'] == 3:
 if happy <= 4000:
 y.append(df.iloc[i]['emotion'])
 im = df.iloc[i]['pixels']
 im = [int(x) for x in im.split()]
 X.append(im)
 happy += 1
 else:pass
 if df.iloc[i]['emotion'] == 4:
 if sad <= 4000:
 y.append(df.iloc[i]['emotion'])
 im = df.iloc[i]['pixels']
 im = [int(x) for x in im.split()]
 X.append(im)
 sad += 1
 else:
 pass
 if df.iloc[i]['emotion'] == 5:
```

```
if surprise <= 4000:
y.append(df.iloc[i]['emotion'])
im = df.iloc[i]['pixels']
im = [int(x) for x in im.split()]
X.append(im)
surprise += 1
else:
pass
if df.iloc[i]['emotion'] == 6:
if neutral <= 4000:
y.append(df.iloc[i]['emotion'])
im = df.iloc[i]['pixels']
im = [int(x) for x in im.split()]
X.append(im)
neutral += 1
else:
pass
return X, y
```

- **Code for training model:**

```
X, y = getData('../input/facial-expression/fer2013.csv')
np.unique(y, return_counts=True)
X = np.array(X)
y = np.array(y)
y_o = []
for i in y:
if i != 6:
y_o.append(i)
else:
y_o.appfor i in range(5):
r = np.random.randint((1), 24000, 1)[0]
plt.imshow(X[r].reshape(48,48), cmap='gray')
plt.xlabel(label_map[y_o[r]])end(1)
```

```
X = X.reshape(len(X), 48, 48, 1)
y_new = to_categorical(y_o, num_classes=6)
```

- **Code for resizing the image:**

```
test_img = cv2.imread('../input/happy-img-test/pexels-andrea-piacquadio-941693.jpg',
0)
test_img = cv2.resize(test_img, (48,48))
test_img = test_img.reshape(1,48,48,1)
model.predict(test_img)
```

- **Code for CNN model to predict accuracy:**

```
model = Sequential()
input_shape = (48,48,1)
model.add(Conv2D(64, (5, 5), input_shape=input_shape,activation='relu',
padding='same'))
model.add(Conv2D(64, (5, 5), padding='same'))
model.add(BatchNormalization())
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(128, (5, 5),activation='relu',padding='same'))
model.add(Conv2D(128, (5, 5),padding='same'))
model.add(BatchNormalization())
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(256, (3, 3),activation='relu',padding='same'))
model.add(Conv2D(256, (3, 3),activation='relu',padding='same'))
model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Flatten())
model.add(Dense(6, activation='softmax'))
model.compile(loss='categorical_crossentropy',metrics=['accuracy'],
optimizer='adam')
model.fit(X, y_new, epochs=22, batch_size=64, shuffle=True, validation_split=0.2)
```

```
model.save('model.h5')
```

- **Code for identifying the expression:**

```
face_haar_cascade = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')
test_img = cv2.imread('0085.jpg', 0)
plt.imshow(test_img, cmap='gray')
plt.show()
test_img = cv2.resize(test_img, (48, 48))
plt.imshow(test_img, cmap='gray')
plt.show()
test_img = test_img.reshape(1, 48, 48, 1)
print(model.predict(test_img))
if model.predict(test_img)[0][0] == 1:
print("Anger")
elif model.predict(test_img)[0][1] == 1:
print("Neutral")
elif model.predict(test_img)[0][2] == 1:
print("Fear")
elif model.predict(test_img)[0][3] == 1:
print("Happy")
elif model.predict(test_img)[0][4] == 1:
print("Sad")
else:
print("Suprise")
```

- **Code for displaying output page:**

```
img = request.files['file1']

img.save('static/file.jpg')

img1 = cv2.imread('static/file.jpg')

gray = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)

cascade = cv2.CascadeClassifier('haarcascade_frontalface_alt2.xml')

faces = cascade.detectMultiScale(gray, 1.1, 3)
```

```
for x, y, w, h in faces:
cv2.rectangle(img1, (x, y), (x + w, y + h), (0, 255, 0), 2)
cropped = img1[y:y + h, x:x + w]
cv2.imwrite('static/after.jpg', img1)
try:
cv2.imwrite('static/cropped.jpg', cropped)
except:
pass
try:
image = cv2.imread('static/cropped.jpg', 0)
except:
image = cv2.imread('static/file.jpg', 0)
image = cv2.resize(image, (48, 48))
image = image / 255.0
image = np.reshape(image, (1, 48, 48, 1))
model = load_model('model7.h5')
prediction = model.predict(image)
label_map = ['Anger', 'Neutral', 'Fear', 'Happy', 'Sad', 'Surprise']
prediction = np.argmax(prediction)
final_prediction = label_map[prediction]
return  render_template('after.html', data1=final_prediction,data2="data")
```

5.2 MODULES

Training: The user first collects emotion datasets from various sources such as from childen facial expression stored in cloud. These datasets contains various expressions of people associated with particular emotions. The datasets collected contain 5 different emotion with their expression. The system is trained with 2100 various datasets. The datasets are used to train the model, which is further used to predict the particular set of expression. The training datasets are used to train the model, which is further used to predict the particular type of expression.

Create Model: Once the system is trained with various types of datasets. Convolutional neural network is used to build a model that predicts the facial expression for a given set of symptoms Convolutional neural network is a supervised classification algorithm.

Prediction: Based on the model created using Convolutional neural network it is used to predict the facial expression based on the set of expression provided. it is said to be the more the data is used to train the model, better the accuracy of the prediction.

Testing: The model is tested using certain set of test datasets for correct outcomes. The test datasets contain emotion of a children which is fed into the model. The model is suppose give the correct expression.

CHAPTER 6

TESTING

6.1 OVERVIEW

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 test. Each test type addresses a specific testing requirement.

6.1.1 TYPES OF TESTS:

1.FUNCTIONAL TESTING: Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted. Invalid Input: identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures : interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

2.SYSTEM TESTING: System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration-oriented system integration test. System

testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

WHITE BOX TESTING: White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.
BLACK BOX TESTING: Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box. you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

3.UNIT TESTING: Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases. Test strategy and approach Field testing will be performed manually and functional tests will be written in detail.

4.INTEGRATION TESTING: Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects. The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

5.ACCEPTANCE TESTING: User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

6.2 TEST CASES

SL.NO	Test Case	Expected output	Actual Output	Result
1	Collection of emotion datasets	Datasets consisting of set of emotions and respective expressions.	Datasets consisting of set of emotions & respective expressions.	Success
2	Training	System is trained with datasets.	System is trained with datasets.	Success
3	Create model	Model that fits trained datasets.	Model that fits trained datasets.	Success
4	Prediction	Correct prediction of emotion for given sets of datasets.	Correct prediction of emotion for given sets of datasets.	Success
5	Prediction	Correct prediction of emotion for given sets of datasets.	Incorrect prediction of emotion for given set of datasets.	Failure
6	Testing	Correct outcome of expression that has already been trained.	Correct outcome of expression that has already been trained.	Success
7	Testing	Correct outcome of expression that has already been trained.	Incorrect outcome of expression.	Failure
8	Creating datasets	Proper creation of datasets within the range.	Proper creation of datasets within the range.	Success

CHAPTER 7

RESULTS AND DESCRIPTIONS

7.1 OUTPUT SNAPSHOTS

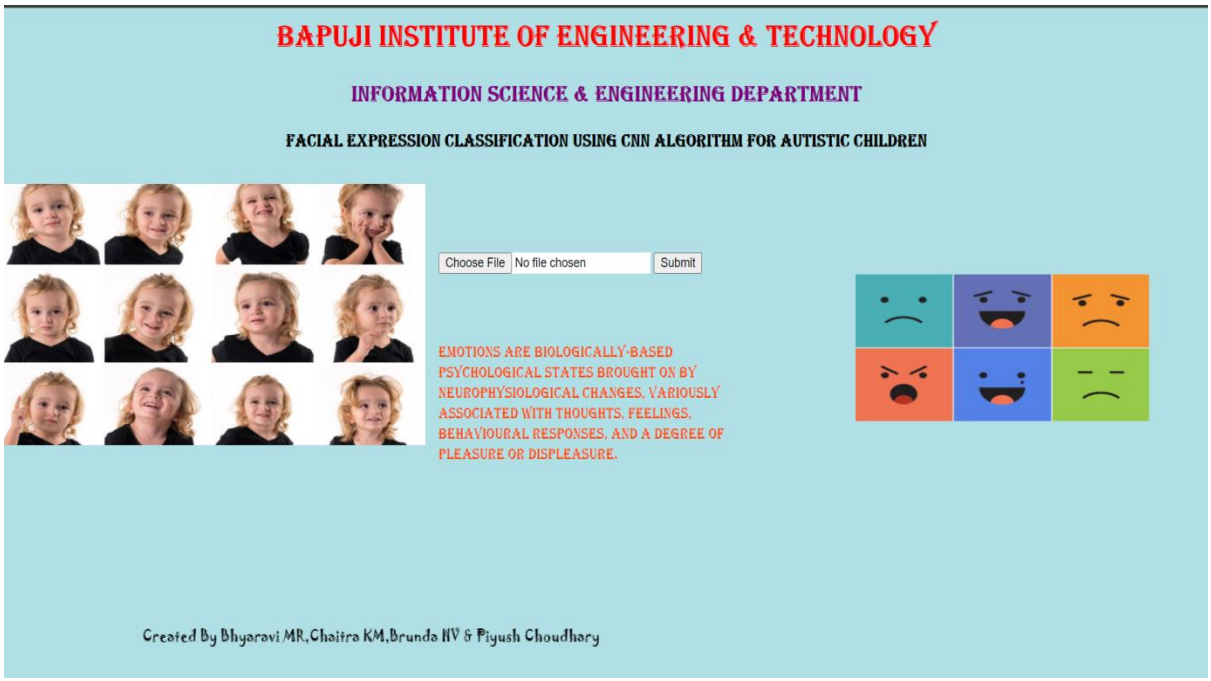


Fig 7.1.1:Front page of facial expression analysis.

Fig 7.1.2:Output classified by our model:HAPPY

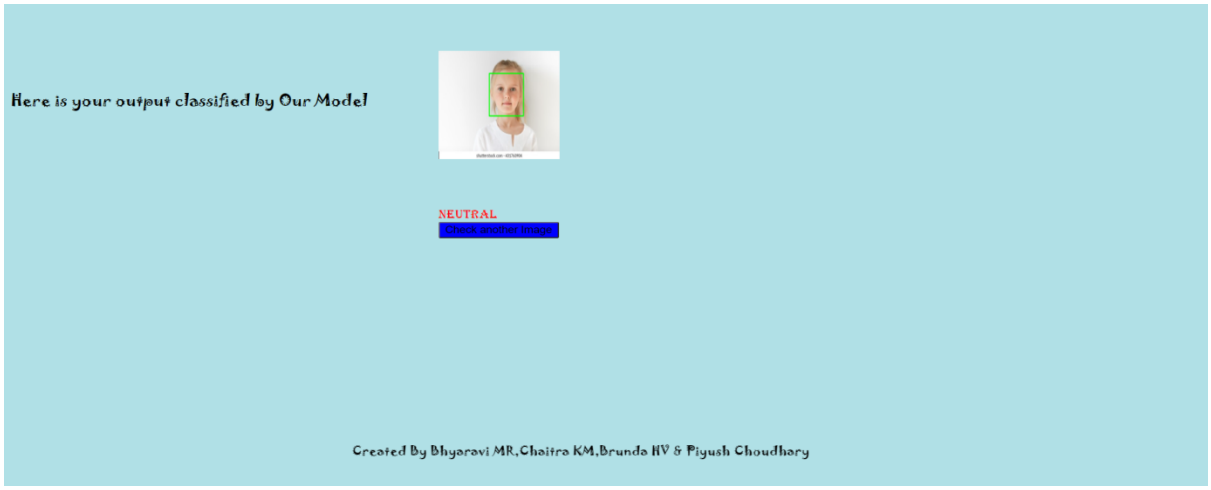


Fig 7.1.3:Output classified by our model: NEUTRAL

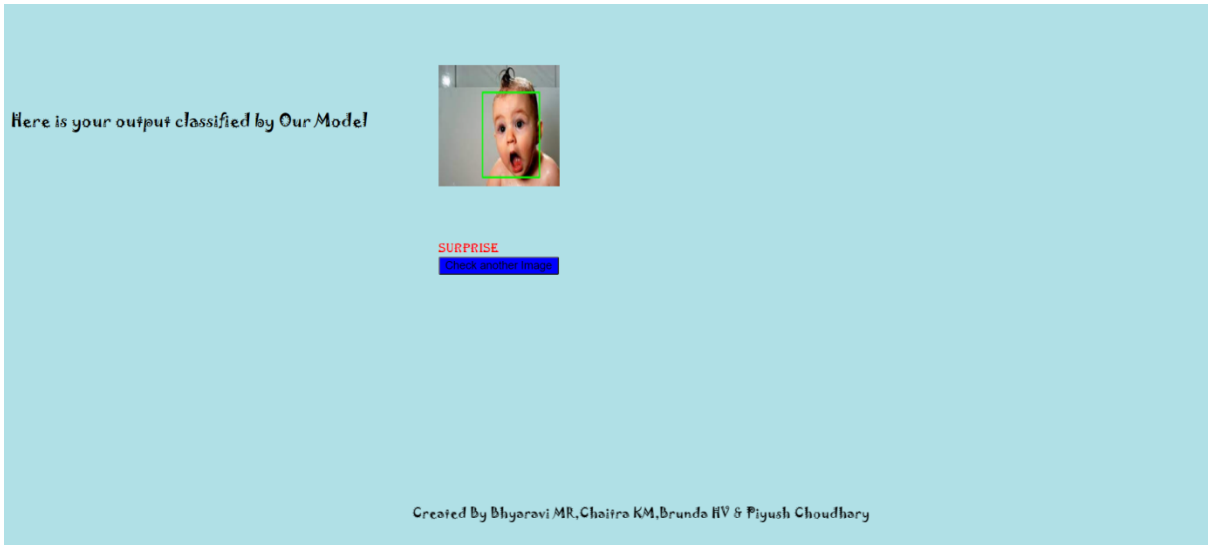


Fig 7.1.4:Output classified by our model: SURPRISE

Fig 7.1.5:Output classified by our model: ANGER

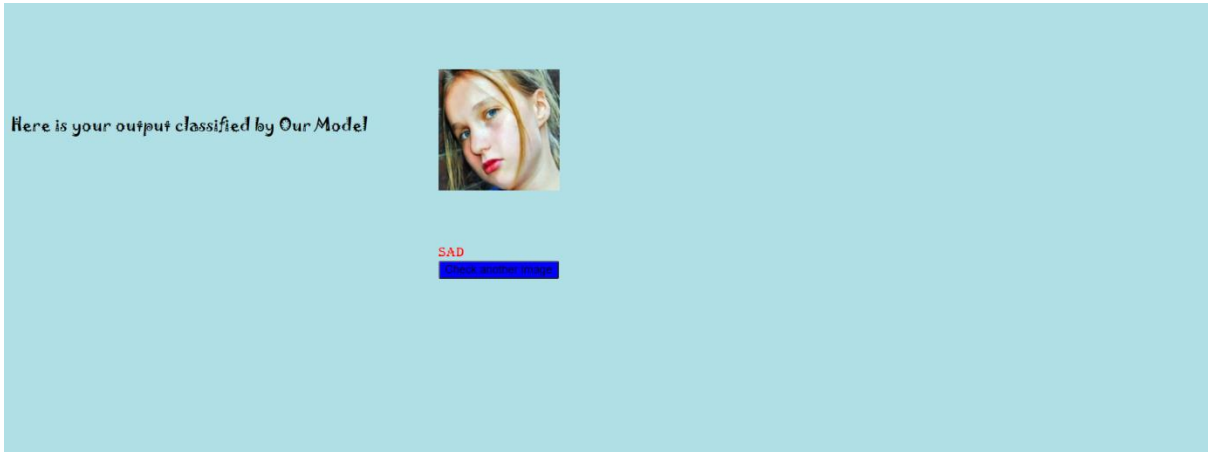


Fig 7.1.6:Output classified by our model: SAD

Fig 7.1.7:Output classified by our model :FEAR

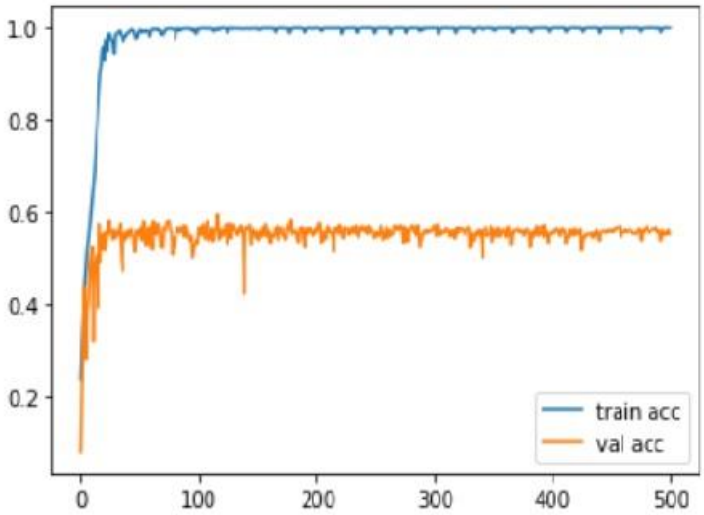


Fig 7.1.8: Accuracy of Training VS Value.

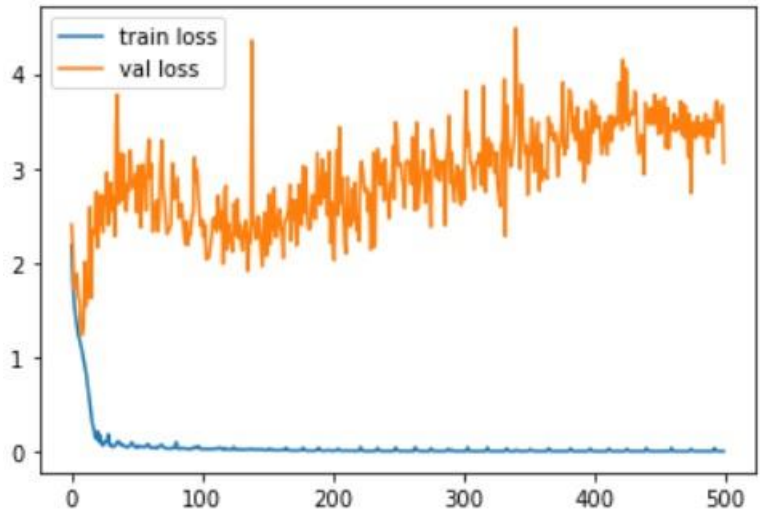


Fig 7.1.9: Accuracy of Training Loss VS Value loss.

7.2 ADVANTAGES AND DISADVANTAGES

ADVANTAGES:

- Facial expression recognition system is important because of its ability to mimic human coding skills. Facial expressions and other gestures convey nonverbal communication cues that play an important role in interpersonal relations.

- By using Facial Emotion Recognition, businesses can process images, and videos in real-time for monitoring video feeds or automating video analytics, thus saving costs and making life better for their users.

- Facial expressions can display personal emotions and indicate an individual's intentions within a social situation. They are extremely important to the social interaction of individuals. Background scenes in which faces are perceived provide important contextual information for facial expression processing.

DISADVANATGES:

- Poor Image Quality Limits Facial Recognition's Effectiveness.
- Data Processing and Storage Can Limit Facial Recognition Tech.
- Small Image Sizes Make Facial Recognition More Difficult.
- Different Face Angles Can Throw Off Facial Recognition's Reliability.

CONCLUSION

Facial Expression is classification of facial features into six basic emotions fear, anger, happy, disgust, sadness and surprise .Specific features from the faces are extracted and classified based on certain algorithms. Facial expression plays an important role in communication and thus identifying the correct expression is as essential as knowing the exact matter of the communication. This project proposes an approach for recognizing the category of facial expressions. Face Detection and Extraction of expressions from facial images has been achieved successfully and is useful in many applications, such as robotics vision, video surveillance, digital cameras, security and human-computer interaction.

This project involves facial expression pre-processing of captured facial images followed by feature extraction using feature extraction using Local Binary Patterns and classification of facial expressions based on training of datasets of facial images based on Support Vector Machines. This project recognizes more facial expressions based on Haarcascade face database. The appropriate emotion is detected and displayed at the position of the each face in the frame.

BIBLIOGRAPHY

[1] " A Review on Facial Expression Based Behavioral Analysis Using Computational Technique for Autistic Disorder Patients", Camellia Ray, Hrudaya Kumar Tripathy, and Sushruta Mishra, pp.450

[2] Suzan Anwar, Mariofanna milanova,"Real Time Face Expression Recognition of Children with Autism", Published Online October-November 2016 in IAEMR, 2016 , Volume-1, ISSUE-1 ,pp.1-15.

[3] MinSeop Lee ,Yun Kyu Lee, Myo-Taeg lim, Tae-Koo Kang ,"Emotion Recognition Using Convolutional Neural Network with Selected Statistical Photoplethysmogram Features", School of Electrical Engineering, Korea University, Seoul 02841, Korea,Department of Human Intelligence and Robot Engineering, Sangmyung University, Cheonan 31066, Korea,2020

[4] Jacob DC Ross, "Understanding Facial Expressions for Autistic Kids", Jacob DC Ross; 1st edition (March 4, 2015)

Websites:

- https://blogs.microsoft.com/ai/happy-sad-angry-this-microsoft-tool-recognizes-emotions-in-pictures/
- https://towardsdatascience.com/emotion-detection-a-machinelearning-project-f7431f652b1f
- https://analyticsindiamag.com/my-first-cnn-project-emotiondetection-using-convolutional- neural-network-with-tpu/
- https://medium.com/themlblog/how-to-do-facial-emotion-recognitionusing-a-cnn-b7bbae79cd8f