DAYANANDA SAGAR UNIVERSITY

KUDLU GATE, BANGALORE – 560068

Bachelor of Technology
in
COMPUTER SCIENCE AND ENGINEERING

Major Project Phase-II Report

"EMOTION RECOGNITION USING CNN"

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(2021-2022)

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CERTIFICATE

This is to certify that the Phase-II project work titled **“EMOTION RECOGNITION USING CNN”** is carried out by **Aanchal Jain(ENG18CS0007), Amogh G Padukone (ENG18CS0032), Banda Preeta (ENG18CS0058), Chaithra K (ENG18CS0066), Haasini T S (ENG18CS0111),** bonafide students of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science andEngineering, during the year **2021-2022**.

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1.

2.

DECLARATION

We, **Aanchal Jain (ENG18CS0007), Amogh G Padukone (ENG18CS0032), Banda Preeta (ENG18CS0058), Chaithra K (ENG18CS0066), Haasini T S (ENG18CS0111),** are students of the eighth semester B.Tech in **Computer Science and Engineering**, at School of Engineering, **Dayananda Sagar University**, hereby declare that the phase-II project titled **"EMOTION RECOGNITION USING CNN"** has been carried out by us and submitted in partial fulfillment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2021-2022**.

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TABLE OF CONTENTS

Page

LIST OF ABBREVIATIONS

CSS	Cascading style sheets
HTML	Hyper Text Markup Language
LAN	Local Area Network
PHP	Pre-Processor Hyper text
CNN	Convolutional Neural Network
Open CV	Open-Source Computer Vision

LIST OF FIGURES

ABSTRACT

Facial expression identification is one of the most fascinating research fields in which numerousscholars have worked for decades. In our paper we have introduces an emotion recognition system based on the convolutional neural network idea (CNN). First the facial expression imageis normalized and the edge of each layer is extracted from the image in the process of convolution. The retrieved edge information is put on each of the feature images to sustain thetexture of the picture's edge structure information. In attempt to lessen the dimensionality of theextracted implicit features, we have used the max pooling method. Finally, the expression of the test sample image is classified and identified using a SoftMax classifier. The purpose of the project is to learn and find information representations from 2-dimensional gray-scale imageryfor the purpose of recognition of facial expression. A built convolutional neural network (CNN)provides the learned features. By cascading different layers together, the created CNN model helps us to learn information from images in a time-saving manner. Because it does not containa high number of layers and handles the overfitting problem at the same time, the developed model is computationally efficient. Using different datasets such as FER- 2013, CK+ and imagedatasets, our suggested approach assists us on focusing on crucial aspects in human faces to detect emotion.

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

1.1 Purpose:

An automatic Facial Expression Recognition system needs to solve the following problems: detection and location of faces in a cluttered scene, facial feature extraction, and facial expression classification. The main aim of this project is to propose a model which achieves higher accuracy rate for facial expression identification through facial images. The model proposed here accepts images as input and this is passed to our CNN model which will further classify the images resulting in the output, the given output is in the form of text. In our model, we can recognize a facial expression based on the different emotion categories mainly angry, neutral, happy, sad, surprise, confident, confused, contempt, fear, sleepy, shy, crying and disgust.

1.2 Scope of the Project:

- It can be used to detect and track a user's state of mind.
- It can be used in marts and shopping centers to know the feedback of the customers in order to enhance the business
- It can also be used for educational purpose such as one can getfeedback on how the student is reacting during the classes.
- It can help people in emotion related research to improve the processing of emotion data.
- It can be used for lie detection amongst criminal suspects during interrogation

CHAPTER 2

PROBLEM DEFINITION

2. PROBLEM STATEMENT

Human emotions and intentions are expressed through facial expressions. Facial expressions convey non-verbal cues which play an important role in interpersonal relations. The automatic recognition of facial expression can be an important component of natural man-machine interface and it can also be used in behavioral science, in clinical practices, intelligent visual surveillance, teleconference and real-time animation from live motion images. The facial expressions are useful for efficient interaction Most research and system in facial expression recognition are limited to six basic expressions (joy, sad, anger, disgust, fear, surprise). It is found that it is insufficient to describe all facial expressions and these expressions are categorized based on facial actions. Detecting face and recognizing the facial expression is a very complicated task when it is a vital to pay attention to primary components like: face configuration, orientation, location where the face is set.

CHAPTER 3

LITERATURE REVIEW

3. LITERATURE SURVEY

Pranav. E *et al* [1] have developed a Deep Convolutional Neural Network (DCNN) model which identifies mainly five different facial emotions. This model is being trained and tested using the manually collected image dataset, here the model uses Adam Optimizer which reduces the loss function hence providing an accuracy of 78.04%. This work can be further used for video sequences.

Bilal T *et al* [2] have extracted two features from grayscale images namely Laplacian of Gaussian (LoG) and LBP. After extraction it would be passed to SVM classifier which is going to handle large number of features during optimization. These features will be compared in the CNN model. They have made use of Bosphours database for conducting the experiment. Overall the model was capable of giving better accuracy about 88.2%. The extraction of facial featureswas quite simple in emotions such as happy class or sad class, but the accuracy was lower when it comes to correlation between these emotional classes such as Anger class with the Fear class and Sad class.

M.A. Ozdemir *et al* [3] have merged three datasets (JAFFE, KDEF andtheir own custom dataset) to train CNN model. Here they have used LeNet architecture for emotion classification which in turn resulted in accuracy of 91.81%. Also they have used HaarCascade library which helped in removing the effect of unimportant pixels due to which training time and number of networks were reduced.

S. Begaj *et al* [4] have used iCV MEFED (Multi-Emotion Facial Expression Dataset) as their main dataset in their CNN model. It is a relatively new dataset and quite a challenging one, hence, giving 74.3% accuracy. Certain emotions such as contempt and sadness were underpredicted, whereas angry, disgust, surprise and fear were overpredicted. The authors suggest using the same dataset but trying a different approach into consideration.

L. Zhang *et al* [5] have proposed a model which predicts only infant expressions, they have used IFER as well as self-built data. Since their self-built dataset was quite limited, therefore the images were extracted from the horizontal and vertical directions by improving the LBP and Sobel edge detection operators which played an important part as it helps the network to obtain the most striking part from each image and effectively overcomes the problem of baby's facial contour. The model achieved 91.67% accuracy using a combination of handmade features and a multistream CNN fusion network.

A. Ghofrani *et al* [6] have employed MTCNN (Multi-Task Convolutional Neural Network) to find out the boundaries of the face with less residual margins, also they have used of ShuffleNet V2 architecture which is able to tradeoff between the accuracy and the speed of the running CNN model. The combination of these two results in prediction of facial expression in real time, this model resulted in the accuracy of 71.19%.

R. Subramanian *et al* [7] have created a CNN model to detect emotions in real time by using Keras, OpenCV and TensorFlow. They have made use of the FER2013 dataset. By keeping the SoftMax layer as the model's final layer has led to more accuracy. The model has attained an overall test accuracy of 89% in detection and classification of emotion in real-time.

A. Kumar *et al* [8] compared their CNN based model with other machine learning classification algorithm such as Support Vector Machine (SVM), K Nearest Neighbours (KNN) and Naive Bayes classifier by evaluating them with the presence of various kinds of noises such as Gaussian Noise and Salt and Pepper Noise. This paper showed how CNN model is able to extract various facial features from the images with its performance not being affected significantly by the presence of large amount of noise. Whereas other ML classification models failed to recognise the emotions due to the presence of the noise.

K.C Liu *et al* [9] has proposed Average Weighting Method to reduce the potential errors while capturing real-time facial expression for recognition. External factors such as influence of light can change the characteristic of image while capturing in real time, so this problem is being overcome by this model. The method refers to previously taken images, later averages the weights between the prior and the current recognition, based on this the errors are reduced, hence making the CNN architecture more robust.

CHAPTER 4

PROJECT DESCRIPTION

4. PROJECT DESCRIPTION

4.1. Proposed Design

The proposed method makes use of CNN for producing the results, firstthe data set is cleaned and also, we get the images from the dataset, which is passed on to the model for the training process. The training process is explained in detail below. After this the model training is completed for the thirteen-emotion set and the testing process can be carried on in this case which can be used for getting the accuracy, thereby providing an insight for scope of improvement in the model. The compilation of these two processes then we can obtain the results using one of the two models based on the requirement, the options for both are provided.

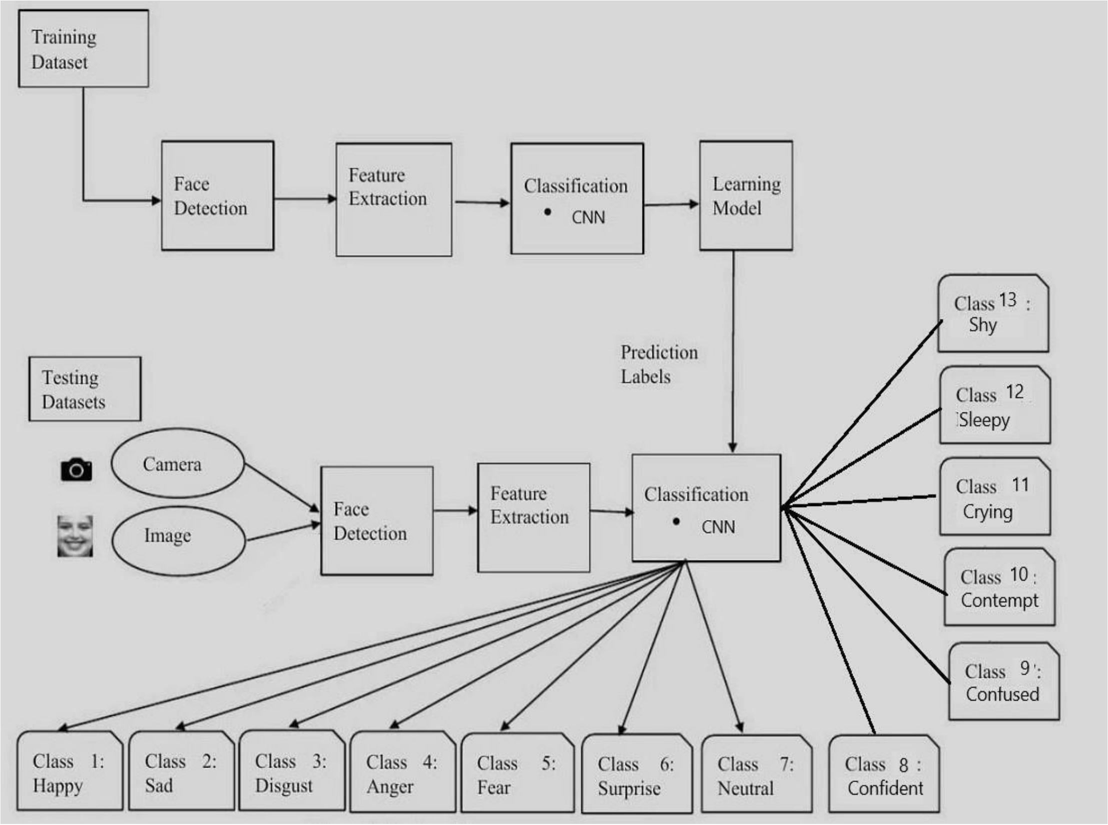


Fig 1: System Architecture

From Fig 2, this neural network model is one of the common methods used for analysing images and frames of images from video or from a live image stream. It provides a different perspective as compared to other models as it has hidden layers called convolutional layers.

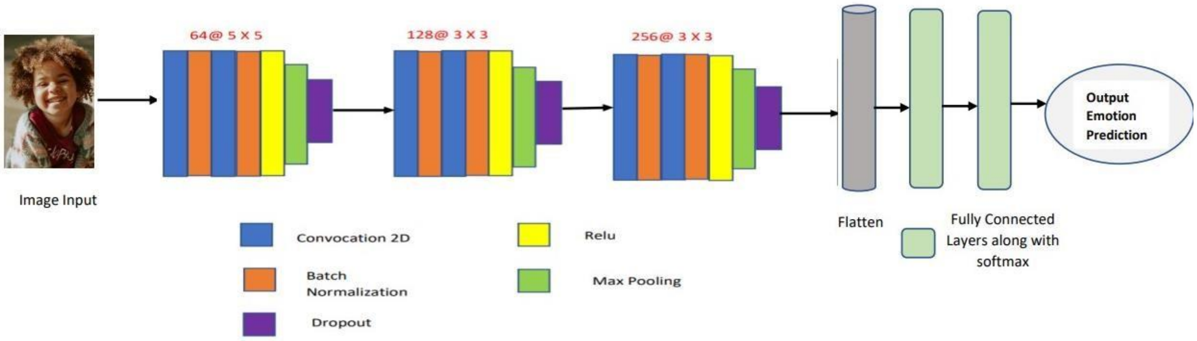


Fig 2: CNN Model

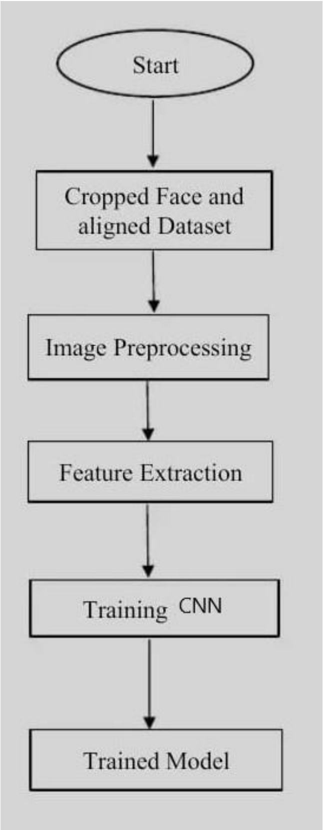


Fig 3: Flowchart of Training

The pre-requirement for this experimentation is first importing the required libraries for building the model. Import NumPy for numerical calculations, Pandas for reading csv file and Keras for developing and evolution of deep learning models and the dataset will be imported. Here, this research work also imports some layers, some Keras library like dense, dropout, Conv2D, Maxpooling2D.Fig 3 and 4 shows the steps to follow for building CNN model.

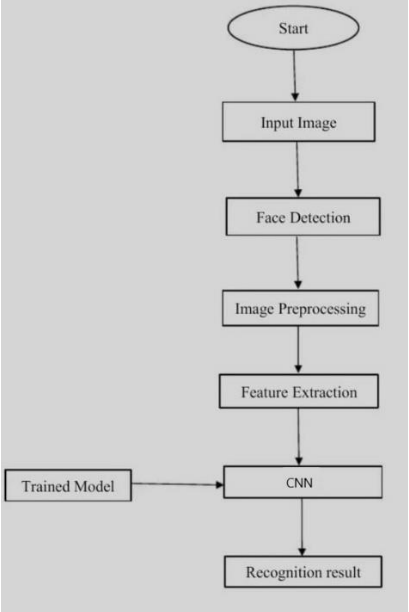


Fig 4: Flow chart of testing/ predicting

4.2. Assumptions and Dependencies

The main assumption that is made will be that there is a proper availability of network and a good wireless or LAN connection. The device has a minimum availability of 1GB memory and enough processing speed.

CHAPTER 5

REQUIREMENTS

5. REQUIREMENTS

This section provides a detailed description of all inputs into and outputs from the system. It also gives a description of the hardware, software and communication interfaces and provides basic prototypes ofthe user interface.

5.1. Functional Requirement

5.1.1 User interface:

A first-time user should see the log-in page when he/she opens the application.

5.1.2 Hardware interfaces:

- Ethernet connection (LAN) OR a wireless adapter (Wi-Fi)
- Hard Drive: Minimum 32 GB; Recommended 64 GB or more
- Processor: Minimum 1 GHz; Recommended 2GHz or more
- Memory (RAM): Minimum 4 GB or above

5.1.3 Software interfaces:

- Jyupter notebook (Google colab)
- Libraries: TensorFlow, Karas, Flask
- Anaconda navigator / Visual studio code Programming
- languages:

  Python

  HTML

  MySQL

  Java script

  CSS

5.2. 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 the non-functional requirements related with this system are hereby below:

a. **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.

b. **Ease of Use:** The system is simple, user friendly, graphics user interface implemented so any can use this system without any difficulties.

- The module should develop using python language ➢ Themodule should give graphs for the results.
- The module Graphical user Interface should be simple andclear ➢ The program should be platform oriented

CHAPTER 6

METHODOLOGY

6. METHEDOLOGY

When a network is designed in order to identify and manage multi- dimensional data like picture or image or frames of images in such a case, we use the concept of convolutional neural network (CNN). The main idea of CNN is for extracting important features and properties, apart from this it can also be used in computation or finding of weights and biases at the time of training. This neural network model is one of the common methods used for analyzing images and frames of images from video or from a live image stream. It provides a different perspective as compared to other models as it has hidden layers called convolutional layers.

The proposed method also uses CNN for producing the results; first thedata set is cleaned and also, we get the images from the dataset, which ispassed on to the model for the training process. The training process is explained in detail below. After this the model training is completed forthe thirteen-emotion set and the testing process can be carried on in thiscase which can be used for getting the accuracy, thereby providing an insight for scope of improvement in the model. The compilation of these two processes then we can obtain the results using one of the two models based on the requirement, the options for both are provided

A. *Live webcam and image upload*

In this case the image input is given from the web-camera then the image will be fed to the model that has been trained. This model formsa box around the face of the person for better feature reading. The model has many hidden layers. The features that are taken into account are eyes, cheek and nose. In case of the image upload the size of image upload is restricted to 48 x 48, the training set used here is in greyscale and of the same size as the upload. The images that are uploaded can be of grayscale or RGB format but with restriction on the resolution.

The box or boundary are not used in case of the image upload. Here also the image emotions are predicted using the same features and have the samenumber of hidden layers as the previous model. The predicted result willbe displayed on the web page for the convenience of the user.

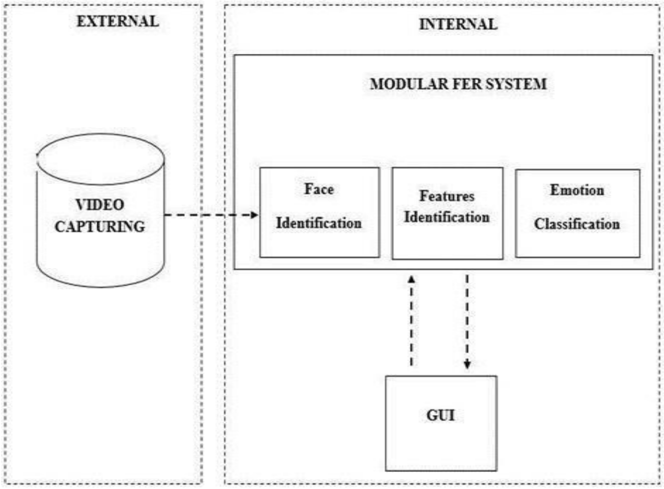


Fig 5: Work Flow

B. *Extraction of face*

A person’s face is captured using a webcam PC or external webcam. In that living smoke the face is removed and all other unwanted parts are not considered. So, we have achieved this efficiency and understandingthat we have used the OpenCV library.

C. *Pre-processing*

Common name for activities with pictures in very low output rate for both input and output are available image stabilization. The purpose of the preliminary processing enhancement of unwanted image data distorts or enhances other important aspects of the input for processing.

i. Face detection and retrieval
ii. Conversion of grayscale
iii. Normalization for the image
iv. Augmentation operations like rotation, flip, shear, zoom etc.

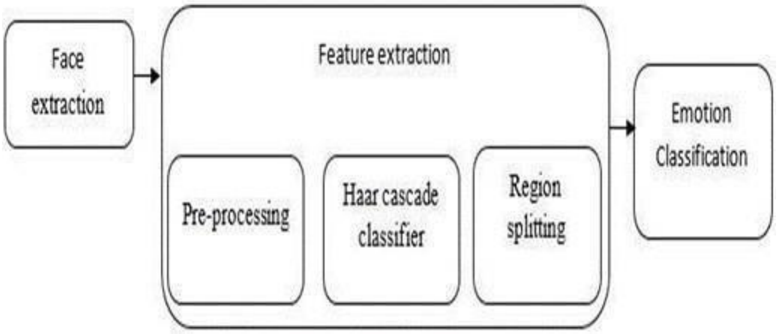


Fig 6: Modules used

D. *Stratified K-Fold*

Stratified k-fold cross-validation is the same as just k-fold cross- validation, But Stratified k-fold cross-validation, it does stratified sampling instead of random sampling. The idea of stratified sampling is chosen over random sampling in machine learning and deep learning models. Stratified K-Fold takes in consideration the imbalance in classification and thereby making predictions more accurate

E. *Haarcascade classifier*

HaarCascade is a used separator, see what is prepared for it, from source. HaarCascade is repaired with a top installation with a good image over many negative images. I training is usually done on the server and in separate categories. Better results are needed using a higher note image and increasing the amount of sections to do filter is adjusted. One can also use the Haar described earlier Affordable Cascades. The Haarcascade classifier depends on the Haarcascade wavelet process for pixel analysis on its image into squares with function. This makes use of entire photo thoughts for separate outstanding registrations. HaarCascades use Ada-help mathematical learning, choosing a few highlights from the main set to give the effect of the separator and use cascading techniques to get a face in a photo.

F. Splitting of Regions

To get emotional attention the main area of the face below considerations are eyebrows and mouth. And the division of the mouth and eyebrows are named as regional divisions. These two will enable the model to be trained in a way to identify the expression by extraction of the abovementioned features.

*G. **Classification of emotions**:*

After a small feature removal function has been completed human reactions are produced simultaneously with their percentage rate. The setting used for this model is Anaconda. The flow of the model process is shown in four main steps starting with database preparation and model validation. These steps are described as A, B, C, and E.

Data set information

i) Fer2013 dataset:

Fer2013 contains human facial images more than 30,000 with size restricted to 48×48.Emotion classes are mainly labelled into 7 types: 0=Angry, 1=Disgust, 2=Fear, 3=Happy, 4=Sad, 5=Surprise, 6=Neutral.While labels have nearly 5,000 samples each, the disgust expression has the minimal number of images, which is below 600.

ii) CK+ dataset:

The Extended Cohn-Kanade (CK+) dataset contains about 593 video sequences. Each video sequence is recorded at 30 frames per second (FPS) with a restricted resolution of 640x490 pixels and depicts a shift in face expression from neutral to a targeted expression.

iii) Custom dataset:

For each expression, there are over 400 images in the dataset. We have created dataset for various facial expressions (such as happy, fear, confused, confident, sad, disgust, contempt, angry, surprised, sleepy).

Construction of custom CNN model

The custom model contains two compatible layers with batch normalization. Then the output of this is given as inputs to other collections between which one group is managed with the convolutional layer and the other collection treated with a see able convolutional layer. Then the results from these layers are followed by my combination of size and earth scale compilation and completion with a SoftMax algorithm.

i) Convolutional 2D:

Convolution 2D is an easy task where you start with a kernel, which contains all the little one's weight matrix. This kernel slides in one step each time with the data to enter and form a matrix multiplication by the matrix element, and then to summarize whole output into a single output pixel. From which we get output of the same size as the input image using zero padding technique.

ii) *Batch Normalization and Max 2D integration:*

Batch normalization is a method used to reduce internal covariance ii) Batch Normalization and Max 2D integration:

Batch normalization is a method used to reduce internal covariance changes in neural networks as well as improves speed, stability and performance in convolutional neural networks. In abundance to combine, a character of n with n X n size is transported across the matrix and in each area the highest value is taken and stored in the corresponding area outgoing matrix.

iii) *Max Pooling*

Max pooling is a pooling operation that selects the maximum element from the region of the feature map covered by the filter. Thus, the output after max-pooling layer would be a feature map containing the most prominent features of the previous feature map

iv) *SoftMax:*

The SoftMax function assumes the actual N vector numbers as input and makes that vector normal values from 0 to 1 This will generally be placed as a last layer for output prediction.

v) *Activation function:*

Reducing the overuse of data usage activities are used. In this model weused the ReLu function. The main role of ReLu is gradient is continually same equal to 1. Negative values for matrix input are always transformed into zero and all the other good ones prices remain unchanged. F

(x) = max (0, x) Optimizer, Loss Function and Metric The loss function is used to measure the total difference between our forecasts and the actual value available in the verification database. Loss function used inthis model cross entropy phase . Cross-entropy loss shows the operationof an input output model with a number of chances between 0 and 1 . Loss of cross-entropy the amount of work output varies as predicted opportunities differ from the actual output. Enhancements are used to minimize job loss by reviewing Neural network attribute values. Optimizer used in our area model Adam () optimizer. Adam represented Flexible Time Rate. Adaptive Moment Measurements are used to calculate variable learning levels for each attribute.

Model training

After all the first steps of data collection, cleaning once to process previously we need to add data to the proposed CNN model. To train the following model, 3 steps are performed on encoded data:

1. Separating data by features and guidelines: First, training Our model requires a set of data training. Train data contains a complete set of flexible (independent) features variable) and target variable(dependent variable). So, we need to distinguish all the features used for prediction targeted variables in our database. The class label isthe only one targeted variable predicted for all variables.

2. Separating data on a set of training and assessment: Wherethere are many ways to measure the separation of a train test but as an exit The data set contains a separate usage column every set of data from the training data set and the test data set Install model: The proposed model builds using CNN algorithm which classifies 7 different categories of emotions. Then a training set is provided. Themodel learns the corresponding emotions from the training set and trains accordingly. Now, model validation time starts when the test is set features are included in the model and the target variable predictions

The model

We have created two custom models one having (48,48,3) input and the other having (48,48,1) input. In the other words the model that is used for input has a depth of 3 whereas the model that is used for the webcam has a depth of 1 and the input image size in both cases is 48X48 pixels. The custom model is a sequential model has Conv2D, Batch normalization, Max-pooling and Dropout layers. There are 13 classes of emotions that are being classified with the batch size of512 and input image dimensions of 48 x 48. Apart from these layers there are two dense and one flattened layer used in the custom model. In first dense layer the activation function used here is a Relu activation function (Exponential linear unit) this aims to provide faster and accurate results, the final dense layer is the activation layer and the activation function used is a SoftMax activation function. We have used a 10-fold stratified function along with 50 epochs to provide the best possible results. The model is compiled with a categorical cross entropy loss function that is mainly used in case of multiclass classification. It uses the Adam optimizer which intends to provide high speed computation along with the advantage that it requires fewer parameters fortuning. The model is also built in such a way that it provides the accuracy matrices.

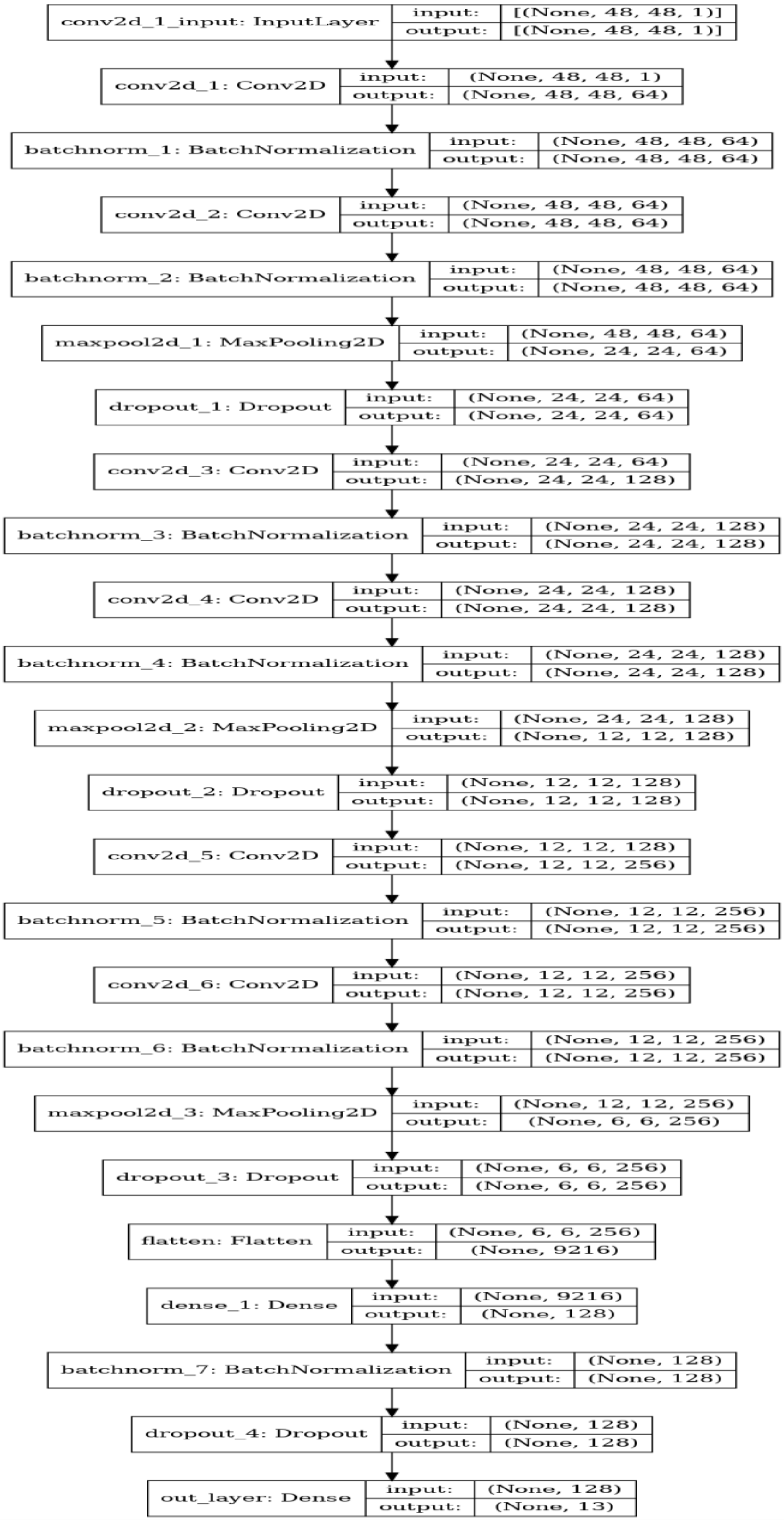

conv2d_1_input: InputLayer | input: [(None, 48, 48, 1)] | output: [(None, 48, 48, 1)]
conv2d_1: Conv2D | input: (None, 48, 48, 1) | output: (None, 48, 48, 64)
batchnorm_1: BatchNormalization | input: (None, 48, 48, 64) | output: (None, 48, 48, 64)
conv2d_2: Conv2D | input: (None, 48, 48, 64) | output: (None, 48, 48, 64)
batchnorm_2: BatchNormalization | input: (None, 48, 48, 64) | output: (None, 48, 48, 64)
maxpool2d_1: MaxPooling2D | input: (None, 48, 48, 64) | output: (None, 24, 24, 64)
dropout_1: Dropout | input: (None, 24, 24, 64) | output: (None, 24, 24, 64)
conv2d_3: Conv2D | input: (None, 24, 24, 64) | output: (None, 24, 24, 128)
batchnorm_3: BatchNormalization | input: (None, 24, 24, 128) | output: (None, 24, 24, 128)
conv2d_4: Conv2D | input: (None, 24, 24, 128) | output: (None, 24, 24, 128)
batchnorm_4: BatchNormalization | input: (None, 24, 24, 128) | output: (None, 24, 24, 128)
maxpool2d_2: MaxPooling2D | input: (None, 24, 24, 128) | output: (None, 12, 12, 128)
dropout_2: Dropout | input: (None, 12, 12, 128) | output: (None, 12, 12, 128)
conv2d_5: Conv2D | input: (None, 12, 12, 128) | output: (None, 12, 12, 256)
batchnorm_5: BatchNormalization | input: (None, 12, 12, 256) | output: (None, 12, 12, 256)
conv2d_6: Conv2D | input: (None, 12, 12, 256) | output: (None, 12, 12, 256)
batchnorm_6: BatchNormalization | input: (None, 12, 12, 256) | output: (None, 12, 12, 256)
maxpool2d_3: MaxPooling2D | input: (None, 12, 12, 256) | output: (None, 6, 6, 256)
dropout_3: Dropout | input: (None, 6, 6, 256) | output: (None, 6, 6, 256)
flatten: Flatten | input: (None, 6, 6, 256) | output: (None, 9216)
dense_1: Dense | input: (None, 9216) | output: (None, 128)
batchnorm_7: BatchNormalization | input: (None, 128) | output: (None, 128)
dropout_4: Dropout | input: (None, 128) | output: (None, 128)
out_layer: Dense | input: (None, 128) | output: (None, 13)

Fig 7: Summary of CNN Model

CHAPTER 7

EXPERIMENTATION

7. EXPERIMENTATION

The model

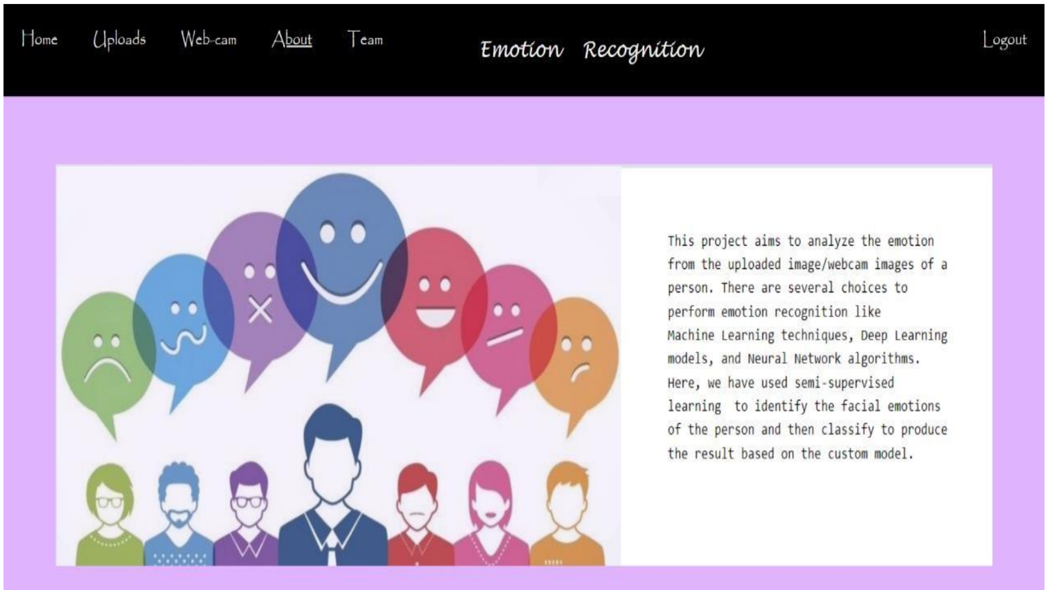
While creating a deep-learning model we want our model to be robust and accurate. To do so we needed an evaluation technique, in order to make sure that the model can perform well on unseen data, we use a re-sampling technique, called Cross-Validation. Here K-fold cross-validation technique is being used. The data is split into 10 stratified folds using the StratifiedKFold function in Sci-Kit Learn and have used those folds to train and test a model before exporting all the splits to csv files.

```
skf = StratifiedKFold(n_splits=10, shuffle=True)
skf.get_n_splits(X, Y)
foldNum=0
for train_index, val_index in skf.split(X, Y):

#First cut all images from validation to train (if any exists)

transferAllClassBetweenFolders('val', 'train', 1.0)
foldNum+=1
print("Results for fold",foldNum)
X_train, X_val = X[train_index], X[val_index]
Y_train, Y_val = Y[train_index], Y[val_index]

# Move validation images of this fold from train folder to the validation folder

for eachIndex in range(len(X_val)):
classLabel=''
for i in range(len(classLabels)):
if(Y_val[eachIndex]==i):
classLabel=classLabels[i]

#Then, copy the validation images to the validation folder

shutil.move(datasetFolderName+'/train/'+classLabel+'/'+X_val[eachIndex],
datasetFolderName+'/val/'+classLabel+'/'+X_val[eachIndex])

train_datagen = ImageDataGenerator(
rescale=1./255,
zoom_range=0.20,
fill_mode="nearest")

validation_datagen = ImageDataGenerator(rescale=1./255)
test_datagen = ImageDataGenerator(rescale=1./255)
```

```
#Start ImageClassification Model

train_generator = train_datagen.flow_from_directory(
train_path,
target_size=(img_rows, img_cols),
batch_size=batch_size,
class_mode='categorical',
subset='training')
validation_generator = validation_datagen.flow_from_directory(
validation_path,
target_size=(img_rows, img_cols),
batch_size=batch_size,
class_mode=None, # only data, no labels
shuffle=False)

# fit model

history=model.fit_generator(train_generator,
epochs=30,
callbacks = [es, mc])
predictions = model.predict_generator(validation_generator, verbose=1)
yPredictions = np.argmax(predictions, axis=1)
true_classes = validation_generator.classes

# evaluate validation performance

print("***Performance on Validation data***")
valAcc, valPrec, valFScore = my_metrics(true_classes, yPredictions)
```

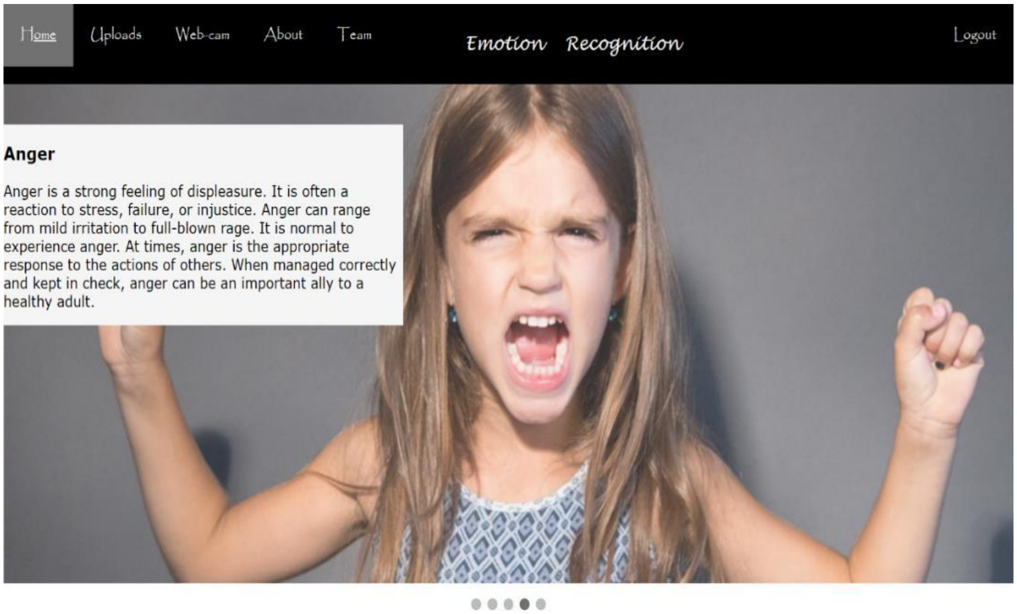
The Website

Our website is being created using HTML, CSS and JavaScript. It contains many webpages which are Home, Uploads, Web-cam, About, Team. Before we need to login to the website where we need to enter the username and password. There is also a register page where the user can sign up. The database part is done using MySQL.



This project aims to analyze the emotion from the uploaded image/webcam images of a person. There are several choices to perform emotion recognition like Machine Learning techniques, Deep Learning models, and Neural Network algorithms. Here, we have used semi-supervised learning to identify the facial emotions of the person and then classify to produce the result based on the custom model.

Fig 8: The About page of the website



Anger

Anger is a strong feeling of displeasure. It is often a reaction to stress, failure, or injustice. Anger can range from mild irritation to full-blown rage. It is normal to experience anger. At times, anger is the appropriate response to the actions of others. When managed correctly and kept in check, anger can be an important ally to a healthy adult.

Fig 9: The Home page of the website

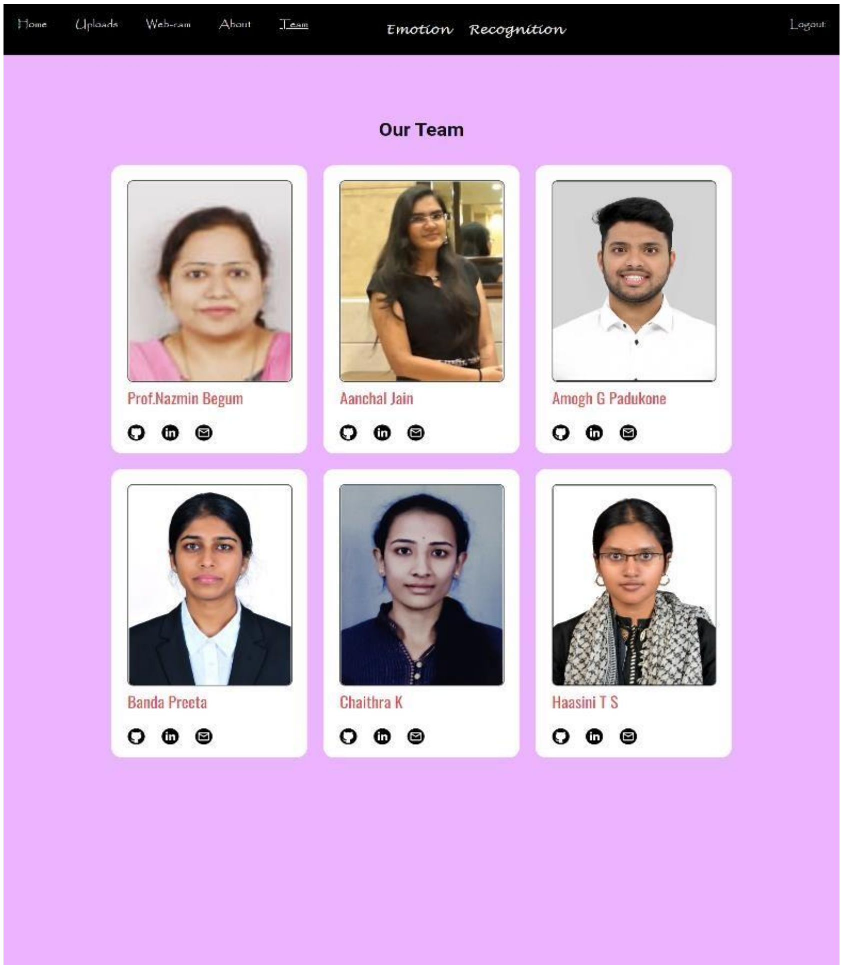


Fig 10: The Team page of the website

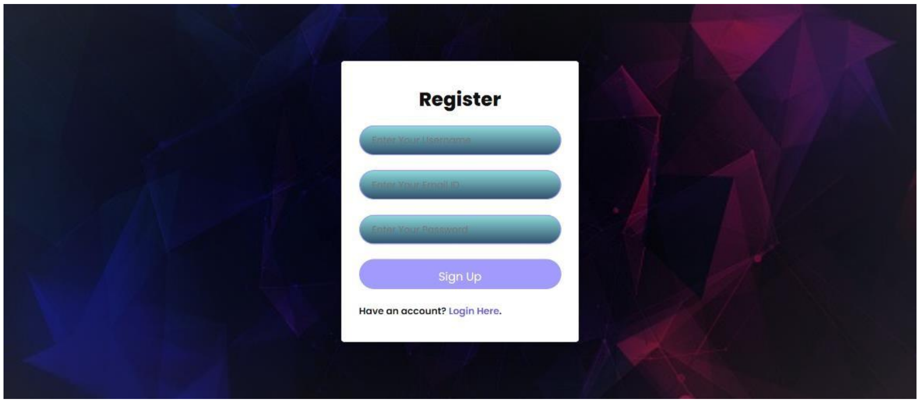
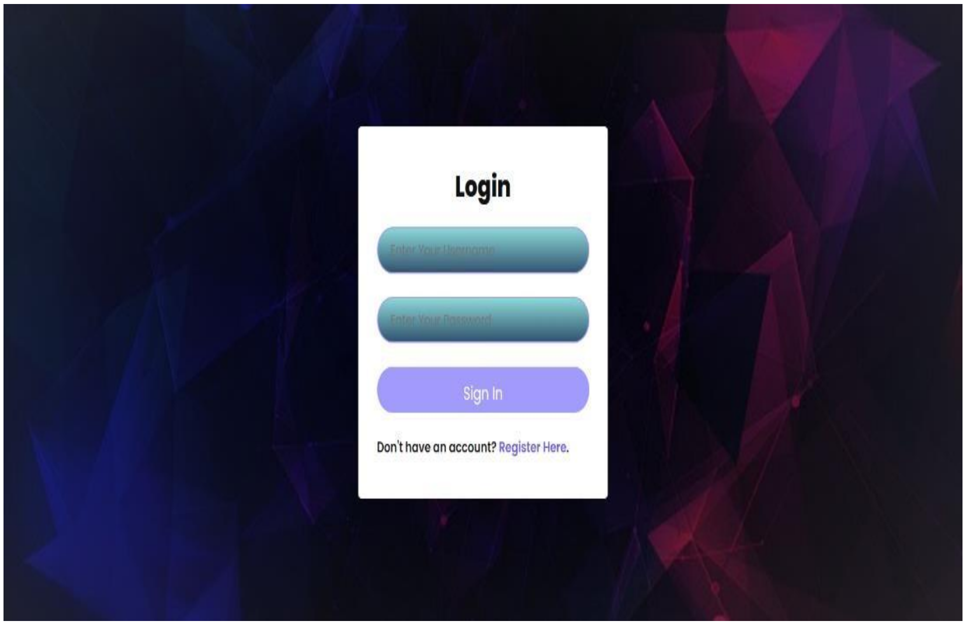


Fig 11: The Register page of the website



Don't have an account? Register Here.

Fig 12: The login page of the website

FLASK

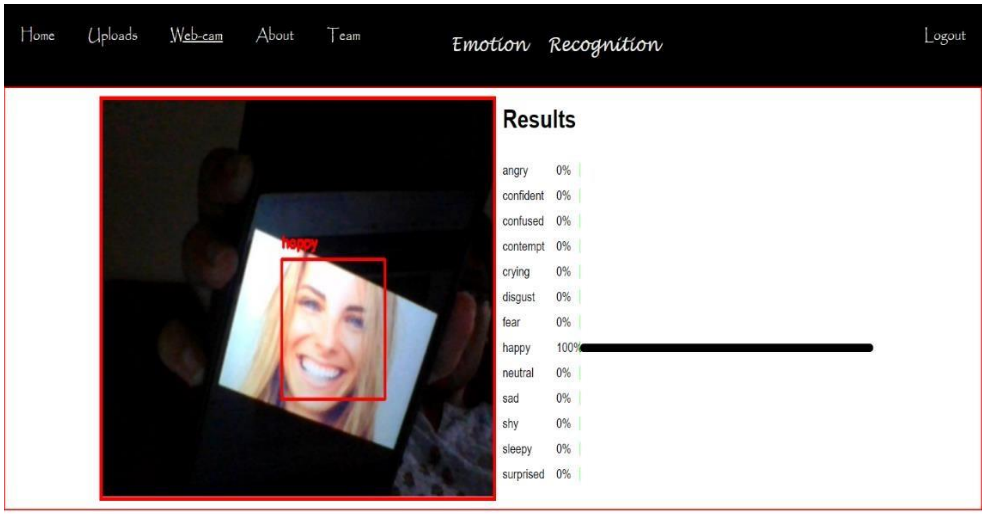
The website and the model is being connected with the help of Flask. Flask is a web framework, it’s a Python module and acts as the interface between the frontend and the backend.

CHAPTER 8

TESTING AND RESULTS

8. TESTING AND RESULTS

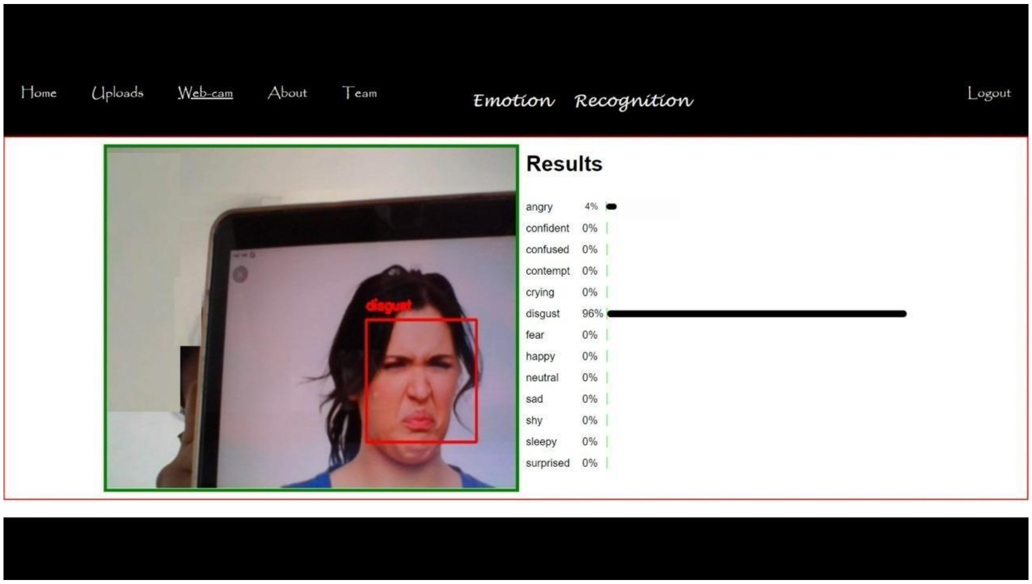
Although the proposed model is trained in integrated databases, it has been successful in gaining 97.73% validation accuracy. This model succeeded in saving it a high level of recognition that is almost equal in each class as it can distinguish geometrically removed facial images. However, there is a slight variation in the level of recognition between thirteen classes, still better compared to the existing models. Proposed model, a convolutional neural network with data augmentation, has always been successfully achieving 97.73% verification accuracy i.e. the highest accuracy in our experiment of facial emotion recognition. This model has succeeded in keeping it high and almost equal the level of recognition of each class as it can differentiate.



Results

angry	0%
confident	0%
confused	0%
contempt	0%
crying	0%
disgust	0%
fear	0%
happy	100%
neutral	0%
sad	0%
shy	0%
sleepy	0%
surprised	0%

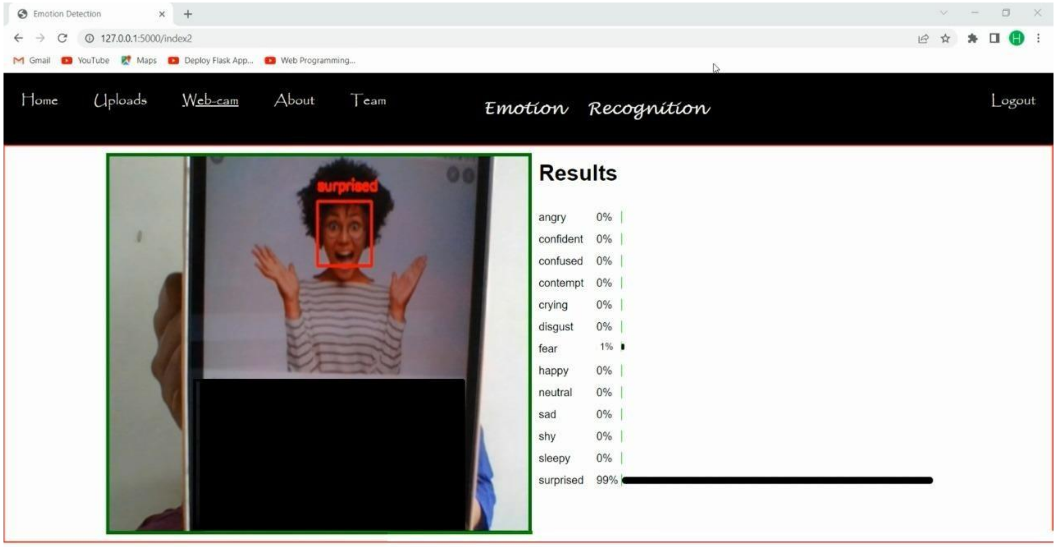
Fig 13: Depicting happy emotion in real time



Results

angry	4%
confident	0%
confused	0%
contempt	0%
crying	0%
disgust	96%
fear	0%
happy	0%
neutral	0%
sad	0%
shy	0%
sleepy	0%
surprised	0%

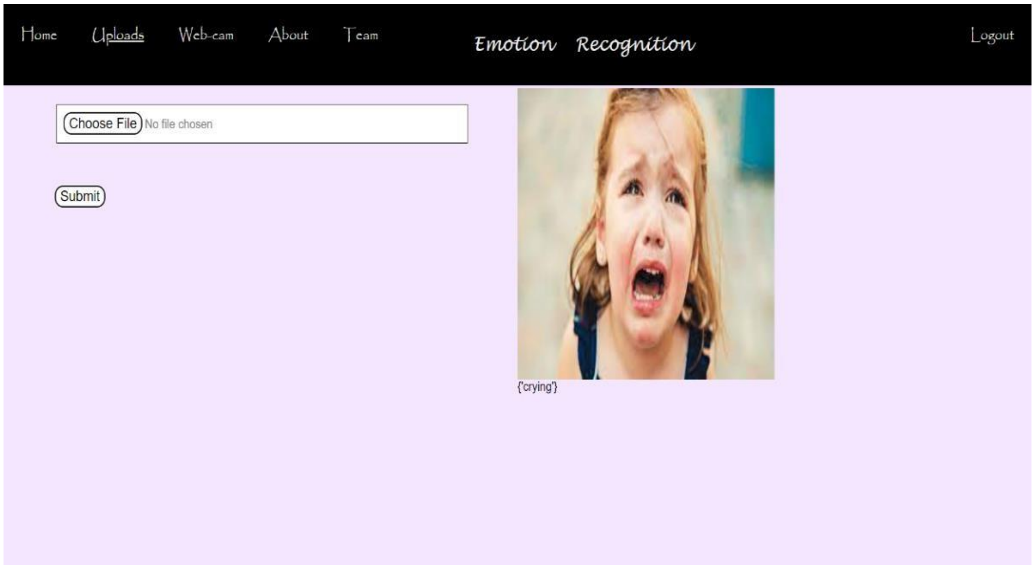
Fig 14: Depicting disgust emotion in real time



Results

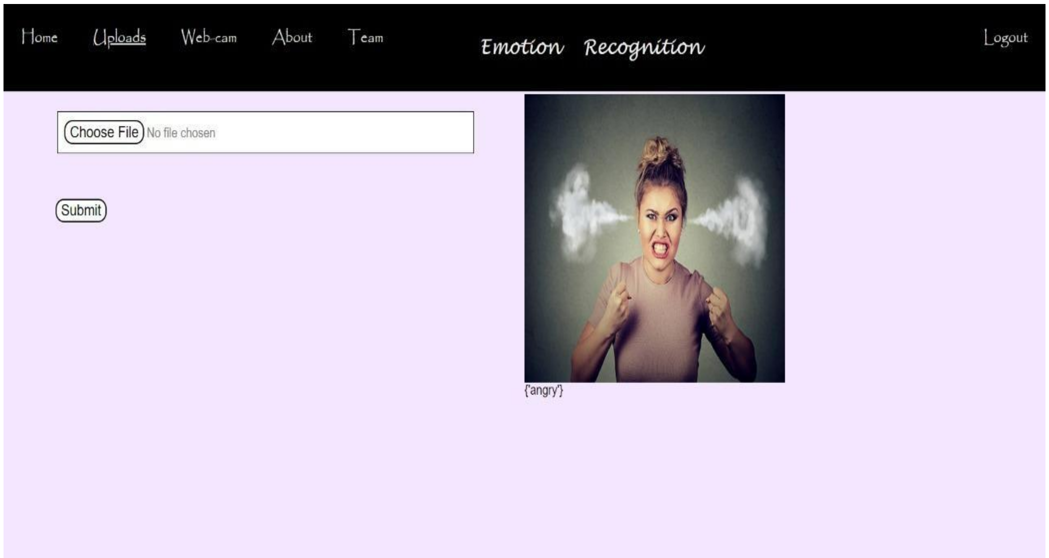
angry	0%
confident	0%
confused	0%
contempt	0%
crying	0%
disgust	0%
fear	1%
happy	0%
neutral	0%
sad	0%
shy	0%
sleepy	0%
surprised	99%

Fig 15: Depicting surprised emotion in real time



{'crying'}

Fig 16: Depicting crying emotion for image upload



{'angry'}

Fig 17: Depicting angry emotion for image upload

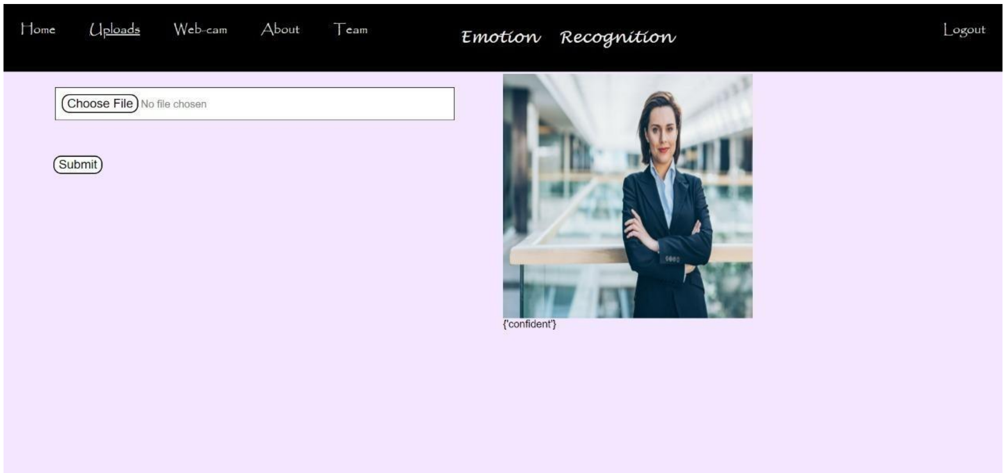


Fig 18: Depicting confident emotion for image upload

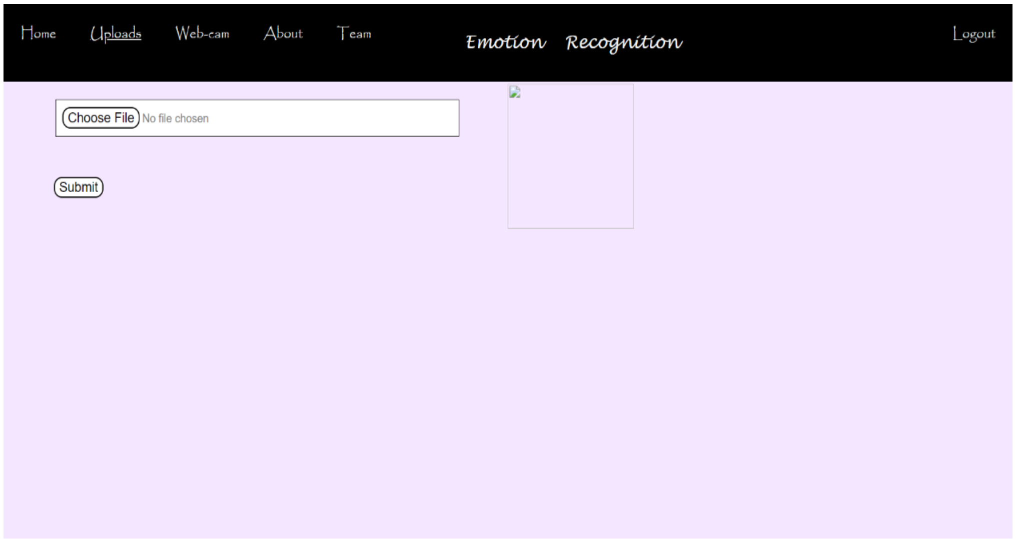


Fig 19: Depicting the result when no image is uploaded

In the Fig 20 we can see that the accuracy is predicted for both testing and training dataset. It is observed that the model accuracy of thetraining data set is more as compared to the testing dataset.

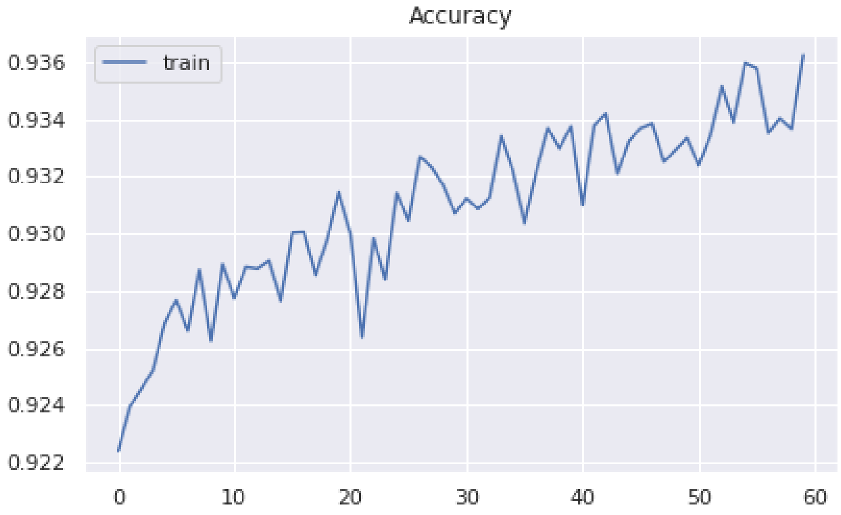


Fig 20: The plot shows the training and testing accuracy of model for 60 epoch

In the Fig 21 we can see that the loss is predicted for both testing and training dataset. It is observed that the model loss of the training data set is less as compared to the testing dataset.

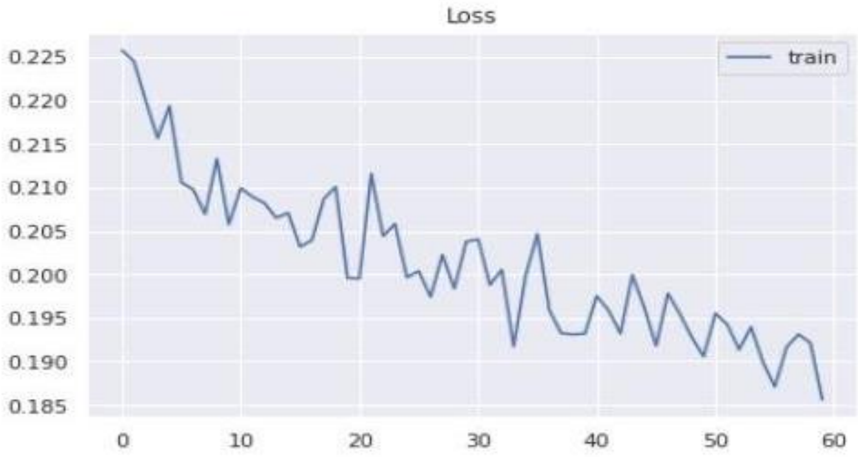
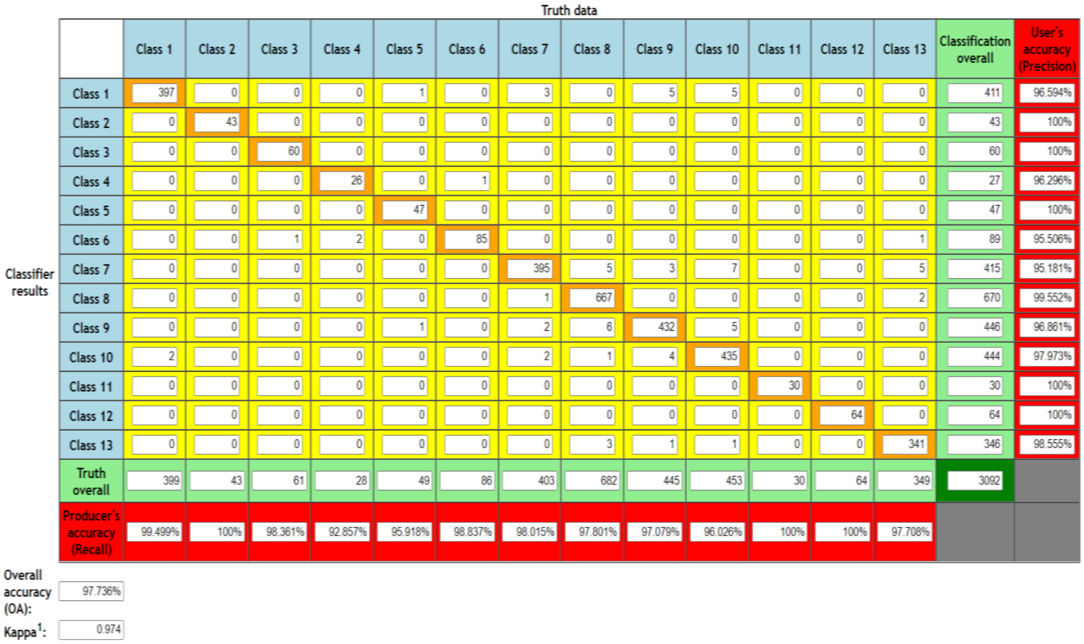


Fig 21: The plot shows the training and testing loss for 60 epoch

The below Fig 22 represents the confusion matrix of the given model that clasifiys emotions in 13 classes namely class 1 as angry, class 2 as confident, class 3 as confused, class 4 as contempt, class 5 as crying, class 6 as disgust, class 7 as fear, class 8 as happy, class 9 as neutral, class 10 as sad, class 11 as shy, class 12 as sleepy and class 13 as surprised.



Truth data

Classifier results

	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Classification overall	User's accuracy (Precision)
Class 1	397	0	0	0	1	0	3	0	5	5	0	0	0	411	96.594%
Class 2	0	43	0	0	0	0	0	0	0	0	0	0	0	43	100%
Class 3	0	0	60	0	0	0	0	0	0	0	0	0	0	60	100%
Class 4	0	0	0	26	0	1	0	0	0	0	0	0	0	27	96.296%
Class 5	0	0	0	0	47	0	0	0	0	0	0	0	0	47	100%
Class 6	0	0	1	2	0	85	0	0	0	0	0	0	1	89	95.506%
Class 7	0	0	0	0	0	0	395	5	3	7	0	0	5	415	95.181%
Class 8	0	0	0	0	0	0	1	667	0	0	0	0	2	670	99.552%
Class 9	0	0	0	0	1	0	2	6	432	5	0	0	0	446	96.861%
Class 10	2	0	0	0	0	0	2	1	4	435	0	0	0	444	97.973%
Class 11	0	0	0	0	0	0	0	0	0	0	30	0	0	30	100%
Class 12	0	0	0	0	0	0	0	0	0	0	0	64	0	64	100%
Class 13	0	0	0	0	0	0	0	3	1	1	0	0	341	346	98.555%
Truth overall	399	43	61	28	49	86	403	682	445	453	30	64	349	3092	
Producer's accuracy (Recall)	99.499%	100%	98.361%	92.857%	95.918%	98.837%	98.015%	97.801%	97.079%	96.026%	100%	100%	97.708%		

Overall accuracy (OA):	97.736%
Kappa[1]:	0.974

Fig 22.: Confusion Matrix

CHAPTER 9

CONCLUSION AND FUTURE SCOPE

9. CONCLUSION AND FUTURE SCOPE

9.1. Conclusion

The proposed model has obtained higher verification accuracy than any other available model. No conflicts between groups as our model fits well with the data. However, plan to work on a complex type or mixed group of emotions, such as a happy shock, surprised by frustration, dissatisfaction with anger, surprise with grief, and so on. As illustrated in our Confusion Matrix Fig -22, the system performed the best when it came to detecting happy faces. The work done by us improved the model's performance, allowing it to distinguish distinct emotions in various lighting and postures. We began by developing and training themodel so that it is capable of recognizing and classifying facial expression in real time. The model was accurate; however, it took a long time to train the data.

9.2. Future Scope

Future research includes exploring the many types of human variables such as personality traits, age, and gender that affect the functioning of emotional detection. The increasing availability of large medical data has necessitated the use of machine learning methods revealing hidden health care patterns. In addition, and focus on the psychological or emotional factors of the man or woman you serve as a mentor as well he leads the situation depending on the moral. Apart from this, the authors will try to refine the model more so accurately that a natural way to recognize facial expressions can be given.

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APPENDIX

CNN

In deep learning, a convolutional neural network (CNN/ConvNet) is a class of deep neural networks, most commonly applied to analyze visual imagery. Now when we think of a neural network, we think about matrix multiplications but that is not the case with ConvNet. It uses a special technique called Convolution. Now in mathematics convolution is a mathematical operation on two functions that produces a third function that expresses how the shape of one is modified by the other

OPEN CV

OpenCV is the huge open-source library for the computer vision, by using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features

FLASK

Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions.

KERAS

Keras is a high-level, deep learning API developed by Google for implementing neural networks. It is written in Python and is used to make the implementation of neural networks easy. It also supports multiple backend neural network computation.

K-FOLD

K-Fold is validation technique in which we split the data into k-subsets and the holdout method is repeated k-times where each of the k subsets are used as test set and other k-1 subsets are used for the training purpose.

STRATIFIED K-FOLD

Stratified kfold cross validation is an extension of regular kfold cross validation but specifically for classification problems where rather than the splits being completely random, the ratio between the target classes is the same in each fold as it is in the full dataset.

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We have successfully published a paper entitled “EMOTION RECOGNITION USING CNN” in International Journal for Researchin Engineering Application & Management (IJREAM), in Vol-07, Issue-10, JAN 2022 Page 124 - 127

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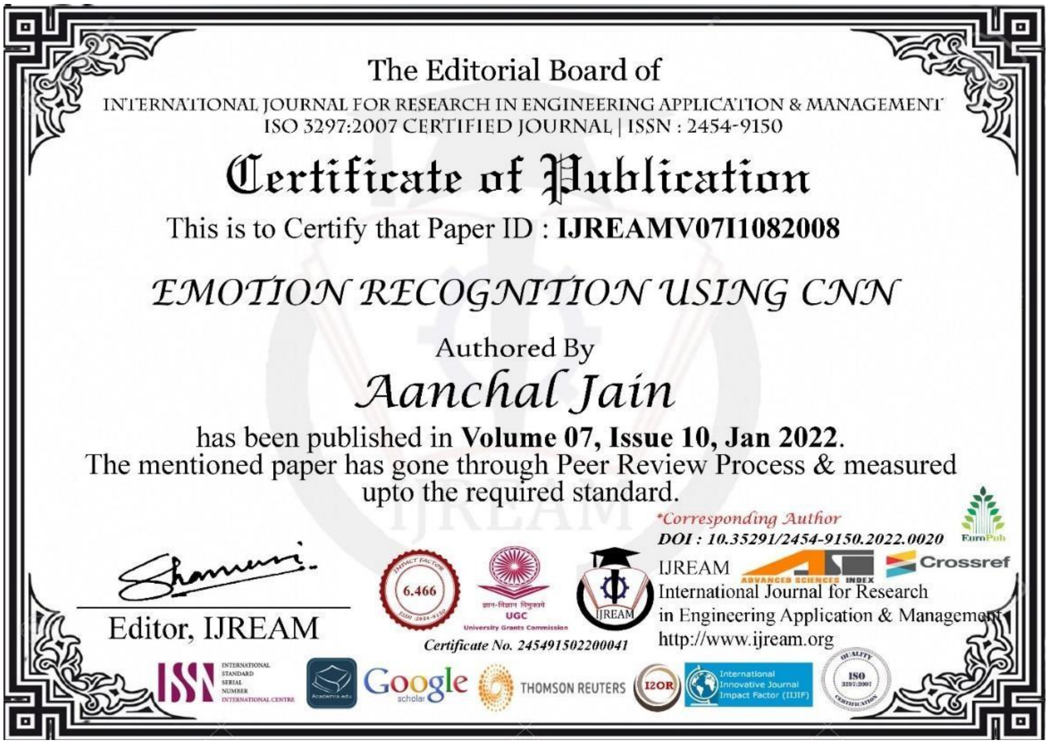

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Aanchal Jain

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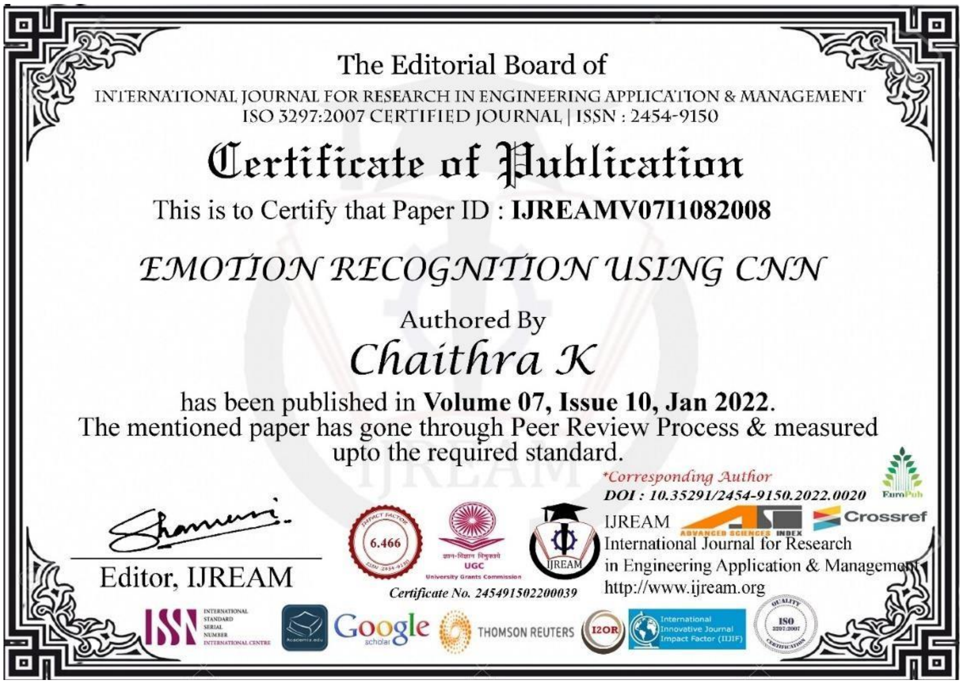

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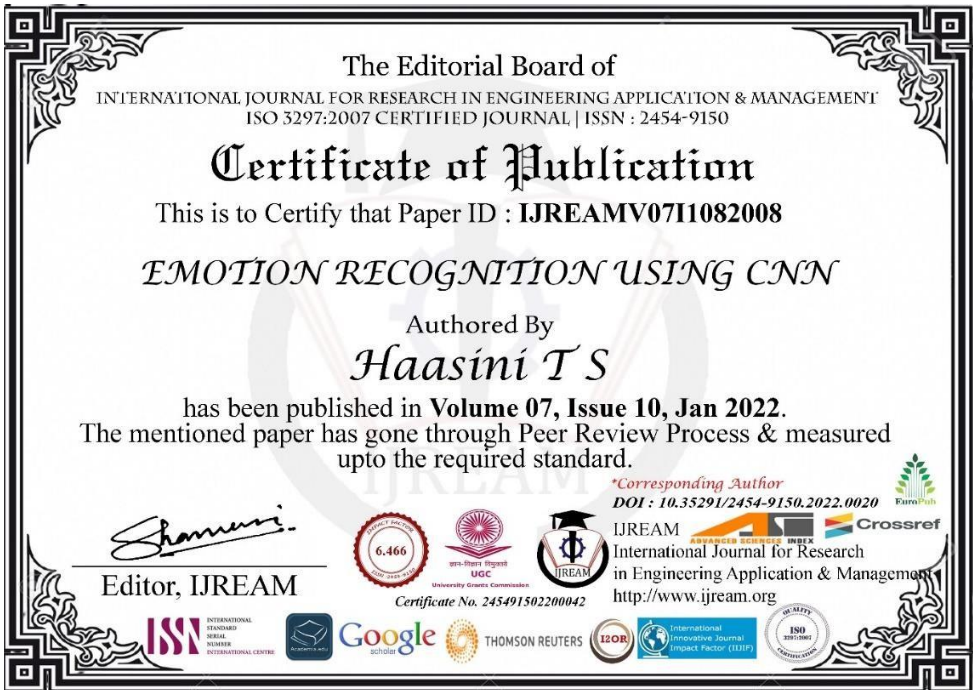

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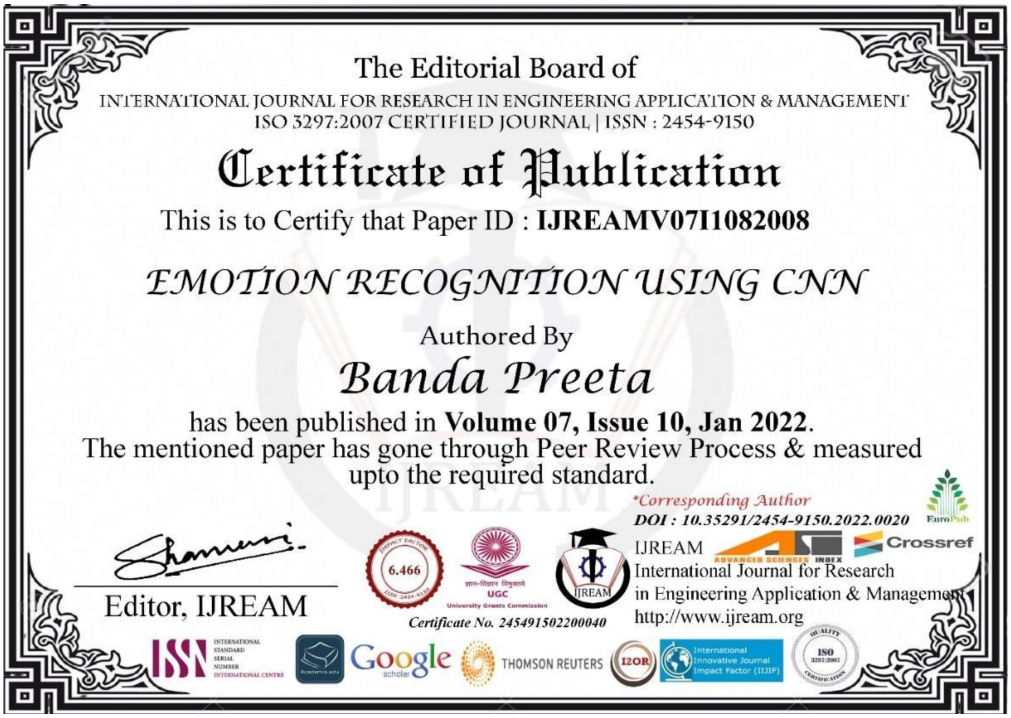

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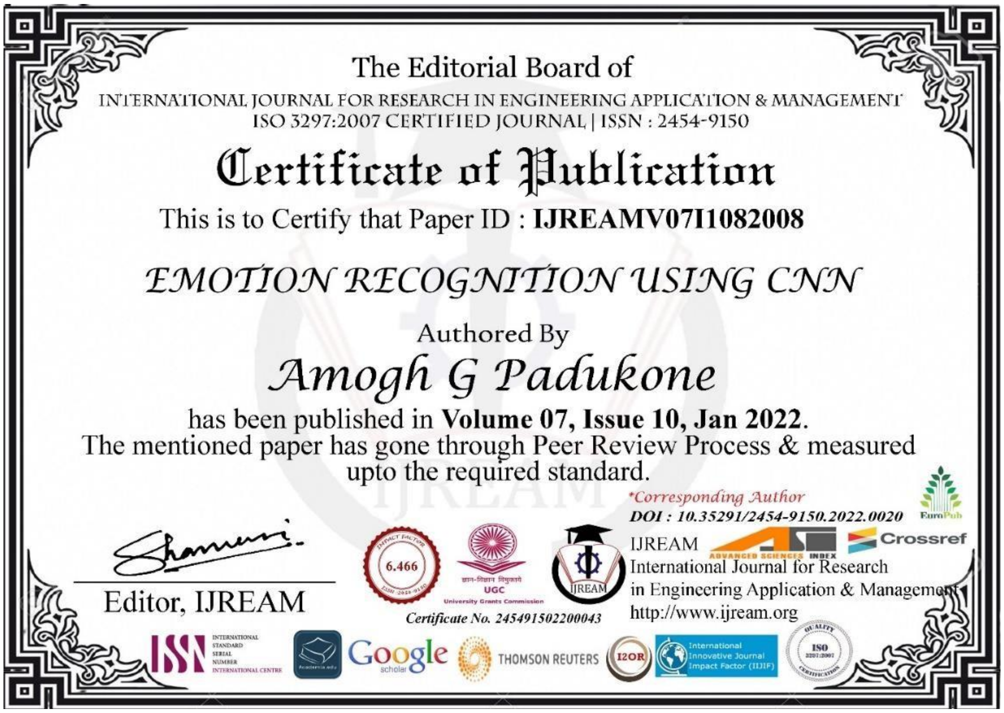

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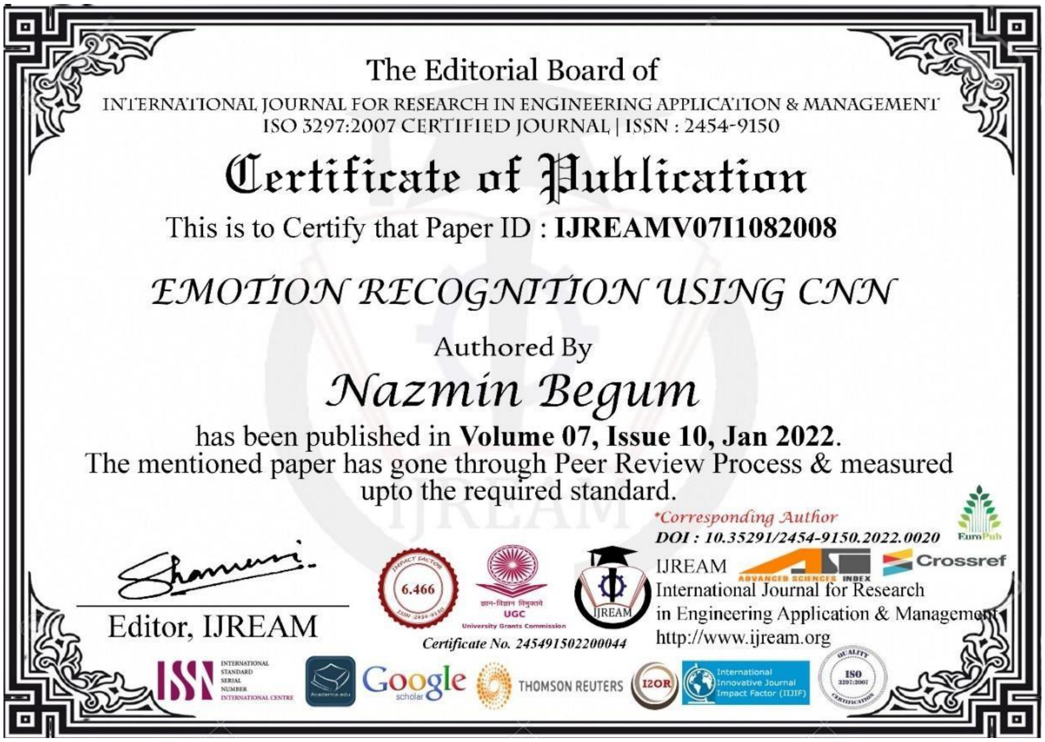

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