

18MCA1078

by Sathyarajasekaran K

Submission date: 25-May-2020 10:06PM (UTC+0530)

Submission ID: 1331685448

File name: 18mca1078.pdf (2.06M)

Word count: 9565

Character count: 50235

Image Classification Based on Data Mining Algorithms and Face Detection

A PROJECT REPORT

Submitted by

Chandni Kumari
Reg. No. 18MCA1078

in partial fulfillment for the award of the degree of

Master of Computer Applications



1
School of Computer Science and Engineering

Vellore Institute of Technology - Chennai Campus
Vandalur - Kelambakkam Road, Chennai - 600 127

Abstract

Here I am going to explain about optical character recognition application on handwritten digits by explaining taking the help neural network. Also we will extract the features by using neural network and this we will do here by implementing MNIST dataset which is handwrittendigits in which 60000 images for study and 10000 images ,which is for testing And I got that here by this method approx.- mately 80 percent of success rate for MNIST database identifi⁶cation. And Today it is seen that detecting faces in video and liv⁶ webcam plays an important role in industry and in all fields.⁵ Today It play an important role in the college. The goal of this project is to develop a system by which we can detect human face a⁵l give a alarm the alarm. The basic use library in this Application is Open Source Computer Vision System (OpenCV). OpenCV is free source which is use for image processing. There are many methods available for sensing human face like Hear-Cascade, Camshaft, Harsdorf distance, I am going to use here only Haar classifier Cascade algorithm which is very important and easy.

Chapter 1

Introduction

Here we are going to recognize of characters by using neural network. In this project first I trained then after that started testing a neuronic system classifier by use of MNIST dataset, the most things which is important is learning, at the time of training because here we have to change the weight of the networks neurons. In the first step or process we did not modify weight and contain attached binary neurons without editable connections. Here MLP is used as classifier for recognizing . The MLP contain three coatings of neuron, In methodical terms we can saying the form of input image. The second parts resemble features subsystems. The third part associate to the output system. every neuron in this layer resembles to one of the output classes, and this part has 10 neurons digits 0 ... 9 for recognition of task of handwritten digits. The unique weights is given to the

network at random connections. During the creation of the perceptron weight will be modified

1. Background

Haar cascade is a machine learning method which is used for detecting face. first, we trained the cascade function by giving different set of input. OpenCV has already many pre-trained Classifiers like for faces, smile and eyes etc. Today we are going to use here face and smiles classifiers. You can experiment with other classifiers as well.

I downloaded the trained classifier XML file, which available in OpenCV's GitHub repository. Keep this file in your working location to use it in your application. during making application provide their full path of this file with extension. Similarly, videos image faces also can detect here because video is nothing it is just like collection of images. because we know video is a made of frames, and

frames is nothing only it is a collection of images. So, we make the face finding for each frame in a video. The only difference in detecting the face in video and images is that in video we use infinite loop for each frame. We use image. Read () for reading image in frame. This function returns two value first value inform that image is read in proper way not.it return flag value. We don't need it. The second value return that is frame or not so that we will do some operation on .it. which helps in locating/visualizing images. This method is use for object detection which works for sensing of substances.

OpenCV

Detection of face in images should know and have practice of NumPy and familiar with Matplotlib and should know about OpenCV. First, I installed all these packages. Before using OpenCV first sure that in your Jupiter notebook you have installed all required packages check it by using OpenCV. Those are three requirement is python3.7,Numpy and matplotlib.

1.2.1 OpenCV-python

- overview
- installation

1.2.2 Images as Arrays

- Binary images
- grayscale images
- Colored image

2. Face Detection with openCV-python

1.3.1 overview

OpenCV was first come to known by Brodsky, after a little later. OpenCV. It plays an important role in face detection system. While it enhanced C/C++, OpenCV is uses by more numbers of user now days due to simplicity and free of cost. uses of it is increasing everyday due to easy and more region. Python language that we implement here for this project. Using python for this project make me so easy here because python has vast library. It also simple to use to code and deploy.

1.3.2 Storing images in Arrays forms here:

An image is a collection of arrays in the form of pixels points. Resolution depends on number of pixels in the images, pixels can represent in the form of 2 D array, and if we increase number of pixels then color information it will give us. The color of images can be shown in following form. For converting into binary form, we need the following to do:

1.3.3 Binary Images

It is made of 1bit/pixels. and it has two colors, i.e., black or white. Black denotes by the value 0 while 1 signifies white.³

1.3.4 Grayscale Images

This image is combination of 8 bits per pixel. This shows that it has 265 dissimilar shades in which black is represented by 0 For example, the image below shown in the form of a grayscale image it is a form of only array it represent in the form of array only.

1.3.5 Colored Images

Color images can represent in the form of red, Blue and green, and more color we can achieved by these primary colors in fixed proportion. primary color i.e., red, green and blue can be mixed with any color to get more and more different colors. A colored image also consists of 8 bits per pixel.it has 256 dissimilar color of dissimilar shades .we can denotes colors by with 0 denoting black and 255 white.

3. function of OpenCV

Before doing face detection process, we should first know about OpenCV and its function and properties that how it works. Here first we will perform simple some operation like importing images in my local repository, opening images and closing images, accessing images, drawing some simple shapes on images etc. This all are basic level that we should know before moving to face detection

1.4.1 importing images in OpenCV

Here I am using Jupiter notebook to do this project. Following are the steps that needs to perform this project perform this project. here i am using Jupiter notebook. following are the steps that we will perform here

1.4.2 import the necessary modules

here first import NumPy, OpenCV and matplotlib by giving alias name.

1.4.3 storing images in variable

```
img raw=cv2.imread('image.jpg')
```

- here we will use keyboard called cv2.waitKey().The wait Key () is a method which is used to wait till you did not press any keyboard that you specified while implementing this application. Means here we can say that it works like event that after performing hat event this window will be closed, otherwise it will not close. After doing that event program will be terminated.
- The second condition affects if you press escape key on the keyboard after handling this event automatic window will be terminating.
- CV2.destroyAllWindows() this will destroy all windows that we made, in case of destroying a particular window, use only cv2.destroyWindow() in argument you have to pass here specific as parameter of window names
- Collection of images or may be it is a single image but it should be save in local directory or in any folder and while importing images in application we have to pass full path of that images.

4. Face Detection

Face detection identifies human faces in digital images, a simple example we can see when we capture images coming from photographs by our phone or mobile. By this method we can detect faces in the form of images. First, I have to convert images in arrays form and represent it in arrays form if images is showing or displaying in images form then it means our images path is correctly imported here now it will work here. we can do operation on images. Face detection and face recognition both are different, face detection detect faces from images and video whereas face recognition application identify that this face is whom or in of right person or not.in face detecting classifier plays an important role in performing operation. A classifier is used to identify that images is positive means there is face or not.it can be that faces is not available in folder or we are working in that cases it will not be work face will be not detected in this case. First here we need to trend the classifier because after trending it be able to identify the images so first have to trend with faces and it can be without faces . OpenCV consist primitive two classifier, here we will use in this application. Two primitive classifier is following :

- First classifier that we need to upload here is Haar Classifier
- Second first we need to load images in binary form Pattern classifier

In this project, I will only know about the Haar Classifier.it is widely used for performing like face detection in computer vision industry.it is a machine learning technology which is specific used for visual object detection which works on processing images at high rate extremely.it gives high rate of detection rate This can be used mainly for three main reason.

- Haar classifier plays an important part in calculating sensor very quickly.it is very simple and easy method.it allows to detect face and do operation on.
- The learning algorithm works on process method in this process we have to select features from huge amount of dataset and provide efficient classifiers.

features' abstraction

Training data is first used as feature abstraction. Each image is comparing first and then match to trained data. collect feature and then store all in different different form so that we can know feature of that images.

Computer vision:

Computer vision is a very important part of Artificial intelligence ,by computer vision, computer can understand ,how to store images and video and how to process and how to retrieve them ,the manipulation task can be done by open computer vision , it is having some library such as

Open cv:

By open cv computer can identify objects, Computer can recognize handwriting and face, computer can process the images and video ,open cv helpsin analysis the any kind Of structure .open cv performs the mathematical operation by the vector space .it is having python ,java++,open cv is compatibility for ios,os,linux,mac,android etc. Open cv describe every part of images and video in very deep .practice application .

Feature of content base images retrieval:

In CBIR, the extraction of of image is happening .these features are including texture, color and shape features in a CBIR system, feature retraval process extract and stores the visual features of any image automatically.

The searching images from dataset, this process held on these visual features. Color is main and first content for retraval and indexing of images. Images taken from any source, that is having the three channels, while gray image have only one. Images is having another important feature which

is texture. Describe and recognition of human visual system and interpretation then put major impact. Texture's power get increases when color combines with it. in this system(CBIR) describes the techniques for integrated of both. the dataset population phase happened for extracting and color of any image.

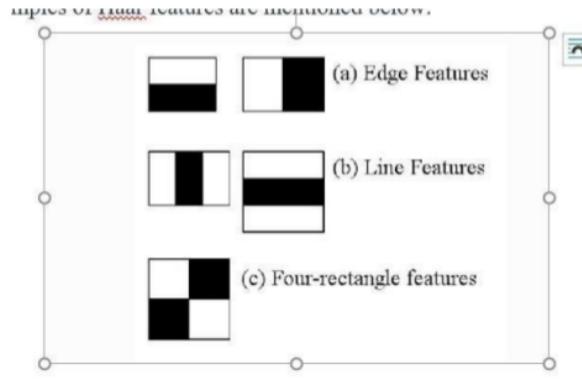


Figure 1.1: Feature Extraction

These features are used to get single character. first we need to import images in folder and give full path in Jupiter notebook. Here algorithm is mainly used for digitized images. Emotion may be detected using the nevertheless picture or the dynamic snapshots through the digital camera.instatic based totally definitely method ,a function vector contains information about the prevailing-day input picture satisfactory

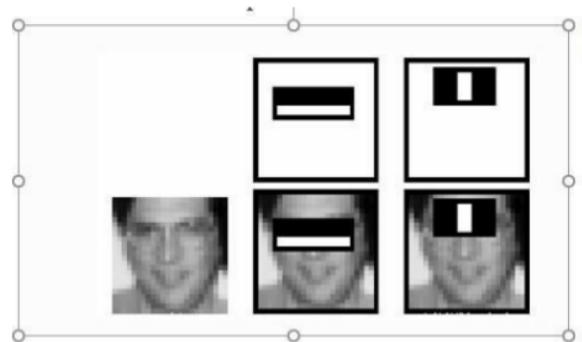


Figure 1.2: Extracting Two Feature

Machine learning trains the model for abundant actions by utilizing the training data

give training set to train the model gather detailed feature .this combines both structure in prototype .single terms or consecutive word sets are taken tweets in sentimental and therefore, the model may learn anything from the feature if the training set is properly thus, these data used for checking the model to check whether or not it is accuracy, for and testing ,the percentage division option is given.75% is used in training out of 2000 instance and 25% is used in testing.

In this project, we used the machine learning models and algorithm such as local Binary pattern of Histogram model, convolution neural networks model, Facial Expression Regression model. The database is taken from MNIST dataset.

1

Aim and objective: the objective of this project is to detect faces of the images and also in video. And also facial expression evaluation and to apply the project for getting the psychological behavior on the respective conditions.

5. overview

Open cv: By open cv computer can identify objects, Computer can recognize handwriting and face computer can process the images and video ,open cv helps in analysis the any kind Of structure .open cv performs the mathematical operation by the vector space .it is having python java++,open cv is compatibility for ios,os,linux,mac, and android etc. Open cv describe every part of images and video in very deep. practice application.

Features of content base image retrieval:

Feature Extraction: In CBIR, the extraction of image is happening. these features are including texture, color and shape features in a CBIR system, feature retraval process extract and stores the visual features of any image automatically.

The searching images from dataset, this process held on these visual features. Color is main and first content for retraval and indexing of images. Images taken from any source, that is having the three channels, while gray image have only one. Images is having another important feature which is texture. Describe and recognition of human visual system and interpretation then put major impact. Texture's powder get increases when color combines with it.in this system (CBIR) describes the techniques for integrated of both. The dataset population phase happened for extracting and color of any image.

1.fetch the feature like color, texture, shape,or location of image.

2 fetch the feature like some degree of logical inference about the image identify.

fetch the feature for mining purpose of object scene.

b. Significance of features space selection in CBIR,

1.space selection :identifies feature and combination of images are to selected for extracting,

Purpose:

2.capturing :choose the algorithm to extracting the feature of images.

3 indexing and search scheme: consider the retrieval speed for the this creates indices and schema.

c. Feature categories: the images have been classified in following categories:

Chapter 2

LITERATURE REVIEW

In this examination ,we executed a multi-layer completely associated neural system with one thousand layer for hand digits recognition .the testing has been led from freely accessible MNIST manually written database .from MNIST database ,we recovered 28,0000 digits picture for preparing and 14,000 digits picture for playing out. The test.our multi-layer fake neural system has an exactness of 99.60% with test execution. Programmed preparing of ban system, the postal location is generally utilized uses of manually written digits recognition. A person has been proffered a typical predisposition to separate various items with varieties, for example,digits,faces,voices.we have utilized MNIST dataset for our proposed written by hand digits ‘recognition with ANN approach .the dataset contain a huge number of data of manually written digits composed by various individual. We removed 42,0000 examples to direct our examination.by various individual. Recognition is called important due to huge use of it.it is used by many industries and today it has huge research area. This is divided into two section. first section is feature extraction from handwritten images and the second section is classification. Re- searchers found many method features.

Handwritten Digit Recognition: A Neural Network Demo:

The introduction comprises of a slideshow clarifying the entire Kohonen arrangement of learning and perceiving ,and a composing cushion with show where guests can compose a digit and see the NN results .this NN is similar one that second best in the analyses:98% right recognition rate ,see Table 1, in this paper, a lot of unclassified digits section is appeared to allow individual additionally to figure out what digit the parts originate from. The entire introduction was a piece of “Neuro Fuzzy Route in the Euregion.

2.1 Database

The MNIST database have 70000 digits in which 60000 is for learning and 10000 is for testing. its range start from 0 to 9. all digits have been normalized and

Dataset: the MNIST dataset is an abbreviate that represent the modified institute of standard and technology dataset.it is dataset of 60,000 little square 28x28 pixel grayscale picture

of manually written signal digits somewhere in the range of 0 and 9 .the understanding is to characterized a given picture of written by hand digits into one of 10 classes speaking to whole number quantities from 0 to 9.comprehensively .it is a broadly utilized and profoundly learning comprehended dataset. For instance ,we realize that the picture are all pre-adjusted that the picture all have a similar square size pixels, and that the picture are grayscale .Subsequently ,we can stack the size of 28x28 pixels,we can change shape of pictures.

The MNIST dataset is given in the configuration of Sixths IDX record design is a basic organization which comes helpful while working with vectors and high dimension latitude of various images.

Machine learning trains the model for abundant actions by utilizing the training data give training set to train the model gather detailed feature. this combines both structure in prototype. single terms or consecutive word sets are taken tweets in sentimental and therefore, the model may learn anything from the feature if the training set is properly thus, these data used for checking the model to check whether or not it is accuracy, for and testing, the percentage division option is given. 75% is used in training out of 2000 instance and 25% is used in testing

centered in one size with 28x28.here it is shown in the form of example .Figure



Figure 2. Examples of MNIST Database

Figure 2.1: Example of MNIST Database

2.1.1 Preprocessing

Pre-processing plays an important role in recognition of digit. In this project the standard MNIST database extracted the images of the digit, then noise is removed by using median filter. In last image is standard mined.

2.1.2 Handwritten Digits Recognition:

The introduction comprises of a slideshow clarifying the entire Kohonen arrangement of learning and perceiving ,and composing cushion with show where guest where show can composes a digit and see the ANN result .this NN is similar one that second best in the analyses 98% right recognition rate .here it appear a lot of unclassified digits .

2.2 Deep Neural Network

So as to consider the system model with high recognition rate, this paper right off the best bat examine the two fold concealed layer. neural network plays various important role here 1.besides CNN is examined .in CNN the fourth layer plays important role of this

2.2.1 Perceptron

The Perceptron is very simple here first we have to decide perceptron after that we should test this according to it we decide it what is right or wrong this is called We can say retina as input and response as output layer.

x: Input layer Frame-Level v

• . y: Output layer

- I: The number of neurons in the input layer

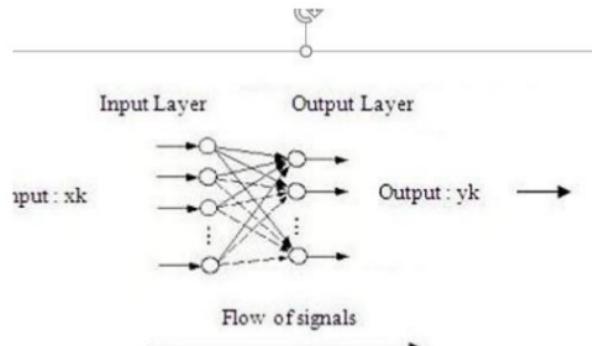


Figure 20. The Perceptron

Figure 2.2: The Perceptron

- x, j : represent production layer
- y, w_{ij} : represent weight constants two row input and output .The neuron show the connection between neuron and brain which find to recognizing the shape, decision It can be also show as:

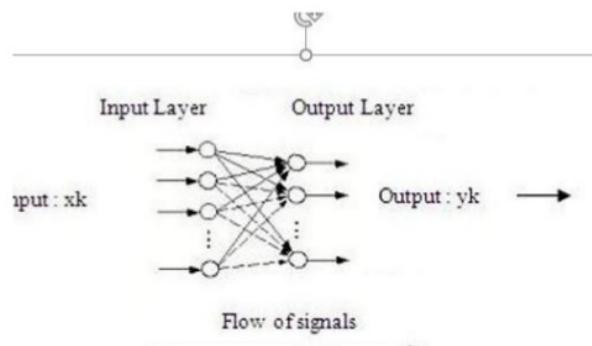


Figure 20. The Perceptron

Figure 2.3: The Multi-Layer-Perceptron

The MLP is composed: - Layer with input x:input contains I

- - a layer with output y: output neuron contains J neurons.
- -between input and output layer one hidden layer present that is called hidden layer., it has no connection from other each layer has hidden layer and each layer has different weight. Total layer in neurons is following as:
- Some neurons is made for input layer and Ten neurons is made for output layer
- - Equal neurons is used in input layers - about 75 percent neurons is used in response layer.
- Here we have to use these three conditions, here also vary by different to different layer number of neurons

Table 1. Details of the Neural Networks

Layers	Neurons
Input	7
Hidden	7
Output	10
Constant of learning	
$\alpha = 0.9$	
Squared error	
$E = \frac{1}{2} * (t - o)^2$	
t: the theoretical output.	
o: the desired output.	
Activation function	
$F(x) = \frac{1}{(1 + e^{-x})}$	

Figure 2.4: Detail of the Neural Network

Training model:

1. Set input layer.
2. Calculate weight of the network
3. total = output-weight
4. Design of slope procedure
5. Alteration of weight.

2.2.2 Issues while training

- - set a function for training here: - When we have to trained dataset
Authentication set value - choose number of neurons.
- - When should end training data
- - Authentication of the outcomes?
- - Choice of construction: number of neurons
- - what is rate of learning rate
-

2.2.3 Classification

removing/mining the properties of images to classify .then show the result and find accuracy.

2.2.4 Experimental Results

We use some value for characteristic vector in the neurons for finding the neural network. We first provide input layer, we already known about desired output but we here try that by neural network we are getting desire output or not.

we first use here images in the form of array , first we will use only 10 images as sample, We used as here ten images, to show the the best constructions that make the most of network .

Table 2. Experimental Results

Handwritten digit sets	Numbers of digits	Validation Database	Test Database
1 Set	10	61.50	40.22
10 Sets	100	71.90	68.98
50 Sets	500	82.00	77.43
100 Sets	1000	82.00	79.28
Numbers of images for test		1.000	60.000
		Images	Images

Figure 2.5: Experimental Results 1

Table 3. Recognition Rate for each Digit with 100 Sets of Images

Types of digits	Recognition rate of test Database	Error rate	Reject rate	Execution Time (s)
0	86.45	13.55	00.00	91.64
1	94.39	05.61	00.00	112.58
2	88.73	11.27	00.00	95.63
3	77.02	22.98	00.00	76.71
4	76.12	2388	00.00	84.29
5	84.10	15.90	00.00	70.77
6	78.81	21.19	00.00	85.91
7	77.12	22.88	00.00	90.33
8	79.03	20.97	00.00	85.37
9	49.64	50.36	00.00	93.90

Figure 2.6: Example of MNIST Database

2.3 Summary

This chapter tell you that how image processing works and classification for hand digits recognition works. Also, it will introduce about here literature survey on this topic and overall information and working principle and function of it. In First part we will introduce here OCR and the template matching machine learning procedure and process. In the second part, we introduce that factor which recognition error rate due to which accuracy is going to decrease. In third part classification technique is going to apply like ML algorithm and many more then in third part we well evaluate the design also .and last and final section will give output and result and what will be implementing in nest stage. This chapter has reviewed the

Table 4. Recognition Rate for All Digits

Digits	0	1	2	3	4	5	6	7	8	9
0	86.45	00.81	01.10	00.01	01.40	00.27	00.22	00.17	06.36	03.21
1	00.02	94.39	01.00	00.84	00.02	00.48	00.44	00.18	01.03	01.59
2	00.09	01.42	88.73	04.33	00.82	00.65	00.03	01.00	02.00	00.93
3	00.06	00.52	00.96	77.02	01.18	00.45	00.00	14.53	04.95	00.32
4	01.21	02.92	00.34	01.44	77.94	02.85	03.30	00.58	03.59	05.83
5	00.03	01.37	01.27	01.03	00.74	84.10	06.73	00.22	02.58	01.92
6	02.29	02.41	00.81	00.10	06.21	02.43	78.81	00.00	06.78	00.15
7	00.04	03.47	06.66	03.83	01.50	00.04	00.00	77.12	04.84	02.48
8	04.82	02.58	01.50	02.03	04.08	00.22	00.70	03.16	79.03	01.86
9	04.85	09.89	08.34	00.65	02.70	08.14	02.51	01.90	11.37	49.64

Figure 2.7: Recognition Rate For All Digit

Dataset:the MNIST dataset is an abbreviate that represent the modified institute of standard and technology dataset.it is dataset of 60,000 little square 28x28 pixel grayscale picture

of manually written signal digits somewhere in the range of 0 and 9 .the understanding is to characterized a given picture of written by hand digits into one of 10 classes speaking to whole number quanlitiesfrom 0 to 9.comprehensively .it is a broadly utilized and profoundly learning comprehended dataset.

For instance ,we realize that the picture are all pre-adjusted that the picture all have a similar square size pixels, and that the picture are grayscale .Subsequently ,we can stack the size of 28x28 pixels,we can change shape of pictuter.

The MNIST dataset is given in the configuration of IDX.this IDX record design is a a basic organition which comes helpful while working with vectors and high dimention latitude of various images.

Chapter 3

System Design

3.1 introduction

in the proposed project ,recognition of face through facial expression on real - time using machine learning algorithm like local binary patterns histogram ,convolution Neural Network (CNN).we proposed the system “real time emotion here detecting algorithm “we have anticipated the emotion of the person using the convolutional neural network.in this gadget, we have capable of training machine from various information points from the beyond to make a face detection.we took facts from previous years dataset to educate the cersion.we majority used four system libraries to remedy the hassle. The primary one was the numpy, which turned to clean and manipulate the information, getting it right the shape for the evalution. The other turned into opencv,which designed to solve the computer vision problems.

3.2 Summary of Requirements

This will introduce to improve the accuracy more than 99 percent in handwritten digit recognition.because different people wrote it in different styles so that machine may be confuse to identify it.fast and getting more accuracy is more important part and aspect of finance .the handwritten pattern recognition contains mostly three main important steps or process i.e., extracting feature from dataset ,then classify it into sub parts, 2nd then preprocessing it.after study on MNIST dataset we have to know that this dataset is an excellent database for machine learning and in finding pattern because it takes minimal efforts in classification and forming pattern.so that I have selected this database in this project. As we saw in literature review that many researchers have got achievement in it and got more accuracy

on handwritten character recognition. This algorithm on the MNIST handwritten digital database, and the accuracy of handwritten digit reached over 9 percent. Also, paper by Phangtriastu, Harefa, and Tanoto attained the highest accuracy, namely 94.4 percent using the SVM classifier. Overall, scientists have used these classifiers to get good results. Since in previous it has been verified all these four classifiers, then after that compare all these four classifiers and determine which one is giving more performance. However here all researchers mostly focused on preprocessing and feature extraction part to achieve high accuracy. So, it is carefully saying that image preprocessing is fundamental. Generally, effect will be decrease by normalization. different people wrote different different language and research have mentioned. Feature recognition is one of the famous methods of extracting handwritten digit it gets more and more success in getting accuracy. However, abstracting more feature and structure is big challenge CNN will automatically use the LENET5 method to get abstraction elements. verification is used and absorb in each phase for getting correct results. After apply each epoch we check accuracy and compare it. first model is optimized, and then test it with known sample then confusion matrix is used and created. confusion matrix for each epoch to ensure the correct training. After the model is optimized, it is then tested with unknown samples to find the test accuracy and represent it with a confusion matrix. Accuracy will be shown in graph. Also, variation in error rate will compared after apply all four epochs. And variation will be absorbed here. this will all be based on different technique. Finally handwritten will be finalized and get output or accuracy 99 percent also display prediction on it. . Figure 3.1 presents some handwritten digits never seen by the systems.

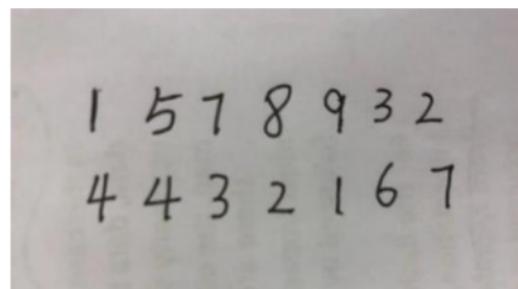


Figure 3.1: HandWritten Digits

3.3 Face Detection

Face detection locates identifies human faces in digital images, a simple example we can see when we capture images coming from photographs by our phone or mobile. By this method we can detect faces in the form of images. First, I have to convert images in arrays form and represent it in arrays form if images is showing or displaying in images form then it means our images path is correctly imported here now it will work here. we can do operation on images. Face detection and face recognition both are different, face detection detect faces from images and video whereas face recognition application identify that this face is whom or in of right person or not.in face detecting classifier plays an important role in performing operation. A classifier is used to identify that images is positive means there is face or not.it can be that faces is not available in folder or we are working in that cases it will not be work face will be not detected in this case. First here we need to trend the classifier because after trending it be able to identify the images so first have to trend with faces and it can be without faces . OpenCV consist primitive two classifier, here we will use in this application. Two primitive classifier is following :

- First classifier that we need to upload here is Haar Classifier
- Second first we need to load images in binary form Pattern classifier

3

In this project, I will only know about the Haar Classifier.it is widely used for performing like face detection in computer vision industry.it is a machine learning technology which is specific used for visual object detection which works on processing images at high rate extremely.it gives high rate of detection rate This can be used mainly for three main reason.

- Haar classifier plays 'Important part in calculating sensor very quickly.it is very simple and easy method.it allows to detect face and do operation on.
- The learning algorithm works on process method in this process we have to select features from huge amount of dataset and provide efficient classifiers.

in this article, however, we will only discuss the Haar Classifier.

3.3.1 Haar feature-based cascade classifiers

Haar -feature-based cascade classifiers are digital features, . This classifier is widely used for tasks like face detection in computer vision industry. Haar cascade classifier is a machine learning method which is specific use for visual object detection which works on processing images at high rate and achieving high detection rates. This can be gained to three forms.

In this project, I will only know about the Haar Classifier.it is widly used for performing like face detection in computer vision industry.it is a machine learning technology which is specific used for visual object detection which works on processing images at high rate extremely.it gives high rate of detection rate This can be used mainly for three main reason.

- Haar classifier plays an important part in calculating sensor very quickly.it is very simple and easy method.it allows to detect face and do operation on.
- The learning algorithm works on process method in this process we have to select features from huge amount of dataset and provide efficient classifiers.

Machine learning trains the model for abundant actions by utilizing the training data give training set to train the model gather detailed feature .this combines both structure in prototype .single terms or consecutive word sets are taken tweets in sentimental and therefore,the model may learn anything from the feature if the training set is properly thus, these data used for checking the model to check whether or not it is accuracy,for and testing ,the percentage division option is given.75% is used in training out of 2000 instanceand 25% is used in testing

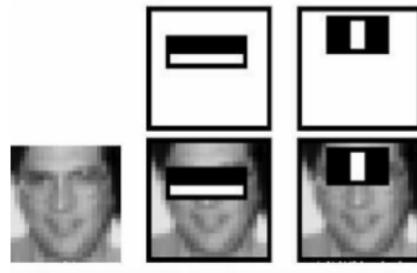


Figure 3.2: Feature Extraction

3.4 Database

Two different databases will be used here for classification scanned from 0 to 9. datasets are participated in two sections which are training and testing and other is testing sets in order to authenticate the technique. As in chapter 2, training set is used there for organizing the testing set, both datasets are independent. The MNIST database is

Are composed by database which is scanned handwritten digits. NIST has original training data which is made by a collection of digits wrote by US census workers. While testing dataset is wrote by uncooperative high-school students. The differences in origin describe by worse performance on the test data.so the NIST database needs a restructurings for per- forming adequately training and test sets, for doing some operation on database that we will use here.The MNIST dataset is made by 60.000 are there for sample which first will check on 100000digita handwritten digits in the training .

TABLE 1. Distributions of *MNIST* sets

Digit	0	1	2	3	4	5	6	7	8	9	Total
Train	5923	6742	5958	6131	5842	5421	5918	6265	5851	5949	60000
Test	980	1135	1032	1010	982	892	958	1028	974	1009	10000

Figure 3.3: Distribution of MNIST set

Some examples of *MNIST* are in Figure 1. As a consequence of the origin of

FIGURE 1. Typical Images from *MNIST* sets

Figure 3.4: Typical Images From MNIST set

3.5 CONFUSION MATRIX

In supervised learning for doing performance on this machine learning this table show confusion matrix of MNIST dataset. This Layout show confusion matrix or matrix represents actual while each row represents the instances in an actual class Confusion matrix show the actual deviation in accuracy .with the help of it we can find deviation that occur in it.following picture is showing actual result or accuracy of confusion matrix.

```
ut[7]:  
array([[ 973,     0,     1,     2,     0,     1,     1,     0,     2,     0],  
       [ 0, 1128,     2,     1,     0,     1,     1,     1,     1,     0],  
       [ 7,     1, 1008,     1,     1,     0,     4,     6,     4,     0],  
       [ 0,     0,     3,  987,     0,     5,     0,     5,     7,     3],  
       [ 1,     0,     4,     0,  966,     0,     2,     0,     0,     9],  
       [ 2,     0,     0,     9,     1,  872,     3,     1,     2,     2],  
       [ 5,     2,     2,     0,     2,     5,  948,     0,     2,     0],  
       [ 0,     6,     9,     1,     1,     0,     0, 1002,     1,     8],  
       [ 4,     0,     2,     4,     3,     2,     1,     4,  951,     3],  
       [ 2,     4,     0,     4,     9,     4,     0,     4,     3,  979]],  
      dtype=int64)  
Out[8]: 98.06  
  
In [8]: cm = confusion_matrix(x,predictionRes)
```

Figure 3.5: Accuracy/Output

Training Data and Test Data: Machine learning trains the model for abundant actions by utilizing the training data give traing set to train the model gather detailed feature .this combines both structure in prototype

.single terms or consecutive word sets are taken tweets in sentimental and therefore,the model may learn anything from the feature if the training set is properly thus, these data used for checking the model to check whether or not it is accuracy,for and testing ,the percentage division option is given.75% is used in training out of 2000 instanceand 25% is used in testing.

3.6 SVM

This area defines allocation issues and shows how the support vector machine classifies presents a rough answer for it.a classifier task ,for example ,arranging the enthusiastic state ,includes a lot of preparing information Strain and testing informationStest,each containing a lot information occurrences.in this work ,it was discovered that tSupport vector machine .machine calculation created the most elevated feeling classification.in this instance of SVM we make the model by building

OUTPUT/RESULT:

```
ut[7]:  
array([[ 973,    0,    1,    2,    0,    1,    1,    0,    2,    0],  
       [  0, 1128,    2,    1,    0,    1,    1,    1,    1,    0],  
       [  7,    1, 1008,    1,    1,    0,    4,    6,    4,    0],  
       [  0,    0,    3,   987,    0,    5,    0,    5,    7,    3],  
       [  1,    0,    4,    0,   966,    0,    2,    0,    0,    9],  
       [  2,    0,    0,    9,    1,   872,    3,    1,    2,    2],  
       [  5,    2,    2,    0,    2,    5,   940,    0,    2,    0],  
       [  0,    6,    9,    1,    1,    0,    0, 1002,    1,    8],  
       [  4,    0,    2,    4,    3,    2,    1,    4,   951,    3],  
       [  2,    4,    0,    4,    9,    4,    0,    4,    3,   979]]],  
      dtype=int64)Out[8]: 98.06  
In [8]: cm = confusion_matrix(x,predictionRes)  
. cm
```

```
Python 7.2.0 -- An enhanced Interactive Python.
c=accuracy_score(x,predictionRes)*100
... ac
ut[3]:
VC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
decision_function_shape='ovr', degree=2, gamma='auto', kernel='po
max_iter=-1, probability=False, random_state=None, shrinking=True
tol=0.001, verbose=False)           precision    recall   f1-sc
0      0.9789  0.9929  0.9858      980
1      0.9886  0.9938  0.9912     1135
2      0.9777  0.9767  0.9772     1032
3      0.9782  0.9772  0.9777     1010
4      0.9827  0.9837  0.9832      982
5      0.9798  0.9776  0.9787      892
6      0.9874  0.9812  0.9843      958
7      0.9795  0.9747  0.9771     1028
8      0.9774  0.9764  0.9769      974
9      0.9751  0.9703  0.9727     1009

micro avg    0.9806  0.9806  0.9806  10000
macro avg    0.9805  0.9805  0.9805  10000
weighted avg  0.9806  0.9806  0.9806  10000
```

Chapter 4

Implementation System/Methodology

Open cv: By open cv computer can identify objects, Computer can recognize handwriting and face computer can process the images and video ,open cv helps in analysis the any kind Of structure .open cv performs the mathematical operation by the vector space .it is having python ,java++,open cv is compatibility for ios,os,linux,mac, and android etc. Open cv describe every part of images and video in very deep. practice application.

Features of content base image retrieval:

Feature Extraction: In CBIR, the extraction of image is happening .these features are including texture, color and shape features in a CBIR system, feature retraval process extract and stores the visual features of any image automatically.

The searching images from dataset, this process held on these visual features. Color is main and first content for retraval and indexing of images. Images taken from any source, that is having the three channels, while gray image have only one. Images is having another important feature which is texture. Describe and recognition of human visual system and interpretation then put major impact.Texture's powder get increases when color combines with it.in this system(CBIR) describes the techniques for integrated of both.the dataset population phase happened for extracting and color of any image.

- 1.fetch the feature like color, texture,shape,or location of image.

2 fetch the feature like some degree of logical inference about the image identify.

fetch the feature for mining purpose of object scene.

Significance of features space selection in CBIR,

space selection :identifies feature and combination of images are to selected for extracting,Purpose:

capturing :choose the algorithm to extracting the feature of images.

3 indexing and search scheme: consider the retrieval speed for the this creates indices and schema.

Feature categories: the images have been classified in following categories:

- PROPOSED SYSTEM

In system design we have to understand the basic skill and have to learn the basic skill to perform our task.the basic skills include the neural network, convolutional neural network etc which is very important to run our model ,these are for images classification and we use this in our model to identify the accuracy the angle of the car and angle of images .with the help of these techniques we will train our model so that the car will take the correct decision of so these are the very important to learn.

Working principle of Convolution Neural Network:

CNN every images is represented in the form of pixel values and it compares images pieces by pieces.it is commonly used to examine visual picture by handling information with a grid like topology. Convolutional Neural Network has five layers and each layers is very important for getting the desired output CNN has the following layers:

a.input layer

b. convolution layer

c.red u layer d.pooling

layer e.fully connects

layer f.output layer

activation function:activation function when there is a node .that node is nothing but copy of the neural in our brain .when this neuron or node receives many input signal depending on the nature of these input signals,depending on the intensity of the input signal.we combine it all and send it to a function which is the activation function.add further this activation function depending on the signal defines an output .generates an output the activation function is broadly into three types:

a.Linear activation function:

b.Heviside function

c.sigmoid function

4.2 Save images in local working directory import matplotlib.pyplot as plt
path=provide full path of images here img=cv2.imread(path) plt.imshow(img)
plt.show()

4.3 Working principle:

-to detect faces which is coming from video camera or it may be live webcam first we need to import two file in form of xml .first for faces to find faces or eye we need to import two files.

The key challenge in the field of strength learning is to build a simulation environment that relies heavily on task to be performed .if in chess,go or Atari the prototype is supernatural,it is fairly easy to prepare the simulation set,while designing an autonomous is important .

Prerequisites:\\

1.python 3.+\\

2.anaconda

3.jupyter notebook.

4.fundamental knowledge of supervised machine learning method: classification in particular.

*technology used:

Machine learning.

*hardware requirements:

1 hard disk-1 TB or above

2.RAM required-4 GB or above

3.processor-core i3 or above

*software requirement:

For the program deployment ,the following software tools are used:

1. Window os

2. Python 3.6

3. Jupyter notebook.

Organized of the report:

This thesis structure in the following manner:

Section2 provides a detail review of the literature in the area that incorporates the ML approach used in the image classification's previous and present publications and the author criterion and the year are included .it is a selection and record of recent works from past maintaining the emphasis of the presentation.Assessing the state of art related studies provide a concise of the software framework to be created.unnit design and hardware and device information include .in addition to a panorama of many ML algorithm,system analysis .

Training Data and Test Data:

Machine learning trains the model for abundant actions by utilizing the training data give traing set to train the model gather detailed feature .this combines both structure in prototype .single terms or consecutive word sets are taken tweets in sentimental and therefore,the model may learn anything from the feature if the training set is properly thus, these data used for checking the model to check whether or not it is accuracy,for and testing ,the percentage division option is given.75% is used in training out of 2000 instanceand 25% is used in testing.

Lets take a images and do some visualization on it:for this first we need to load image in project.provide full path of it: if the image is displaying in array form it means our images impoted correctly in project: during importing images if image is not load in project then it will not throw image but it will give error during ececuting time.

```
# setting image resizing parameters
WIDTH = 48
HEIGHT = 48
x=None
y=None
labels = ['Angry', 'Disgust', 'Fear', 'Happy', 'Sad', 'Surprise', 'N

#loading image
full_size_image = cv2.imread("F:/master thesis/thesis/test1.jpg")
print("Image Loaded")
gray=cv2.cvtColor(full_size_image ,cv2.COLOR_RGB2GRAY)
face = cv2.CascadeClassifier('F:/master thesis/thesis/haar cascade/haarcascade_frontalface_default.xml')
faces = face.detectMultiScale(gray , 1.3 , 10)
```

```
# setting image resizing parameters
WIDTH = 48
HEIGHT = 48
x=None
y=None
labels = ['Angry', 'Disgust', 'Fear', 'Happy', 'Sad', 'Surprise', 'N

#loading image
full_size_image = cv2.imread("F:/master thesis/thesis/test1.jpg")
print("Image Loaded")
gray=cv2.cvtColor(full_size_image ,cv2.COLOR_RGB2GRAY)
face = cv2.CascadeClassifier('F:/master thesis/thesis/haar cascade/haarcascade_frontalface_default.xml')
faces = face.detectMultiScale(gray , 1.3 , 10)
```

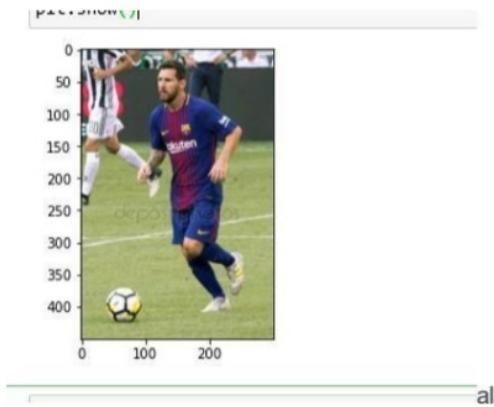


Figure 4.1: Reading image

```
df=pd.read_csv('fer2013.csv')
#print(df.info())
#print(df["Usage"].value_counts())
#print(df.head())

X_train,train_y,X_test,test_y = [],[],[],[] #X_train , X_Test contains

for index, row in df.iterrows():
    val=row['pixels'].split(" ")
    try:
        if 'Training' in row['Usage']:
            X_train.append(np.array(val,'float32')) #appending the pixels
            train_y.append(row['emotion'])
        elif 'PublicTest' in row['Usage']:
            X_test.append(np.array(val,'float32'))
            test_y.append(row['emotion'])
    except:
        print(f"error occurred at index:{index} and row:{row}")
    """
print(f"X_train sample data:{X_train[0:2]}")
print(f"train_y sample data:{train_y[0:2]}")
print(f"X_test sample data:{X_test[0:2]}")
print(f"train_y sample data:{train_y[0:2]}")
"""


```

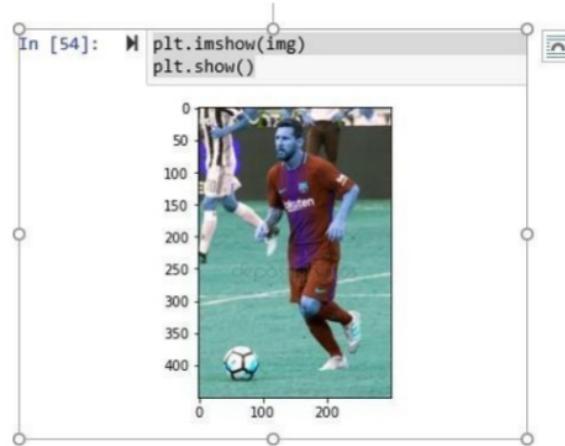


Figure 4.2: Converting in GrayScale Images

A screenshot of a Jupyter Notebook cell. The code in the cell is:

```
import cv2  
xml=r'G:\umang_sir_machine_learning\umang\faces.xml'
```

Figure 4.3: Load Classifier

```
while True:
    ret,frame=cam.read()
    faces = face_Cascade.detectMultiScale(frame,1,2,5)
    for(x,y,w,h) in faces:
        cv2.rectangle(frame,(x,y),(x+w,y+h),(255,0,0),2)
    cv2.imshow("faces in webcam",frame)
    if cv2.waitKey(1)==13:
        break
cam.release()
cv2.destroyAllWindows()
```

Figure 4.4: code to Detect face of webCam images

```
In [7]: for (x,y,w,h) in faces:  
    cv2.rectangle(img,(x,y),(x+w,y+h),(255,0,0),2)  
    cv2.imshow("Faces",img)
```

Figure 4.5: Detecting Images

5

and image of without faces are called ‘Negative Image’. The value of each feature is calculated by doing the subtraction between the sum of Pixels of white rectangle and black rectangle

Figure 4.3: Real Time detection code

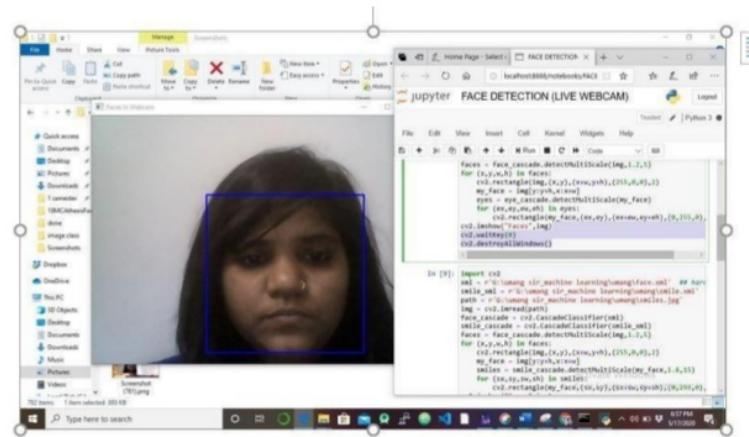


Figure 4.6: Output



Figure 4.7: Group Images

```
import cv2
xml = r'G:\umang sir_machine learning\umang\face.xml' ## harcascade
eye_xml = r'G:\umang sir_machine learning\umang\eye.xml'
path = r'G:\umang sir_machine learning\umang\faces.jpg'
img = cv2.imread(path)
face_cascade = cv2.CascadeClassifier(xml)
eye_cascade = cv2.CascadeClassifier(eye_xml)
faces = face_cascade.detectMultiScale(img,1.2,5)
```

Figure 4.8: load Classifier file

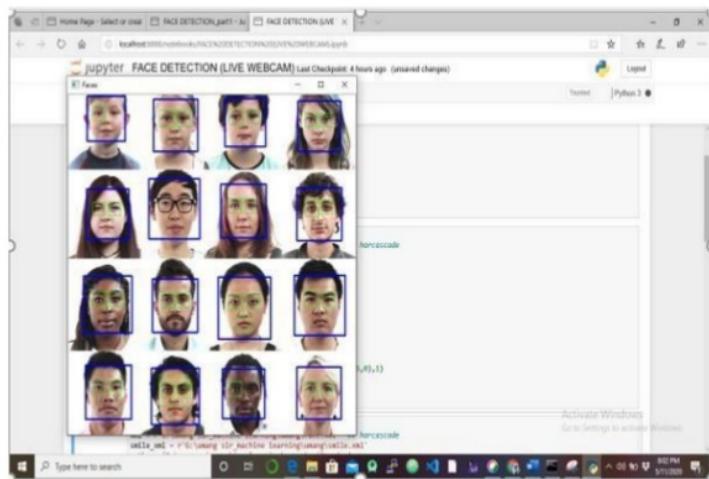


Figure 4.9: Output

Chapter 5

System Design

5.1 Result and Discussion:

After taking 10 set of data as tests from experiment, the result is shown in table. here 75.78 got an average correct result or accuracy. on other side it also shows that the result so each test in experiment. This experiment is based on python which is based on OpenCV also implemented with OpenCV with the help of fisherfaces. This I have implemented in python language here which makes it very easy with the help of OpenCV . During experiment some mistakes also occurred which should generate error.

5.2 Conclusion

We also developed a method for developing a reliable and more accurate speaker recognition program. The suggested structure sets out a system for identification of speakers. Speaker registration is the first step in developing a speaker recognition program, in which each applicant registered receives a collection of statements. For training, an equivalent number of speaking templates is generated for each speaker (for individual speaking templates it does not need to be of the same duration) but it may differ for testing. Speaker's series of models is used as

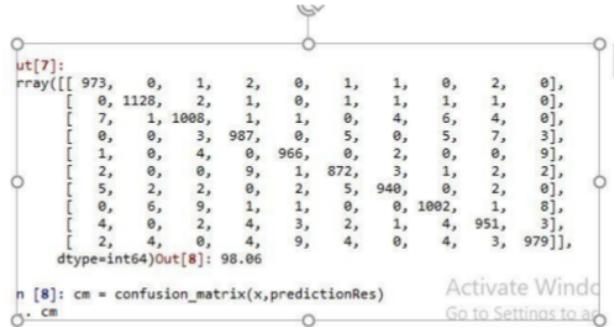


Figure 5.1: Image classify result

Support vector machines:

This area defines allocation issues and shows how the support vector machine classifies presents a rough answer for it.a classifier task .for example ,arranging the enthusiastic state ,includes a lot of preparing information Strain and testing informationStest,each containing a lot information occurrences.in this work ,it was discovered that tSupport vector machine .machine calculation created the most elevated feeling classification.in this instance of SVM we make the model by building

The speaker identification device output using different techniques for extracting and matching features. Our program uses MFCC algorithm because it has the least false acceptability ratio. In can be used in function matching technique in order to boost device efficiency and also to achieve high precision GMM model. The speakers were equipped and tested using model MFCC and model GMM. They offer a better rate of identification for features of speakers. This technique combined the pitch information with MFCC in future research, and also evaluated the output of the speaker identification device in the presence of noise. This paper gives an overview of the speaker recognition that includes various methods of features extraction and model training mainly focused on MFCC and GMM.

Security puts great setbacks for sensitive information in today's world. Recognition of speakers is a multidisciplinary biometrics branch that can be used to classify and validate speakers to protect sensitive information. Therefore to prevent unauthorized access, a voice-based recognition system needs to be developed that provides a solution for financial transaction and protection of personal data that would minimize theft. MFCC features extraction technique and GMM modeling

technique use in speaker recognition are discussed in this paper which can be applied to develop a real time application for speaker identification and verification system for confidential data securing in the future.

5.3 Face detection result

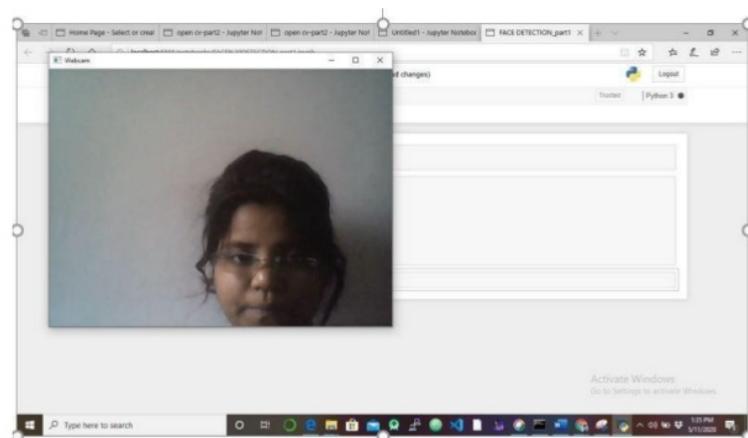
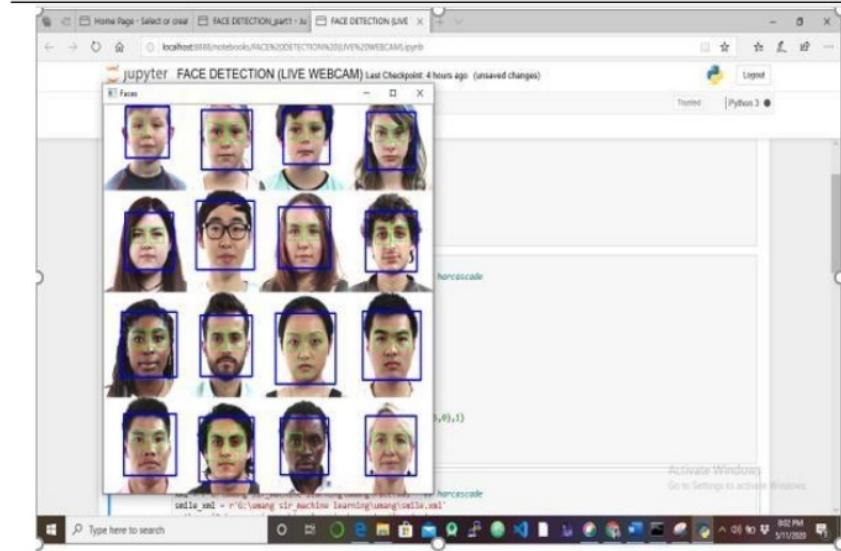


Figure 5.2: webCam images Detection



5.4 here we are going to detect face on group of images.this images is in the form of array .first we need to import this images in local directory.

5.5 Future scope

The area of Speaker Recognition is really fascinating and to explore. But, as per the current scenario, we have had very limited research in this area. In this sector, therefore, there is a lot to be done. We are dealing with a big chunk of audio data every day. Plus, we could never leave behind synthesizing speeches and honoring speakers in this progressing country.

For ease in user experience, my project can be expanded further with a GUI interface. If we think about its applicability it will have tremendous potential

for the future. The method followed, and my project results would be useful to other researchers. They will consider and suggest new ways of improving model accuracy and consistency.

This specific project can be used as a biometric voice device for detecting and catching offenders. I have a vision of further expanding this initiative by adding Speech Recognition to the initiative. Speech Recognition + Spokesperson Recognition will suit my purpose perfectly. I'd like to make an intelligent device that would start tapping phone calls while receiving some weak keywords, often used by terrorists; then that terrorist or other criminal will be recognized by the speaker recognition program. This will aid our country immensely in rising crime and terror attacks.

The results indicate fairly strong awareness Continuous speech with a broad vocabulary, by various speakers. The Specific modules were analyzed and analysed in their respective domains Checked successfully for the various speech input files. We figured out the 4 stages Recognition of speech-general diagnosis, pre-processing, phoneme Computer Recognition and Text Recognition. Independent Voiced recognition systems were equipped to identify speech effectively Inputs reported using a microphone and spoken specimens Retrieved from repositories. Key challenges for future research include acoustic robustness, use Multiple word pronunciations and successful access restrictions Extremely broad lexicon and well developed methods for conceptual extraction Word-hypothesized representations. The reconnaissance device seen in our proposed method conducts inde-

pendent speech by speaker stage mode Reconnaissance. The results obtained can be improved with fine tuning of the program For wider repositories for the instruction. The next move will be live acknowledgement Redeeming this will take more resources like greater expression Databases, acoustic models and extensive vocabulary to provide strong Performance on acceptance.

5.6 conclusion

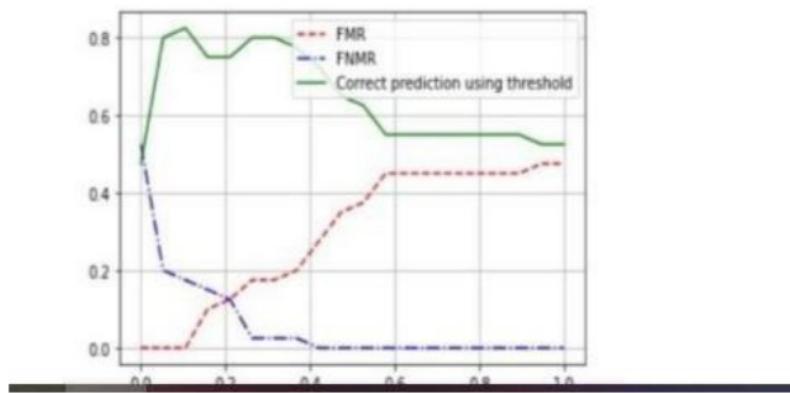
In this project, the neural network is used for classification of the standard base MNIST isolated digit.before implementing extraction ,technique for abstracting the characteristics from given MNIST dataset.here we get 80.00 percent accuracy bu using 60,000 test dataset.so this method is good in getting accuracy.

WORKING As the data-intensive science has become separation standard among other sciences, this research paper has assessed the presentation of K-nearest neighbor, decision tree and neural network extract knowledge extraction from data. New awareness is made to be search by connected as supervision for computer experts and experts in handwritten digit acknowledgment. Grades presented that both ANN and K-NN classifiers able to provide a high accuracy in arrangement task for data mining. Future work will effort on sightseeing meta-heuristic algorithms such as ant colony algorithm to discover the best rules as a new method for data mining in the task of analytical

0.000000e+00	Correct predictions: 19/40 = 0.475	FPR: 0.0	FNPR: 0.525
5.263158e+06	Correct predictions: 32/40 = 0.8	FPR: 0.0	FNPR: 0.2
1.0520132e+07	Correct predictions: 33/40 = 0.825	FPR: 0.0	FNPR: 0.175
1.578947e+07	Correct predictions: 30/40 = 0.75	FPR: 0.1	FNPR: 0.15
2.105203e+07	Correct predictions: 30/40 = 0.75	FPR: 0.125	FNPR: 0.125
2.611579e+07	Correct predictions: 32/40 = 0.8	FPR: 0.175	FNPR: 0.025
3.157095e+07	Correct predictions: 32/40 = 0.8	FPR: 0.175	FNPR: 0.025
3.664211e+07	Correct predictions: 32/40 = 0.775	FPR: 0.2	FNPR: 0.025
4.210526e+07	Correct predictions: 29/40 = 0.725	FPR: 0.275	FNPR: 0.0
4.716642e+07	Correct predictions: 26/40 = 0.65	FPR: 0.35	FNPR: 0.0
5.263158e+07	Correct predictions: 25/40 = 0.625	FPR: 0.375	FNPR: 0.0
5.789470e+07	Correct predictions: 22/40 = 0.55	FPR: 0.45	FNPR: 0.0
6.315790e+07	Correct predictions: 22/40 = 0.55	FPR: 0.45	FNPR: 0.0
6.842105e+07	Correct predictions: 22/40 = 0.55	FPR: 0.45	FNPR: 0.0
7.368421e+07	Correct predictions: 22/40 = 0.55	FPR: 0.45	FNPR: 0.0
7.894737e+07	Correct predictions: 22/40 = 0.55	FPR: 0.45	FNPR: 0.0
8.421053e+07	Correct predictions: 22/40 = 0.55	FPR: 0.45	FNPR: 0.0
8.947378e+07	Correct predictions: 22/40 = 0.55	FPR: 0.45	FNPR: 0.0
9.473644e+07	Correct predictions: 21/40 = 0.525	FPR: 0.475	FNPR: 0.0

Figure 5.21: Predictions

Correct Prediction Using Threshold:



Chapter 6

Conclusion and Future Work

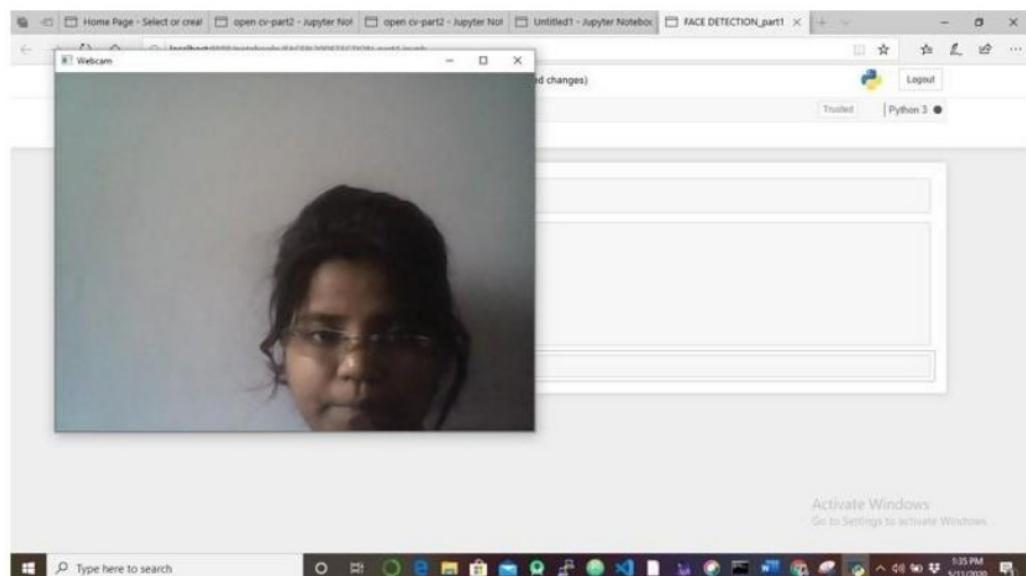
6.1 conclusion

The neural network is used for MNIST dataset for handwritten digits extraction ,technique for abstracting the characteristics from given MNIST dataset. Here we get 80.00 percent accuracy bu using 60,000 test dataset.so this method is good in getting accuracy.

WORKING As the data-intensive science has become separation standard among other sciences, this research paper has assessed the presentation of K-nearest neighbor, decision tree and neural network extract knowledge extraction from data. New awareness is made to be search by connected as supervision for computer experts and experts in handwritten digit acknowledgment. Grades presented that both ANN and K-NN classifiers able to provide a high accuracy in arrangement task for data mining. Future work will effort on sightseeing meta-heuristic algorithms such as ant colony algorithm to discover the best rules as a new method for data mining in the task of analytical

Challenges:different person may have very similar appearance.the identification and recognition system could even be model recognition approach es like fingerprint recognition .signature, retina etcaddititionally to other .

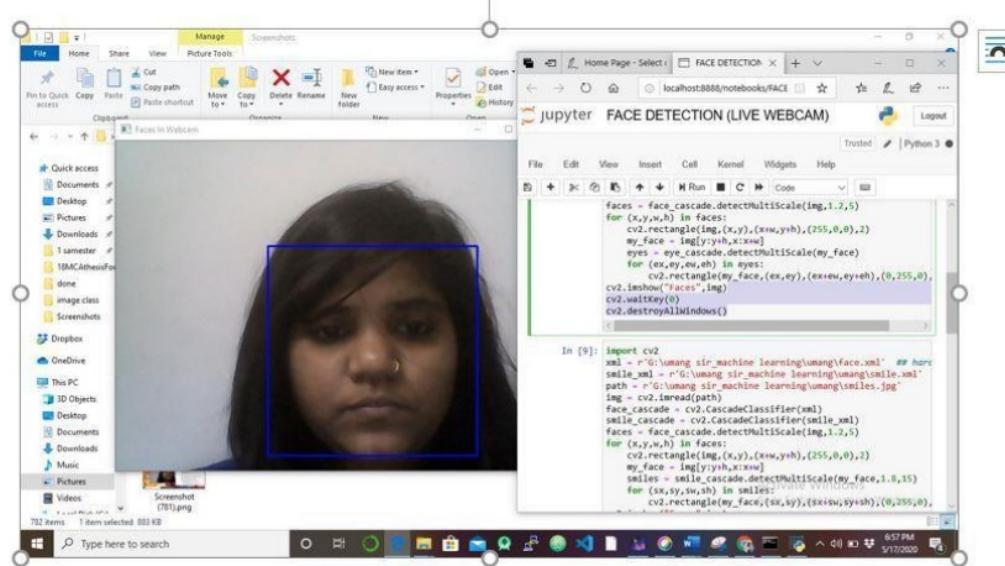
Expression variation :



4

Image Classification Based on Data Mining Algorithms and Face Detection

45



1

There are two kind of picture for face acknowledgement procedure:despite everything picture and video picture.in any case,we discovered a few issues in facacknowledgement framework, for example pose problem:due to can not control face picture for catching and have many posture :

In this study,the machine learning and neural algorithm are used to build model which predict the images .for improving classification accuracy ,the combination of different feature extracted from theimagesandspeech dataset.the primary features are Entropy,Shannon- Entropy,moments,region properties from MRI scan images data and Time Frequency features,Wavlet Transform,Vocal Fold feat from speech Data have been taken to perform the binary classification overall ,success rate of 98 percent have been achived by applying perceptron .this whole system can help the image classification to detect images.To enhance the overall execution of classification algorithm and to improve accuracy ,further advancements in each algorithm step will be taken.in future work different combination of feature s,optimization methods or various dimension reduction techniques can be analyze the classification accuracy

Appendix A

Appendices

2 A.1 The summary of the classification report in the experiment

	precision	recall	f1-score	support
0	0.95	0.97	0.96	1015
1	0.97	0.98	0.98	1190
2	0.92	0.95	0.93	1077
3	0.91	0.91	0.91	1070
4	0.93	0.94	0.94	1034
5	0.91	0.93	0.92	930
6	0.94	0.96	0.95	1044
7	0.96	0.93	0.95	1129
8	0.93	0.88	0.90	995
9	0.92	0.90	0.91	1016
avg / total	0.94	0.94	0.94	10500

Figure A.1: The Classification Reports for the RF

	precision	recall	f1-score	support
0	0.97	0.99	0.98	1015
1	0.96	0.99	0.98	1190
2	0.98	0.96	0.97	1077
3	0.96	0.97	0.96	1070
4	0.98	0.96	0.97	1034
5	0.95	0.97	0.96	930
6	0.97	0.99	0.98	1044
7	0.96	0.97	0.96	1129
8	0.99	0.91	0.95	995
9	0.95	0.95	0.95	1016
avg / total	0.97	0.97	0.97	10500

2
Figure A.2: The Classification Reports for K-NN



PRIMARY SOURCES

- 1 Smart Innovation Systems and Technologies, 2016. 7 %
Publication
- 2 arrow.tudublin.ie 2 %
Internet Source
- 3 www.datacamp.com 1 %
Internet Source
- 4 Liu Chuanli, Liao Qumin. "Research on plant information identification, extraction and change monitoring based on multi-source remote sensing data", 2010 Second IITA International Conference on Geoscience and Remote Sensing, 2010 1 %
Publication
- 5 Mohammad Ashraful Hoque, Thouhidul Islam, Tanvir Ahmed, Al Amin. "Autonomous Face Detection System from Real-time Video Streaming for Ensuring the Intelligence Security System", 2020 6th International Conference on Advanced Computing and Communication 1 %

Systems (ICACCS), 2020

Publication

6

"ICDSMLA 2019", Springer Science and Business Media LLC, 2020

<1 %

Publication

7

Weichun Zhang, Hongbin Liu, Wei Wu, Linqing Zhan, Jing Wei. "Mapping Rice Paddy Based on Machine Learning with Sentinel-2 Multi-Temporal Data: Model Comparison and Transferability", Remote Sensing, 2020

<1 %

Publication

8

collections.lib.utah.edu

Internet Source

<1 %

Exclude quotes

On

Exclude matches

< 10 words

Exclude bibliography

On