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Handwritten Text Recognition

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ABSTRACT: - Due to increased usage of digital technologies in all sectors and in almost all day-to-day activities it is needed to store and pass information, Handwritten character recognition has become a popular subject of research. Handwriting remains relevant, but people still want to have Handwritten copies convertedinto electronic copies So, that can be communicated and stored electronically. Handwritten recognition is the ability of a machine to receive and interpret the handwritten image from an external source like image. Handwritten Text Recognition (HTR) systems consist of handwritten text in the form ofscanned images. The character recognition involves several steps like acquisition, feature extraction,classification, and recognition. This project in a machine learning domain.

Keywords: **-**Convolutional Neural Network (CNN), Neural Network Architecture (NNA), MNIST dataset, Optical character reorganization (OCR), Machine Learning.

INTRODUCTION

Machine learning (ML) is the study of computer algorithms that can improve automatically through experience and by the use of data.[1]It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as training data, in order to make predictions or decisions without being explicitly programmed to do so.[2]Handwritten Text recognition is a fundamental, but most challenging in the field of pattern recognition with large number of useful applications. It has been an intense field of researchsince the early days of computer science due to it being a natural way of interactions between computers and humans. .[3] More precisely Handwritten text recognition is the processof detecting and recognizing handwritten text from the input image and converts it into ASCII or other equivalent machine editable form.

The technique by which a computer system can recognize characters and other symbolswritten by hand in natural handwriting is called handwriting recognition system.

Handwriting recognition is classified into offline handwriting recognition and online handwriting recognition. If handwriting is scanned and then understood by the computer, itis called offline handwriting recognition.

If handwriting is scanned and then understood by the computer, it is called offline handwriting recognition. In case, the handwriting is recognized while writing through touchpad using stylus pen, it is called online handwriting recognition.[3].

Handwritten character processing systems are domain and application specific, like it is notpossible to design a generic system which can process all kinds of handwritten scripts and language. Lots of work has been done on European languages and Arabic (Urdu) language.Whereas domestic languages like Hindi, Punjabi, Bangla, Tamil, Gujarati etc. are very lessexplored due to limited usage.

LITERATURE SURVEY

An early notable attempt in the area of character recognition research is by Grimsdale in 1959. The origin of a great deal of research work in the early sixties was based on an approach known as analysis-by-synthesis method suggested by Eden in 1968. .[4]The great importance of Eden's work was that he formally proved that all handwritten characters areformed by a finite number of schematic

features, a point that was implicitly included in previous works. This notion was later used in all methods in syntactic (structural) approaches of character recognition.

K. Gaurav, Bhatia P. K.Et al, this paper deals with the various pre-processing techniques involved in the character recognition with different kind of images ranges from asimple handwritten form based documents and documents containing colored and complex background and varied intensities.[5]. In this, different pre-processing techniques like skew detection and correction, image enhancement techniques of contrast stretching, binarization, noise removal techniques, normalization and segmentation, morphological processing techniques are discussed.

It was concluded that using a single technique for pre-processing, we can't completely process the image. However, even after applying all the said techniques might not possible to achieve the full accuracy in a pre-processing system technique for pre-processing, we can't completely process the image.[7]. However, even afterapplying all the said techniques might not possible to achieve the full accuracy in a pre-processing system.

EXISTING SYSTEM

A handwritten English character recognition system based on the Hidden Markov Model (HMM). This method made use of two different feature extractions namely global and local feature extraction. Global feature includes many features like gradient features, projection features and curvature features in the numbers of four,six and four respectively.

A Existing System proposed a method in order to reduce the training time of systemby utilizing a single layer neural network. Segmented characters are scaled to 80 X 80 pixels. Data normalization is performed on the input matrices to improve the training performance. But their result has a low accuracy rate

Since a very long time, human used to write their thoughts in the form of letter,transcripts etc. In order to convey them to others. But since the development of computer technology the format of handwritten text changed rapidly to computer generated digital text and so people feel a need of such method that can transform the handwritten text to digital text as it makes the processing of such data very fastand easy.

Many recognition studies have been made for offline and online handwritten characters of major languages used worldwide: like English, Chinese, Indian scriptssuch as Devanagari, Malayalam and Bangla , but they all suffer with some sort of drawback: like low conversion speed, low accuracy, higher false detection rate and poor performance with noisy input etc.

ISSUES IN EXISTING SYSTEM

The Existing system has issues like low conversion speed, low accuracy, higher falsedetection rate and poor performance with noisy input. Some existing System classified the data into 26 different English letters. This method performs well but it did not include the classification of small Englishletters.

A existing system requires human suggestion for only those inputs for which thesystem gets confuse. Although It keep the accuracy to high level, it increases thehuman lead. The only problem was that the system was not fully automatic and requires human intervention for operation.

The existing System does not have high quality training dataset.

PROPOSED SYSTEM

The system that takes handwritten English characters as input, process the input, extract the optimal features, train the neural network using either Resilient Back-propagation or scaled conjugate gradient, recognize the class of input text, and finally generate the computerized form of input text. We are reshaping the train & test image data so that they can be displayed as an image, as initially in the CSV file they were present as 784 columns of pixel data. So, we convert it to 28×28 pixels. We will be using CNN model for training the model over the training dataset. Handwritten text will be recognized with more than 97% test accuracy.

ALGORITHM USED

CONVOLUTIONAL NEURAL NETWORK (CNN)

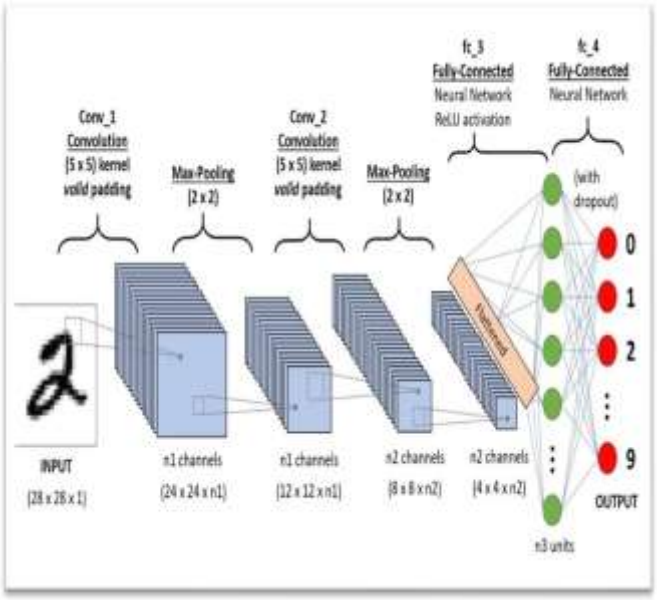
The system will use the convolutional neural network (CNN), which class of deepneural networks that are used for character recognition from images.

An underlying architecture of CNN that will be used in the OCR system.

The architecture shows different types of layers, with the first layer being the input layerand the last layer being the output layer.

The description of the CNN architecture is as follows:

Input layer: The input layer is used to feed the system with the image with the handwriting. The layer can be colored image (RGB values) or grayscale. It can have dimension W*H*W, depending on the input image. The W*H refers to the width andheight of the image, while D refers to the depth of the image.



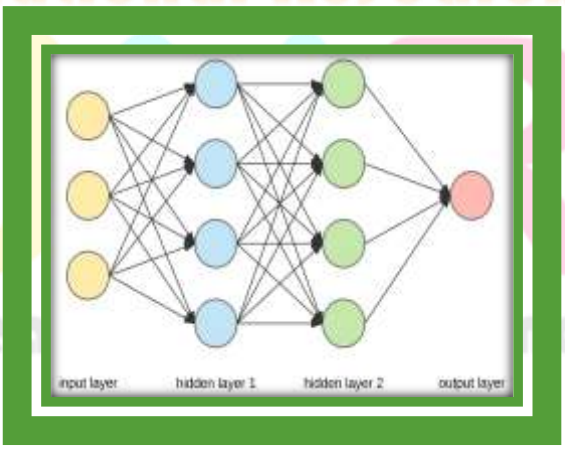
Convolution layer

Convolution layer: - The convolution layer is the building block of the whole network. Most of the computational work that is required to recognize characters from the input isdone in this layer. The layer consists of a set of learnable filters known as parameters of the convolution layer.

Pooling layer: - The pooling layers are found between the convolutional layers in the CNN architecture. They are responsible for progressively reduce the spatial size of computational work in the network. They help to streamline the underlying computation. They do so by reducing the dimension of the input data by combing theoutputs of the neuron clusters. They operate independently. That way, the system can achieve the intended outputs.

Fully connected layer: - Neurons in a fully connected layer are fully connected to allactivations in the prevision layer. Hence, this layer, activations, can be computed withmatrix multiplication. Based on the architecture, a system can have multiple fully connected layers.

NEURAL NETWORK ARCHITECTURE



Neural network architecture

The HTR systems are most efficient when they are based on neural networks.

The neural network architecture refers to the elements that are connected to make anetwork that is used for handwriting recognition.

Several units are layers to form a network and arrange from the ones that are responsiblefor receiving input to the layer that is responsible for output values.

Between the output and input level layers, there is a hidden layer that is involved inmuch of processing.

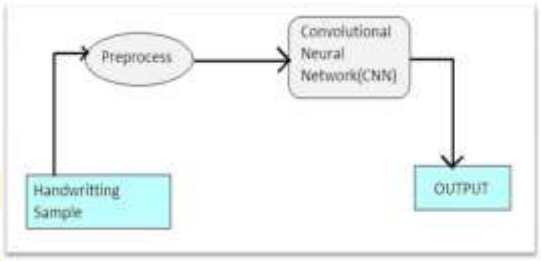
Different neural network architectures can be used to provide different results from theinput images of handwriting. It is because architectures are based on different parameters, data, and duration of training.

The size of a deep neural network layer is dependent on the work that the system is supposed to do. However, in most cases, more computational efficient smaller hidden layerscan be developed to achieve the same task as one that can be achieved with an exponentiallylarge deep neural network.

DESIGN AND ARCHITECTURE

The design and architecture of the proposed handwritten text recognitionsystem that will be using the neural network approach are:

The proposed system comprises input pre-processing, CNN, and output sections.



MODULES

1. Data Pre-Processing
2. CNN Architecture
3. Application
4. Android Based Text Recognition

1. Data Pre-Processing

In data pre-processing first we take data from Kaggle which is a part of a IAM dataset which contain A-Z alphabet in different style. Second, we take MNIST dataset which contain 0-9 number in written format with different style.

After that we reshaping and shuffle both datasets together for more accuracy and getting more accurate value.

After that we merge both dataset for find the result and fast processing.

And again we shuffle the merge dataset for find easily and accurate value which the system is looking for recognition of character.

A-Z Dataset

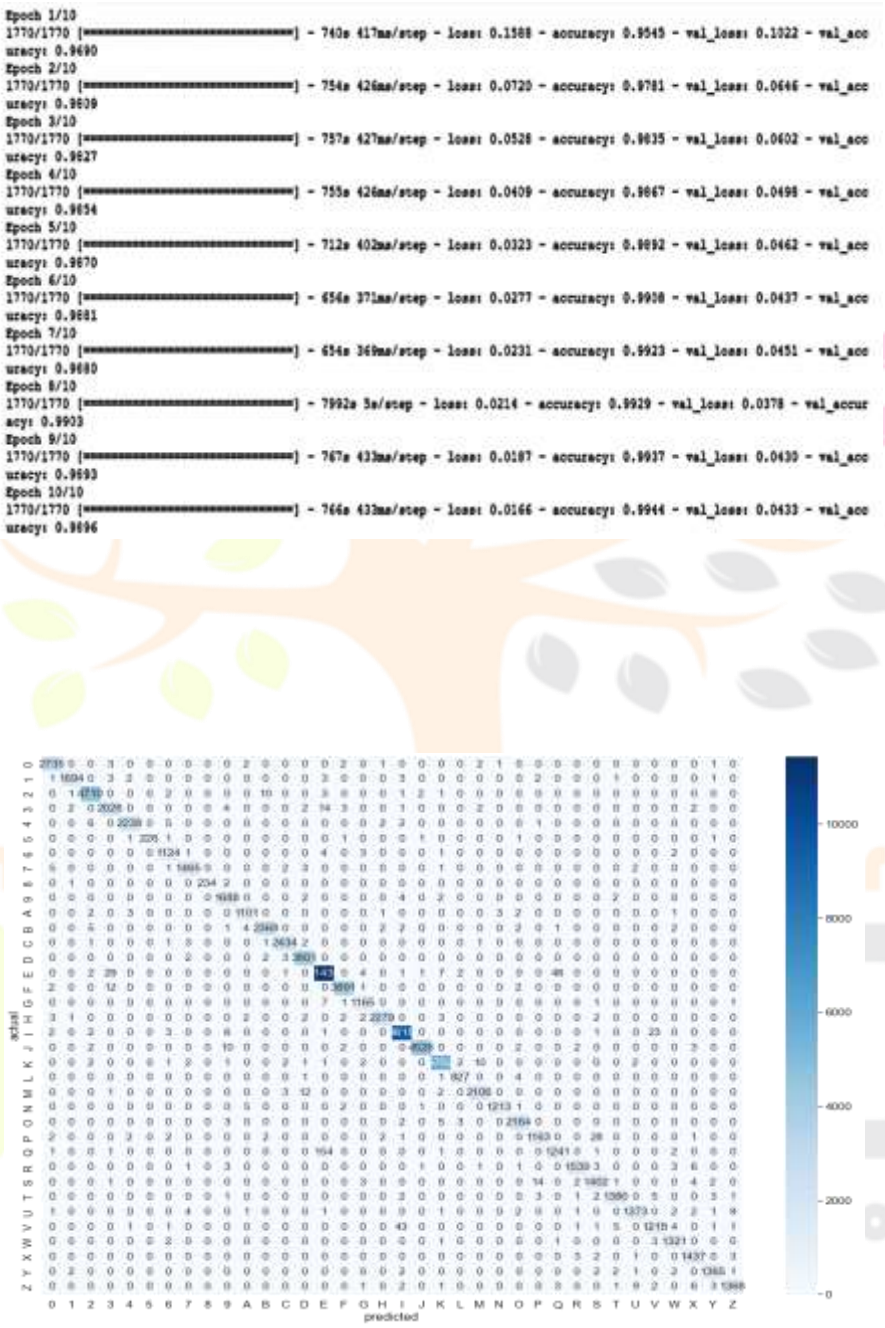
Mnist Dataset

Shuffled Dataset

2) CNN Architecture

The model type that we will be using is Sequential. Sequential is the easiest way to build a model in Keras. It allows you to build a model layer by layer. We use the 'add ()' function to add layers to our model. Our first 2 layers are Conv2D layers. These are convolution layers that will deal with our input images, which are seen as 2-dimensional matrices. The activation function we will

be using for our first 2 layers is the ReLA, or Rectified Linear Activation. This activation function has been proven to work well in neural networks. In between the Conv2D layers and the dense layer, there is a 'Flatten' layer. Flatten serves as a connection between the convolution and dense layers. 'Dense' is the layer type we will use in for our output layer. Dense is a standard layer type that is used in many cases for neural networks. We will have 36 nodes in our output layer, one for each possible outcome (A-z)& (0–9). The activation is 'softmax'. Softmax makes the output sum up to 1 so the output can be interpreted as probabilities. The model will then make its prediction based on which option has the highest probability. We need to compile our model. Compiling the model takes three parameters: optimizer, loss and metrics. We will use 'categorical_crossentropy' for our loss function. This is the most common choice for classification. A lower score indicates that the model is performing better. We will use the 'accuracy' metric to see the accuracy score on the validation set when we train the model.



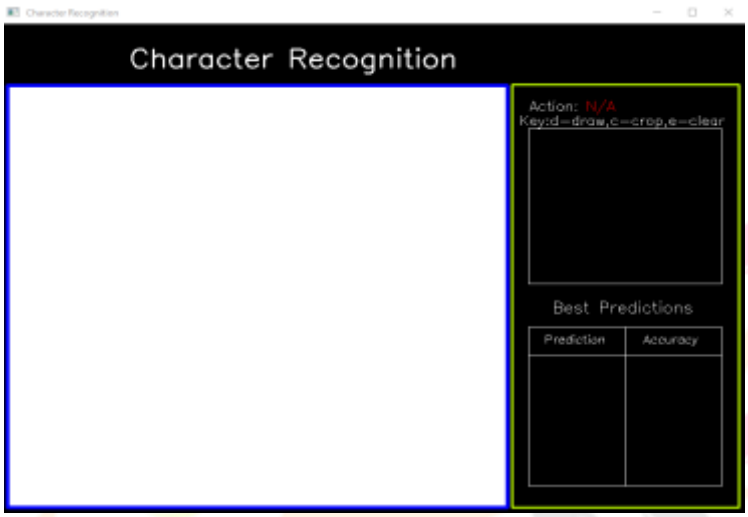
3)Application

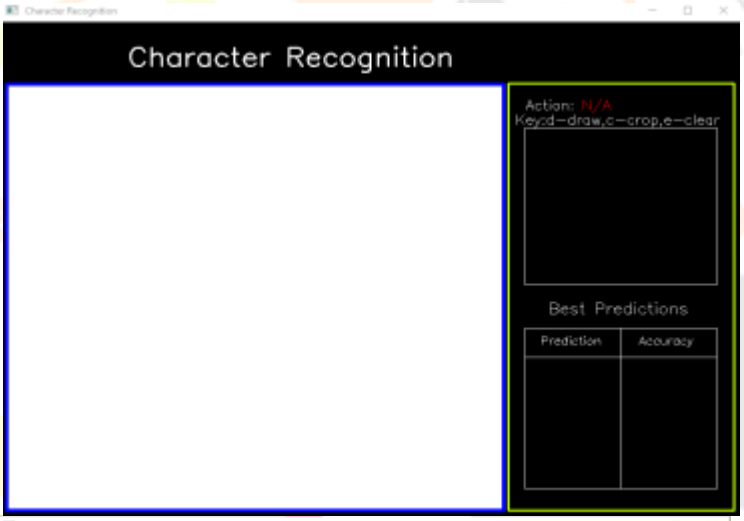
After the pre-processing of data and implementation of CNN then we work on Application where we have to write the character to convert into a digital character after run the code of application. There are 3 type of layer where the first layer is used to draw/Enter the character number or alphabet in the white screen. In second layer we can crop the character or digit for better result. The third layer shows the accuracy level of the character which is drawn and show the accuracy level for that drawn character or digit.

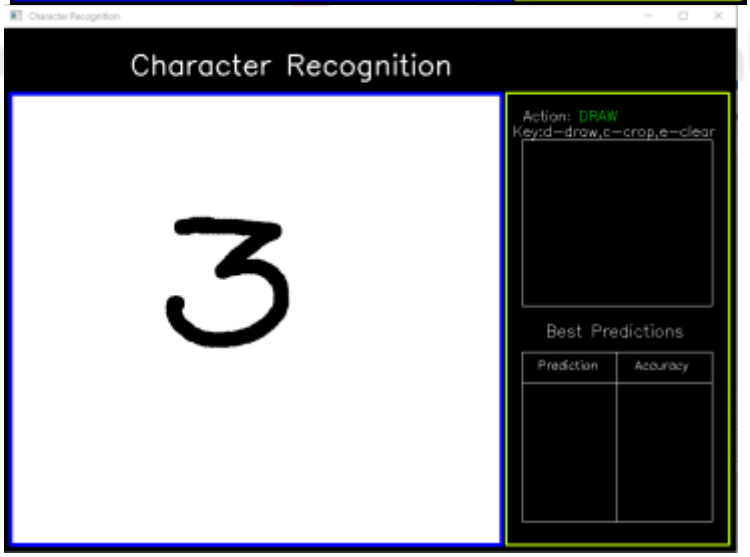
4) Android Based Text Recognition

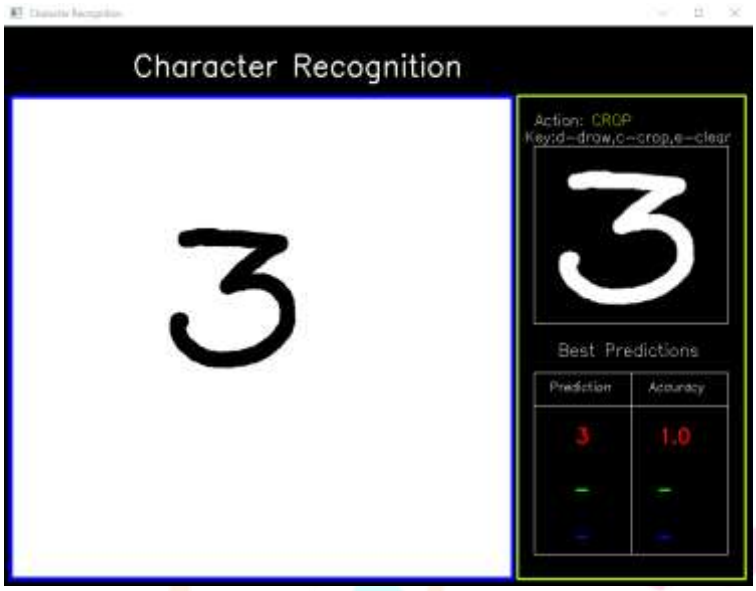
This is simple mobile application in which you have to take a snap or capture the image of written text or upload the written image from your file after that the application scanned all the imager if written character and convert into the digital text after you can choose in which format you want to save or copy that digital character or text easily.

OUTPUT

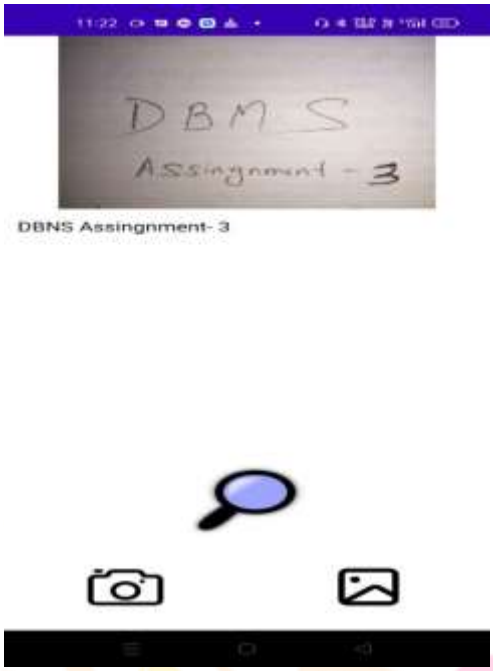








ANDROID APPLICATION OUTPUT



RESULT

This system is executed and the result is analysed with the existing system, in this analysis we have noticed a significant increase in accuracy level. The time taken to recognize the character is being shorten and it becomes much faster.

CONCLUSION

An implementation using CNN is provided and some important parts of the code were presented. Finally, hints to improve the recognition accuracy were given. Many regional languages throughout world have different writing styles which can be recognized using proper algorithm and strategies but in this project we will be only using English characters or digits for recognition.

REFERENCES

i. Mitchell, Tom (1997). Machine Learning. New York: McGraw Hill. ISBN 0-07-042807-7OCLC 36417892.

ii. The definition "without being explicitly programmed" is often attributed to Arthur Samuel, who coined the term "machine learning" in 1959, but the phrase is not found verbatim in this publication, and may be a paraphrase that appeared later. Confer "Paraphrasing Arthur Samuel (1959), the question is: How can computers learn to solve problems without being explicitly programmed?" in Koza, John R.; Bennett, Forrest H.; Andre, David; Keane, Martin A. (1996). Automated Design of Both the Topology and Sizing of Analog Electrical Circuits Using Genetic Programming. Artificial Intelligence in Design '96. Springer, Dordrecht. pp. 151–170. doi:10.1007/978-94-009-0279-4_9.

iii. Isha Vats, Shamandeep Singh, "Offline Handwritten English Numerals Recognition us- ing Correlation Method", International Journal of Engineering Research and Technology

iv. Gunjan Singh,Sushma Lehri, " Recognition of Handwritten Hindi Characters usingBack propagation Neural Network",International Journal of Computer Science and InformationTechnologies

v. S S Sayyad, Abhay Jadhav, Manoj Jadhav, Smita Miraje, Pradip Bele, Avinash Pandhare, 'Devnagiri Character Recognition Using Neural Networks" ,International Journal of Engineering and Innovative Technology (IJEIT)Volume 3, Issue 1, July 2013. Access Date:09/07/2015.

vi. Shabana Mehfuz,Gauri katiyar, 'Intelligent Systems for Off-Line Handwritten Character Recognition: A Review" ,International Journal of Emerging Technology and Advanced Engineering Volume 2, Issue 4, April 2012. Access Date: 09/07/2015.

vii. Prof. Swapna Borde, Ms. Ekta Shah, Ms. Priti Rawat, Ms. Vinaya Patil, "Fuzzy Based Handwritten Character Recognition System" ,International Journal of Engineering Re- searchand Applications (IJERA) ISSN: 2248-9622,VNCET Mar'12. Access Date: 09/07/2019.