Recognition of Hand Written And Printed Text Using CNN

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Abstract- *Character recognition still remains an active area for research towards exploring the new techniques that would help in improving recognition accuracy. This project focuses on recognition of character from the image with the help of CNN. The steps involved in this methodology are Preprocessing, Feature Extraction, Training, Classification and Recognition using CNN. Preprocessing is a series of operation performed on input image it involves removing or enhancing data images. Feature Extraction it extract different line type that form a particular character and the gradient measures the magnitude and direction of the greatest change in each pixel. The Data sets, containing texts are used to train the system. Finally the CNN classifier is used to classify the words and the features of each character written in the input are extracted and then passed to the neural network and text characters are recognized. The CNN proposed recognition system gives high level accuracy*

Keywords- Handwritten, printed text pre-processing, feature extraction, recognition, optical character recognition, Convolutional Neural Network

I. INTRODUCTION

Handwritten character recognition is a field of research in artificial intelligence, computer vision, and pattern recognition. A computer performing handwriting recognition is said to be able to acquire and detect characters in paper documents, pictures, touch-screen devices and other sources and convert them into machine-encoded form. Its application is found in optical character recognition and more advanced intelligent character recognition systems. Most of these systems nowadays implement machine learning mechanisms such as neural networks. Machine learning is a branch of artificial intelligence inspired by psychology and biology that deals with learning from a set of data and can be applied to solve wide spectrum of problems.

A supervised machine learning model is given instances of data specific to a problem domain and an answer that solves the problem for each instance. When learning is complete, the model is able not only to provide answers to the data it has learned on, but also to yet unseen data with high precision. Neural networks are learning models used in machine learning. Their aim is to simulate the learning process that occurs in an animal or human neural system. Being one of the most powerful learning models, they are useful in automation of tasks where the decision of a human being takes too long, or is imprecise.

A neural network can be very fast at delivering results and may detect connections between seen instances of data that human cannot see. We have decided to implement a neural network in an Android application that recognizes characters written on the device's touch screen by hand and extracted from camera and images provided by the device. Having acquired the knowledge that is explained in this text, the neural network has been implemented on a low level without using libraries that already facilitate the process. By doing this, we evaluate the performance of neural networks in the given problem and provide source code for the network that can be used to solve many different classification problems. The resulting system is a subset of a complex OCR or ICR system; these are seen as possible future extensions of this work. It is a field of research in pattern recognition, artificial intelligence and machine vision. Though academic research in the field continues, the focus on character recognition has shifted to implementation of proven techniques.

The organization of the paper is as per the following. In section II literature survey is explained. Section III explains the proposed methodology. Section IV shows the conclusion and future enhancement.

II. LITERATURE REVIEW

Handwritten Character Recognition [HCR][1] is a general procedure of written texts or digitizing pictures of printed with the goal that they could be electronically revised, put away and looked through more proficiency and accurately. The target of an OCR technique is an acknowledgment of composition (same as people) in a troublesome article. OCR techniques are significantly classified in two sorts, First online text recognition and Second offline recognition. Offline OCR

is considered in two subclasses initially is typed and second is handwritten text.

Optical character recognition is a technique for consequently recognizing various character from a record picture moreover gives complete alphanumeric recognition for printed or handwritten characters, text numerical, letters, and symbols into PC procedure capable format including ASCII, Unicode thus forth [2]. These OCR innovations help to look at interesting records written in English, Chinese, Hindu, Arabic, Russian and other languages. This work illustrates the audit of certain investigates has been made in English, Arabic, and Devanagari characters The initial step is pre-processing, for example, noise detection and removal, binarization, etc. The segmentation of archives images into line, word, and characters. This is trailed by feature extraction for representing character pictures and a classification module, finally post-processing.

Segmentation of handwritten archive pictures into text lines and words is a basic task for Optical character recognition[3]. However, a feature of written text is unpredictable and differs from person to person. To address the issue, the authors have characterized the word segmentation issue as a binary quadratic assignment task that considers the pairwise relationship between the spaces similarly as the probabilities of individual space.

Printed text recognition is the limit of PCs to understand input characters from an outside source for example e-forms and e-reports[4]. Machine learning algorithms gives an ability to decipher the printed text to digitized characters. The purpose is to actualize a machine written character recognition framework for lower case English characters for two unique styles i.e.., Times New Roman and Arial by using the Learning Vector Quantization algorithm.

Segmentation of handwritten text archives into singular character or digit is a critical stage in archive examination, character recognition, and numerous different zones. In this paper, the author has examined different strategies to segment a picture containing text at different degrees of segmentation[5]. Text segmentation and histogram technique to partition each character individually.

Handwritten recognition is the limit of PC's to perceive and decode written text from sources[6]. Recognition of handwritten characters by a PC is a troublesome issue because of the human handwriting changeability, uneven skew, orientation writing habit, style. In this work, the test characters are sorted into vowel/consonant classes utilizing the multiclass SVM classifier, acquiring 89.84% accuracy in recognizing Kannada vowels and 85.14% accuracy in recognizing consonants.

Optical Character Recognition [OCR] of printed Latin content documents are universally guaranteed as a tackled issue[7]. The latest methodologies recognize characters by segmentation. The paper portrays a text line recognition approach utilizing multi-layer perception [MLP] and hidden Markov models [HMMs].

This paper expected to prepare our classifier in case we are considering using data mining methods for such purposes[8]. There are a few set up generic classification techniques that can be utilized together with feature extraction mechanism yet it is imperative to know which of them improve under which condition. This assesses three methodologies for OCR from manuscripts and considers their outcome.

The paper proposed a novel multi-model archive image recovery system by misusing the data of text and design areas[9]. The system applies various part based hashing formulation for the generation of composite records utilizing various modalities. In the ensuring commitment propose novel multi-modular archives report ordering system for recovery of an old and degraded text document by joining OCR'ed content and image-based representation utilizing learning.

The paper proposed the utilization of stacking denoising encoder for programmed feature extraction clearly from raw pixel estimation of pictures[10]. Such profound learning systems have not been applied for recognizing the Urdu text so far. Along these lines, prepared systems are approved and tried on degraded forms of UPTI informational collection.

Character recognition assumes a significant role in removing the necessary content from the document[11]. The essential point is to perceive the printed characters in a given data picture and isolating it. The machine learning procedure is utilized, where the framework is first arranged for all the letters in order and evaluates the English language along with the expected result. There are four stages in this particular technique pre-processing, segmentation (Line segmentation, Word segmentation, character segmentation) and next is to identify the features of each character. And lastly, the classification has been done.

In the current strategy, it makes use of topographical features and projection profiles to identify character

segmentation region from monochrome images [12]. Using a multi-stage graph search algorithm, a nonlinear character segmentation routes is found. Lastly, Recognition based segmentation technique is utilized to check the correctness of the nonlinear character segmentation routes and output. This approach is found to be successful in identifying overlayed and close by characters.

Modi was helpful content in the kingdom of medieval Maharashtra[13]. In the region of incomparable Maharatha Chatrapathi Shivaji and the rule of Peshwas, the content was broadly joined in administering the state. This content was very like the shorthand, Around then it was utilized in Maharashtra to set up the document, for example, Property issues, Dan-Patra, Land revenue, and so on, right now Modi content is considered, Recognizable proof and recognition of handwritten of Modi characters are done. The database of handwritten tests set up by utilizing the ANSEP program

In this paper has designed a very distinctive android based Multilanguage smart device application that improves user's writing experiences[14]. The main purpose of the work is to perceive character recognition algorithms that perform better on low-performance devices. Right now strategies are language free and have been effectively utilized for many languages of India.

This paper inspects the issues in recognizing the Devanagari characters in the wild like sign sheets, commercial, logos, and soon[15]. It manages the issues in recognizing the machine printed and the handwritten Devanagiri characters. The current OCR method is useful for the scanned images of printed text, perform ineffectively on characters extracted from the images of the wild. It is a result of the images of the wild contain the unforeseen fonts, 3D impacts, and have distortion and noise in characters. character recognition, and many recent methods have been proposed to design better feature representations and models for both. In this paper, we apply methods recently developed in machine learning–specifically, large-scale algorithms for learning the features automatically from unlabeled data–and show that they allow us to construct highly effective classifiers for both detection and recognition to be used in a high accuracy end-to-end system. The machine learning procedure is utilized, where the framework is first arranged for all the letters in order and evaluates the English language along with the expected result.

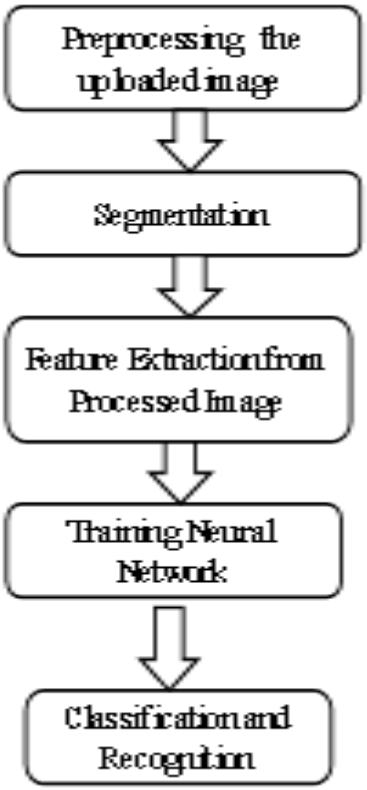
III. PROPOSED SYSTEM

The scope of this design document is to achieve the features of the system such as pre-process the images, feature extraction, display the text present in the image, and recognition of text. They are normally used in sequence image preprocessing helps make feature extraction a smoother process, while feature extraction is necessary for correct classification.

The proposed methodology uses some techniques to remove the background noise, and features extraction to detect and classify the handwritten text. The proposed method comprises of 3 phases:

1.Pre-processing.
2.Feature Extraction.
3.Classification and Recognition.

Block diagram of proposed method



The aim to implement the concept of Convolutional Neural Network for text recognition. Understanding CNN and applying it to the handwritten text recognition system is the target of the proposed model. Convolutional Neural Network extracts the features maps from the 2D images.

Then it can classify the images using the features maps. The convolutional neural network considers the mapping of image pixels with the neighborhood space rather than having a fully connected layer of neurons. The convolutional neural network is a powerful tool in signal and

image processing. Even in the fields of computer vision such as handwriting recognition, natural object classification, and segmentation, CNN has been a much better tool compared to all other previously implemented tools. The broader aim may be to develop a machine learning model that could recognize people's handwriting.

Convolutional neural networks are deep artificial neural networks. It is used to classify images, cluster them by similarity (photo search) and perform object recognition within scenes. It can be used to identify faces, individuals, street signs, tumors, platypuses and many other aspects of visual data. The convolutional layer is the core building block of a CNN. The layer's parameters consist of a set of learnable filters (or kernels) which have a small receptive field but extend through the full depth of the input volume. During the forward pass, each filter is convolved across the width and height of the input volume, computing the dot product, and producing a 2- dimensional activation map of that filter. As a result, the network learns when they see some specific type of feature at some spatial position in the input. Then the activation maps are fed into a down sampling layer, and like convolutions, this method is applied one patch at a time. CNN has also fully connected layer that classifies output with one label per node.

The architecture diagram shows the different stages of text recognition of handwritten and printed text.

Image preprocessing is crucial in the recognition pipeline for correct character prediction. These methods typically include noise removal, image segmentation, cropping, scaling, and more. In our project, these methods have mainly been used when recognizing from an image, but some of them, such as cropping the written character and scaling it to our input size, are also performed in the touch mode. Digital capture and conversion of an image often introduces noise which makes it hard to decide what is actually a part of the object of interest and what is not. Considering the problem of character recognition, we want to reduce as much noise as possible, while preserving the strokes of the characters, since they are important for correct classification. There are many ways of achieving this. Local processing is one of them.

Grey-scaling of an image is a process by which an RGB image is converted into a black and white image. This process is important for Binarization as after greyscaling of the image, only shades of grey remains in the image, binarization of such image is efficient.

Binarisation of an image converts it into an image which only have pure black and pure white pixel values in it. Basically during binarization of a grey-scale image, pixels with intensity lower than half of the full intensity value gets a zero value converting them into black ones. And the remaining pixels get a full intensity value converting it into white pixels.

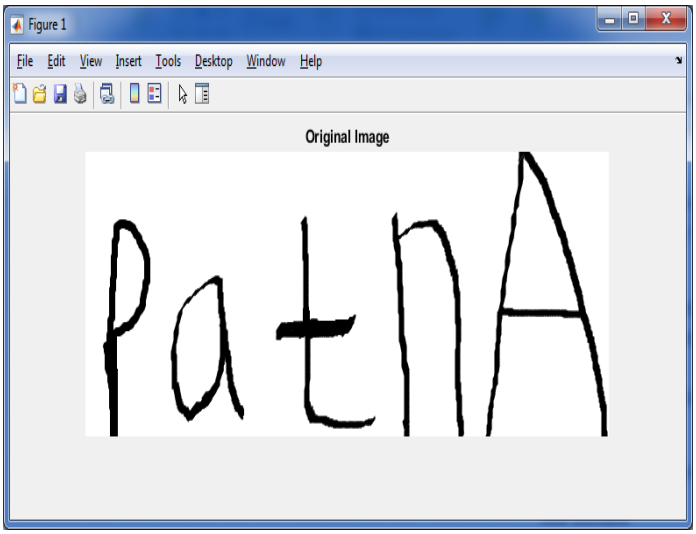


Fig:3.1 Input image

The input is in image format which contains some noise so it can be removed from the input image by preprocessing it can enhance the image and noise free input image shows in fig:3.1

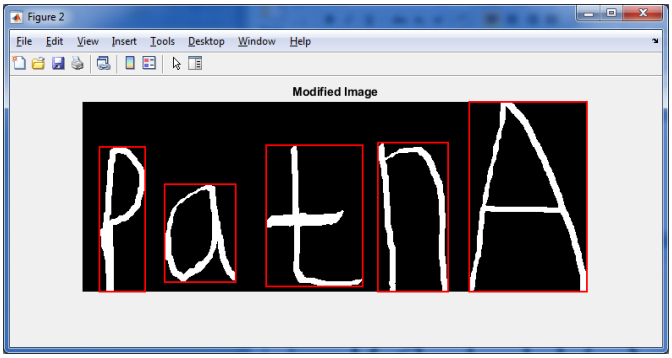


Fig:3.2 Modified image

Fig 3.2 shows the modified image of text from the preprocessed image. After boxing the character a cleaned image is accessible. The sequence of characters in the image is seeking to extract sub images of individual characters.

Features of input data are the measurable properties of observations, which one uses to analyze or classify these instances of data. The task of feature extraction is to choose

relevant features that discriminate the instances well and are independent of each other. The selection of a feature extraction method is probably the single most important factor in achieving high recognition performance. There is a vast amount of methods for feature extraction from character images, each having different characteristics, invariance properties, and reconstruct ability of characters.

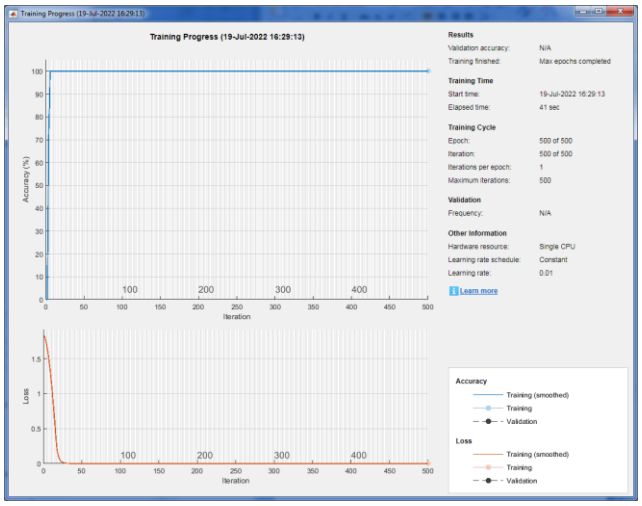


Fig:3.3Convolutional Neural Network trainer tool

The process that takes in raw data and makes an action based on the category of the pattern. It find the regularities and similarities in data. During training, the network is trained to associate output with input patterns and when the network is used, it identify the input pattern and tries to output the associated output pattern.

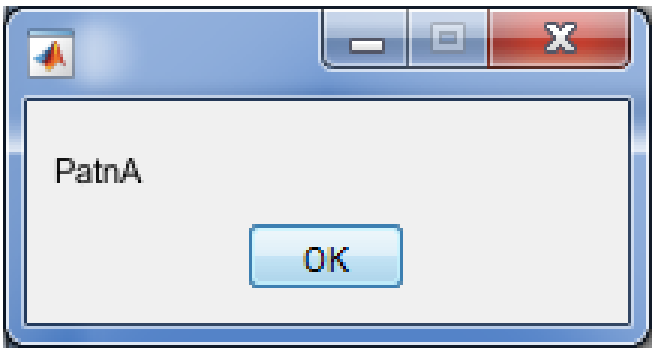


Fig:3.4Text recognition

After recognition the input image containing noise is segmented and the noise can be removed using morphological operations.In dilation operation it adds pixels to the boundaries of objects in a image and the area of foreground pixels grow in size and holes within those regions become smaller. Next the erosion operation performed to removes pixels on object boundaries and the area of foreground pixels shrink in size and holes within those areas become larger.

Fig.3.4 shows the character extracted from the input image compared with the trained data set.once the data set is trained and the character extracted randomly.

IV. CONCLUSION AND FUTURE ENHANCEMENT

The proposed recognition system gives high levels of accuracy as compared to the conventional approaches in this field. Neural network followed by the Back Propagation Algorithm which compromises Training. An experimental result shows that ANN with back propagation network yields good recognition accuracy of 99%.In future work A Convolutional Neural Network (CNN) is trained on the resulting dataset to predict the probability of each pixel of being foreground given a patch centered on it. The CNN learns what a finger vein pattern is by learning the difference between vein patterns and background ones. The pixels in any region of a test image can then be classified effectively.

In future, planning to develop a real-time handwritten text recognition system

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