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Handwritten Text Recognizer

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***Abstract*— The aim of the project is to develop OCR softwarefor Hindi text recognition. OCR is an optical text recognition and is the mechanical or electronic translation of images of typewritten or handwritten (usually captured by a scanner)into machine-editable text. Text recognition is used most often to describe the ability of computer to translate printer or human writing into text.Using the machine learning algorithms,we are going to recognize handwritten text.The first step is image acquisition which acquires the scanned image followed by noise filtering, smoothing and normalization of scanned image, rendering image suitable for segmentation where image is decomposed into sub images. Feature Extraction improves recognition rate and misclassification. We are going to use text extraction and edge detection algorithm for training the ma- chine learning model to classify and recognize the handwritten text. Existing Applications which are similar to our application contain many mismatches and errors that will be rectified in our project which increases the accuracy of the text recognition**

I. INTRODUCTION

Intelligence of humans makes them different from computers. The human can do various tasks that are still impossible for machines to do by their own. One of such tasks is handwritten text recognition. Even though, Text recognition in the handwritten documents has been studied as one of the prominent research areas by different researchers during the last few decades and because of that many automatic handwritten systems are developed by different researchers in past . However, the recognition algorithm and its efficiency is still an open research issue. Due to the vast inconsistency in handwriting styles, frequently the state-of-the-art handwriting recognition systems fails to provide satisfactory performance on various types of handwriting samples.

Despite the significant progress made in the field of HTR, the recognition of handwritten text remains a challenging task, This challenge stems from the vast inconsistency in handwriting styles, making it difficult for state-of-the-art recognition systems to provide satisfactory performance on various types of handwriting samples. Additionally, the problem is further complicated due to the presence of diacritical marks and ligatures in script. Hence, there is an urgent need for advanced methodologies that can address these issues and improve the accuracy of Handwritten Text Recognition.

To address this challenge, we propose a novel methodology for recognizing Handwritten Text that leverages the power of deep learning and image processing techniques. Our methodology involves the pre-processing of images to extract features that are essential for recognition. We then use a Support Vector Machine (SVM) algorithm for classification, which has proven to be an effective approach for solving classification problems. Our proposed methodology can handle different styles of handwriting and is capable of recognizing text accurately.

In this research paper, we present a detailed description of our proposed methodology for recognizing Handwritten Text. We also present experimental results on a dataset of Handwritten Text, demonstrating the effectiveness of our proposed methodology. Our results show that our proposed method achieves state-of-the-art performance in recognizing Handwritten Text.

II. LITERATURE SURVEY

Recognition of Handwritten Hindi Characters using Back-propagation Neural Network Automatic recognition of handwritten characters is a difficult task because characters are written in various curved and cursive ways, so they could be of different sizes, orientation, thickness, format and dimension. An offline handwritten Hindi character recognition system using neural network is presented in this paper. Neural networks are good at recognizing handwritten characters as these networks are insensitive to the missing data. The paper proposes the approach to recognize Hindi characters in four stages 1) Scanning, 2) Preprocessing, 3) Feature Extraction and, 4) Recognition. Preprocessing includes noise reduction, binarization, normalization and thinning. Feature extraction includes extracting some useful information out of the thinned image in the form of a feature vector. The feature vector comprises of pixels values of normalized character image.

A Back propagation neural network is used for classification. Experimental result shows that this approach provides better results as compared to other techniques in terms of recognition accuracy, training time and classification time. The average accuracy of recognition of the system is 93.

III. THE PROPOSED RECOGNITION SYSTEM

In this section, the proposed recognition system is described. A typical handwriting recognition system consists

of pre-processing, segmentation, feature extraction, classification and recognition, and post processing stages. The schematic diagram of the proposed recognition system is shown in Fig.1

- **3.1 Image Acquisition** This is the first step where the scanner processes a document or image of text into binary form. The OCR software then analyzes the scanned object to determine the dark areas that are classified as characters and light areas as background.

- **3.2 Pre-processing** The pre-processing is a series of operations performed on the scanned input image. It essentially enhances the image rendering it suitable for segmentation. The various tasks performed on the image in pre-processing stage are shown in Fig.2. Binarization process converts a gray scale image intoa binary image using global thresholding technique.Detection of edges in the binarized image using sobel technique, dilation the image and filling the holes present in it are the operations performed in the lasttwo stages to produce the pre-processed image suitable for segmentation [16].

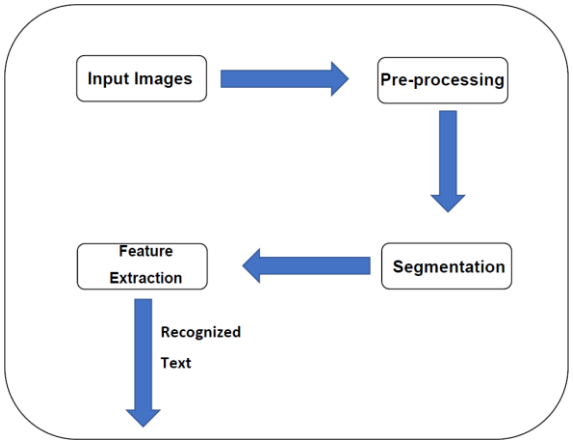

Figure 1. System Architecture

- **3.3. Segmentation** Segmentation in OCR (Optical Character Recognition) is the process of identifying and separating individual characters or words from an input image or document. OCR segmentation involves detecting the boundaries of each character or word in the image and then extracting those segments as separate entities.
  Segmentation is a critical step in OCR because it allows the OCR system to isolate each text or wordand process it individually. This makes it easier forthe OCR system to recognize and interpret the text accurately.

IV. PROPOSED FEATURE EXTRACTION METHOD

In this stage, the features of the text that are crucial for classifying them at recognition stage are extracted. This is an important stage as its effective functioning improves the recognition rate and reduces the misclassification [17]. Diagonal feature extraction scheme for recognizing off-line handwritten characters is proposed in this work. Every text image of size 90x 60 pixels is divided into 54 equal zones, each of size 10x10 pixels (Fig.3(c)). The features are extracted from each zone pixels by moving along the diagonals of its respective 10X10 pixels. Each zone has19 diagonal lines and the foreground pixels present long each diagonal line is summed to get a single sub-feature, thus 19 sub-features are obtained from the each zone. These 19 sub-features values are averaged to form a single feature value and placed in the corresponding zone (Fig.3 (b)). This procedure is sequentially repeated for the all the zones. There could be some zones whose diagonals are empty of foreground pixels. The feature values correspondingto these zones are zero. Finally, 54 features are extractedfor each character. In addition, 9 and 6 features are obtained by averaging the values placed in zones rowwise and columnwise, respectively. As result, every text is represented by 69, that is, 54 +15 features.

V. CONVOLUTIONAL NEURAL NETWORK ARCHITECTURE

A basic convolutional neural network comprises three components, namely, the convolutional layer, the pooling layer and the output layer. The pooling layer is optional sometimes. The typical convolutional neural network architecture with three convolutional layers is well adapted for the classification of handwritten images as shown inFigure 3. It consists of the input layer, multiple hidden layers (repetitions of convolutional, normalization, pooling) and a fully connected and an output layer.Neurons in one layer connect with some of the neurons present in the next layer, making the scaling easier for the higher resolution images. The operation of pooling or sub-sampling canbe used to reduce the dimensions of the input. In a CNN model, the input image is considered as a collection of small sub-regions called the “receptive fields”. A mathematical operation of the convolution is applied on the input layer, which emulates the response to the next layer. The response is basically a visual stimulus. The detailed description is as follows

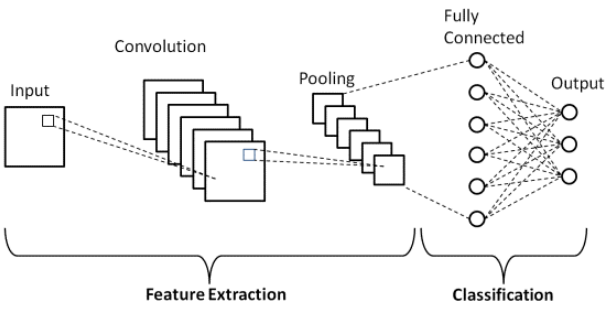

Figure 2. Typical convolutional neural network architecture.

convolutional neural network contains following layers

- Input Layer
- Hidden Layer
- Convolutional Layer
- Pooling Layer
- Activation Layer
- Classification Layer

VI. RESULT

HCR Using Neural Network ”is aimed at recognizing the handwritten characters. The “handwritten Character Recognition System ”is implemented using a neural network.in this system original image is converted into gray scale image then After gray scaling image is converted in black and white and segmented form. After preprocessing and segmentation operation system show final output.

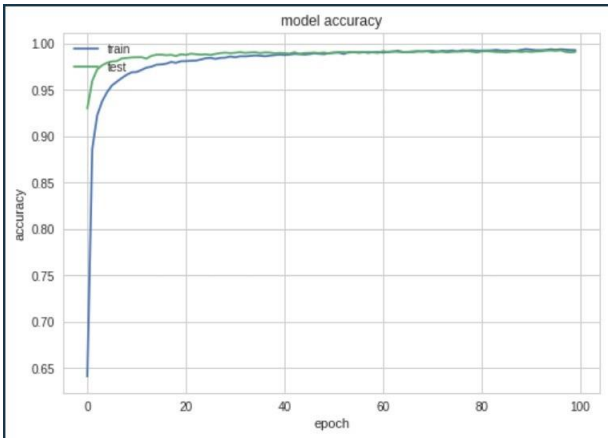

Figure 3. Model Accuracy.

VII. CONCLUSION

Machine learning, like any other technology, is not a silver bullet solution that can guarantee a better world, butit undoubtedly has the potential to significantly contributeto the global effort to combat climate change. With its ability to automate monitoring through remote sensing, ac- celerate scientific discovery, optimize systems to improve efficiency, and speed up computationally intensive physical simulations through hybrid modeling, such as climate and energy scheduling models, ML offers a wealth of possibilities to address climate-related challenges. If applied correctlyand ethically, machine learning can play a crucial role in advancing sustainable development and building a more resilient future for our planet.

REFERENCES

[1] Juhee Sachdeva, Sonu Mittal, “ Handwritten Offline English Compound text Recognition Using Machine Learning “,ACI’21: Workshop on Advances in Computational Intelligence at ISIC 2021.0.

[2] Indu Dokare ,Siddesh Gadge,Kedar Kharde, “Recognition of Handwritten English text using Convolutional Neural Network”, IEEE 3rd International Conference on Signal Processing and Communication (ICPSC) , 13 – 14 May 2021 .

[3] Shalini Puri, Satya Prakash Singh, “An efficient English text classification in printed and handwritten documents using SVM”, International Conference on Pervasive Computing Advances and Applications PerCAA 2019, Science direct Procedia ComputerScience ,111–121 ,2019

[4] Patel C, Patel A, Patel D. Optical text recognition by open source OCR tool tesseract: A case study. International Journal of Computer Applications. 2012 Jan 1;55(10)

[5] Verma R, Ali DJ. A-Survey of Feature Extraction and Classification Techniques in OCR Systems. International Journal of Computer Applications Information Technology. 2012 Nov;1(3).

[6] Pradeep J, Srinivasan E, Himavathi S. Diagonal based feature extraction for handwritten text recognition system using neural network. InElectronics Computer Technology (ICECT), 2011 3rd International Conference on 2011 Apr 8 (Vol. 4, pp. 364-368). IEEE.

[7] Khandelwal A, Choudhury P, Sarkar R, Basu S, Nasipuri M,Das N. Text line segmentation for unconstrained handwritten document images using neighborhood connected component analysis. InInternational Conference on Pattern Recognition and Machine Intelligence 2009 Dec 16 (pp. 369-374). Springer Berlin Heidelberg

[8] Bishnu A, Bhattacharya BB, Kundu MK, Murthy CA, Acharya T. A pipeline architecture for computing the Euler number of a binary image. Journal of Systems Architecture. 2005 Aug 31;51(8):470-87.

[9] Shah P, Karamchandani S, Nadkar T, Gulechha N, Koli K, Lad K. OCR-based chassis-number recognition using artificial neural networks. InVehicular Electronics and Safety (ICVES), 2009 IEEE International Conference on 2009 Nov 11 (pp. 31-34). IEEE

[10] sha Vats, Shamandeep Singh, “Offline Handwritten English Numerals Recognition using Correlation Method”,InternationalJournal of Engineering Research and Technology (IJERT): ISSN: 2278-0181 Vol. 3 Issue 6, June 2014. Access Date: 09/07/2015.

[11] unjan Singh,Sushma Lehri, “ Recognition of Handwritten Hindi Characters using Back propagation Neural Network”,International Journal of Computer Science and Information Technologies ISSN0975-9646, Vol. 3 (4) , 2012,4892-4895. Access Date:09/07/2015.

[12] 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.

[13] habana 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.

[14] rof. Swapna Borde, Ms. Ekta Shah, Ms. Priti Rawat, Ms. VinayaPatil, “Fuzzy Based Handwritten Character Recognition System” ,International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622,VNCET 30 Mar’12. Access Date: 09/07/2015.