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OCR on English Handwritten Text

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Abstract: *Image Processing is a vital tool when one is dealing with several images and wishes to perform several complex actions on the same. With advances in technologies, one can now compress, manipulate, extract required information etc. One such application of Image Processing is detecting handwritten text and converting it into a digital text format. The main objective is to bridge the gap between the actual paper and the digital world and in doing so, one can operate on the digital data much faster as compared to the actual data. The detection of handwritten text via optical Character Recognition.*

Keywords: Image Processing, Handwritten text, Optical Character recognition

I. INTRODUCTION

Humans are constantly been evolving and working towards making their lives better. The internet penetration has increased by leaps and bounds. Commensurate to this increase, a lot of data has been digitized. This digitization has enabled a seamless transmission of data in various forms. When one has digital data one can manipulate it according to one's requirement and can arrive at results, which earlier used to take a lot of time, in a matter of seconds. Converting handwriting to digital data can be characterized into the above category. Using optical character recognition (OCR), it aims to achieve this task. A Neural Network (NN) model is devised to be trained on dataset. This neural network model will consist of various layers. The image of the word will act as the input to the entire model and pass through the several layers, eventually to come out as digital text data.

II. PROBLEM IDENTIFICATION

Text is an arbitrary sequence of characters, and for those reasons one requires a higher accuracy. This problem is efficiently solved by using Optical Character Recognition. Optical Character Recognition is the process of modification or conversion of any form of text or text-containing documents such as handwritten text, printed or scanned text images, into an editable digital format for deeper and further processing. Optical character recognition technology enables a machine to automatically recognize text in such documents. Converting handwriting to digital data can be categorized into above category. In real world example, it is like combination of mind and eye of human body.

III. METHODOLOGY STEPS FOR HANDWRITTEN TEXT RECOGNITION

Step 1: This step transforms the handwritten or machine-printed documents into digitized form. The digitalization is carried out with the help of electronic device, like cameras, scanners.

Step 2: The pre-processing is one of the most crucial step in OCR, which includes smoothing, binarization, skew correction, slant correction, thinning, filtering, base line detection, etc.

Step 3: The segmentation is defined as the mechanism in which the pre-processed input data is divided or segmented into sub- data in order to identify what actually is comprised in the input image.

Step 4: The Feature Extraction aims towards the extraction of salient and unique patterns from the character image in order to improve discriminatory power by reducing the amount of data for recognition.

Step 5: The classification or recognition is the final decision making stage in OCR systems. The effectiveness of this stage is completely based on the characteristics of features extracted in the preceding stage. Therefore, the patterns are recognized and identified from input features.

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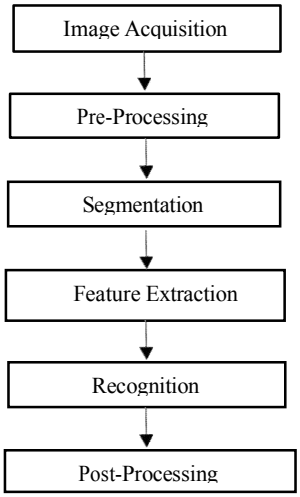

Figure 1: Handwritten recognition overview

IV. ALGORITHM

The Handwritten Text Recognition process can be broadly divide into sub-parts:

1. Character Recognition
2. Text(word) Recognition.

- **Image pre-processing:** The input image that consists the written text is gray value image of dimensions 128x32. Since all input images do not have same dimensions, the image needs to be resized and normalized without distorting and make the resultant image of the dimensions of height 256px and width 256px.
- **Convolutional Neural Network (5 Layers):** The pre- processed image is further divided in a fixed sequence length before passing to the CNN network. Here, a sequence length of 32 has been decided and divided into features. For feature extraction by the CNN network, the sequence length has been divided into 256 features. Some features show relatively high correlation with high-level properties of the input image. Therefore, high correlation is obtained between some features of the input image. Thus, when the entire training data-set is passed into the CNN, all features are extracted from the input images. After training the network, following features are extracted from the training data-set and will be used for next layer of RNN:"!"'()*+,-./0123456789 :;?ABCDEFGHIJK LMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz "

Recurrent Neural Network (2 Layers): Recurrent Neural Networks (RNN) is used for word prediction. RNN is required as memory element is needed to predict the word based on current feature and the previous feature.

V. TESTING

TEST CASE ID	TEST CASE	INPUT	EXPECTED OUTPUT	OBTAINED OUTPUT	RESULT
1.	Upload	Handwritten Image.	Image is uploaded successfully.	Image is uploaded successfully.	Pass
2.	Recognition	Handwritten Word and Line Image.	Word and Line Image should be recognized.	Word and Line Image is recognized.	Pass
3.	Display	Handwritten Word and Line Image.	Word and Line Image should be Displayed.	Word and Line Image is Displayed.	Pass
4.	Efficiency	Handwritten Image	Quick and Responsive	Quick and Responsive	Pass

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VI. RESULTS

1. Select the image from the folder.
2. Selected image is shown on the interface.
3. The result is displayed by clicking the predict button.

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