Recognition of Handwritten Text Using Neural Network Approach: A Complete Study

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Abstract—Handwritten content recognition is the skill to transliterate the text input encased in reports or pictures into digitally advanced content. The content example can change from dialect to dialect. Human composed content includes a wide arrangement of varieties, for instance, couple of languages have characters segregated from one another while a couple of languages incorporate cursive organizations. Along these lines, making it profoundly difficult to precisely recognize transcribed contents. Customarily, recognizing transcribed contents was done through character segmentation, feature extraction, or character acknowledgment. With changing occasions and developing innovations, neural networks - a machine learning approach has helped in characterizing and grouping transcribed messages massively. This paper tries to decipher a person's manually written content to computerized organize utilizing a neural system approach. Simulating a neural network to recognize written by hand content would help in accomplishing unrivalled exactness, and make an enhanced and quick calculation. The cutting-edge approaches focus on extracting features by eliminating distortions in addition to the commotion, and later anticipate the conceivable outcomes of that specific character. The way toward recognizing written by hand message has been distinguished as one of the high-flying tests in the field of characteristic natural language processing, machine learning, and computer vision applications.

Keywords—Handwritten Text Recognition, machine learning, neural network, image recognition

I. INTRODUCTION

Handwriting is the inscription finished with the assistance of pen or pencil in the hand and is additionally a sort of social biometrics. Character or content acknowledgment is the specialty of distinguishing, sectioning and characterizing character from datasets. The idea of transcribed content acknowledgment is to influence machines to mimic human composed content reading capabilities so as to read and alter it. The fruitful recovery of transcribed content should be tended to with proficient calculations since the human composed content includes a different arrangement of the set of variations, thus making it tricky to accomplish better than average precision levels. Contingent upon the dialect, the complexity of characters written a change, which in this manner has been perceived as a test in the region of Natural Language Processing (NLP) by a few scientists [6].

Traditionally, to address this problem, Optical Character Recognition was being utilized; however, this methodology requires a scope of upgrades with complex content structures. Optical character recognition (OCR) has its roots from converting printed text to machine coherent configuration, in order to construct perusing gadgets for visually impaired [5]. Apart from OCR, other conventional techniques incorporate character extraction, character segmentation, feature extraction, and a couple of something beyond.

Deep learning, a multilayer neural network approach has brought a new wave to machine learning, making human-machine interaction advance with big treads [3]. Neural networks are a set of algorithms, modeled and designed to perceive patterns in data. A standout amongst the most unmistakable and novel ways to deal with look at visual portrayals and concentrate highlights from information is the Convolutional Recurrent Neural Networks – a mix of Convolutional Neural Network and Recurrent Neural Network.

The Convolutional recurrent neural network gains the focal points from Convolutional Neural Network (CNN) for local feature extraction of trained data and Recurrent Neural Networks (RNN) for chronological summarization of identified features. This neural network model depicts decent levels of proficiency and exemplifies strong performance with massive datasets.

II. RELATED WORK

Here, we would like to present the previously existing systems and their methodologies that have tend to improve

the effectiveness and precision for transcribed content. In the past, many handwritten text recognition systems have been developed. Based on different areas where they are implemented, a few are using traditional techniques while newly developed systems are utilizing present-day advances. Frameworks utilizing conventional strategies have constraints to utilize information and datasets, in this manner restricting the outcomes.

Optical Character Recognition is viewed as an exceptionally old and viable customary technique for character recognition which at first centred on templating and later enhanced its exactness with the unmistakable utilization of feature extraction.

When it comes to modern methodologies, the focus is on obtaining good proficient results for recognizing handwritten scripts. In the course of the most recent decade, machine learning has been regarded to display amazing arrangements concerning manually written content recognition. This paper focuses on reviewing the varied neural network approaches available in terms of accuracy and performance [2].

In order to trounce over the problem of manually extracting features, Hinton et al lay forth deep learning in 2006, offering to ascend to another rush of research in counterfeit neural systems [4]. The principle motto following the exploration of neural networks was the keen desire to design a machine that works analogously to the human brain. In this spectrum of research, it has been observed that the characters like digits or alphabets are treated as binary graphics whilst the human mind can easily identify and commit them up to memory, as a consequence making it a necessity to generate algorithms that can undoubtedly classify characters that are human- composed [7].

Since, the machine learning strategies involve large sets of balanced data [3], a wide range of neural network approaches have been trained to get respectable outcomes. Consequently, the most known deep learning models Deep Convolutional Neural Networks was tested for accuracy with handwritten scripts and was observed that DCNN models often function well with inputs and outputs of fixed dimension. Out of many DCNN architectures, DenseNet has traced out to be a superior performer in classifying [6] Indic scripts with precision levels >97%.

The other popular neural network models include Deep Belief Network (DBN) and Convolutional Neural Networks (CNN), where DBN is an unsupervised learning method and CNN is a supervised learning strategy.

Keeping in tune with judicious technology update, research by [8] delineates that multidimensional recurrent neural networks have been widely adopted by Handwritten Text Recognition (HTR) community. Though being computationally very expensive but are successful inline level HTR.

Studies have observed that a blend of feature extraction and convolution layers together as a model is adequately fit for correct detection in the domain of machine-generated images and training it with handwritten images [1]

An exploration by [9] presents a robust, productive and quicker strategy to recognize Devanagari script online by optimizing crossover feature vector for faster grouping with the assistance of Feed Forward Neural Networks (FFNN). The results demonstrate that using this technique characters can be accurately ordered in 0.83 seconds.

The comprehensive literature study over various methodologies for transcribed content recognition research papers evaluates and funnels the actualities that there are numerous algorithms that have been simulated to recognize manually written text scripts of shifted dialects individually either on the web or offline, and apparently making it necessary to create a summed up model to recognize human composed scripts with better dimensions of precision and proficiency. Hence, the sole motivation of this study is to develop a straightforward easy to use and a unified framework for handwritten text recognition.

III. METHODOLOGY

In the field of machine learning, the Convolutional Neural Networks (CNN) are most commonly valuable to examine visual depictions while the Recurrent Neural Network (RNN) uses its internal state memory to process a sequence of inputs. The handwritten text recognition system using the Convolutional Recurrent Neural Network, a combination of CNN and RNN, and trained datasets to recognize the content contained in the image of segmented text dataset prove to illustrate fine exactness and efficiency.

The input image is bolstered into the CNN layers, which will help us dig out critical highlights from the image dataset. The input gray-value image will be utilized to normalize the gray-values of the image and later integrate data augmentation to it.

The output of the CNN layer would contain 256 features per time step, which are additionally processed by the RNN layers to trace the correlation with characters or character properties such as loops in text like 'l's, 'r's or 'e's. The output of the RNN layers would be a character probability matrix. This output matrix can be then classified using Connectionist Temporal Classification (CTC) or Hidden Markov Model (HMM) to label the output sequences.

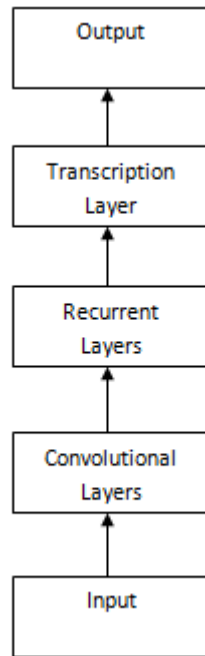Thus, the proposed workflow would obtain straight and better recognition accuracy for characters and digits.

Figure 1. Network architecture for proposed model

IV. RESULTS AND DISCUSSION

Using the above-proposed model, the neural network can be trained to recognize the custom image of handwritten text and learn its properties to output text that is a lexicon word.

The adapted neural network approach for handwriting recognition can have few noteworthy applications like:

- Efficient management of data in forms in Banks. Universities, Hospitals, etc.
- Signature Verification for forensic purposes
- Postal Address Reading

V. CONCLUSION AND FUTURE SCOPE

This paper aims to provide a generalized platform to recognize handwritten script in a more faster and accurate way. In the proposed model, we are attempting to advance the terms of recognizing handwritten text and decipher them into digital format for obtaining decent level of recognition accuracy.

In the future, the expansion of significant pre-processing strategies and even developing better feature extraction techniques will help us accomplish better acknowledgment of cursive too square letters. We can likewise attempt to apply content to discourse transformation methods (digital book reading) for the outwardly disabled in order to permit access to digital books to them.

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