

A STUDY ON DEEP LEARNING APPROACH FOR HAND WRITING TEXT RECOGNITION IN IMAGES

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Abstract

This paper discusses on Handwriting text recognition that extract text from an image which converts it into digital form. The need for data digitization is increased in recent years. Handwriting recognition is an ongoing field of research. The high variance in style of writing, size, orientation, alignment, low brightness of text in images is a challenging issue. This study aims on deep learning techniques which are applied to handwriting text images for improved accuracy and recognition levels. Deep learning recognize object in an image using Convolutional Neural Network (CNN). Additionally, this paper focuses on preprocessing, text segmentation and feature extraction using CNN for text recognition of images into digital form.

Keyword: Handwriting text recognition, Deep learning Convolutional Neural Network, feature extraction.

I INTRODUCTION

Nowadays, there has been rapid development in digitalization of handwritten documents to maintain important historical information. The use of digital documents are convenient and they can improve the ability to protect valuable old documents for easy access [1]. The need for handwritten recognition methods is to make historical manuscript images available for efficient information retrieval and transcription of handwritten data into a digital format. Recognition of handwriting text is difficult as the styles of writing vary from person to person [2].

The major issues in the handwritten characters are the

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classification of individual text. This is difficult because of huge changes in the styles of writing by diverse people in different languages. The differences in style of writing, shape of the letters, dimension of specific letter and connections with other letter makes the handwriting recognition more complex. Deep learning techniques is used for characters and digits recognition in different languages, and in several classification based tasks [2].

Deep learning is a subset of machine learning and artificial intelligent which is a type of neural network. The neural network replicates the behavior of human brain with three or more layers. Deep learning trains the machines in which they can learn from the past knowledge. The classification and recognition of data in the images are recognized just like a human brain does. CNN (Convolutional Neural Network) is used in deep learning to recognize the object.

Handwriting recognition splits the words into individual characters and finds best accurate words. Two types of handwriting recognition methods are online handwriting recognition and offline handwriting recognition.

A. Online handwriting recognition

Online handwriting recognition includes digital pen or stylus and has access to the stroke details, location of the pen, flow of text is accurate and separation between different characters. The process of online handwriting recognition is classified into preprocessing, feature extraction and classification.

B. Offline handwriting recognition

Offline handwriting recognition includes recognizing

text once when it is written down and no strokes and directions information of characters are involved.



Fig 1: Sample of Handwriting Methods

II SIGNIFICANCE OF THE STUDY

Handwriting recognition benefits in converting handwritten paper documents to a text document format which can be in electronic readable format. Handwriting has progressive to the point that numerous types of handwritten characters, such as digits, numerals, cursive script, symbols, and scripts in different languages, may be revealed. This paper aims to find out major problems as huge difficulty in strokes and styles vary from person to person, Poor quality in handwritten text images and cursive handwriting styles makes separation and recognition of individual characters a challenging issue. This study focusses to provide effective methods and techniques for recognition.

III THE OBJECTIVE OF THE STUDY

- To identify more advanced recognition algorithm and deep learning method to manage handwriting task more accurate.
- To reduce background noise and handle real-time images more accurately for classification of text.
- To find more accuracy in recognizing high difference in styles of writing across people and poor quality of the hand written text.

IV. METHODOLOGY

Deep learning plays an important role in handwriting image recognition. By collecting large amounts of data and analyzing it, deep learning creates frequent predictive

models to know patterns and trends within the data [3].

Deep neural networks contain one or more layers of connected nodes which depend on the preceding layer. This layer will process and optimize the calculation or classification. The visible layers in deep neural network include input and output layers. In input layer, the deep learning model takes the input for processing and in the output layer, the final prediction or classification is done which holds the output.

In Deep Learning, a Convolutional Neural Network is a type of artificial neural network, which is commonly used for recognition and classification of images. Algorithms used under deep learning which process data the same approach as the human brain does, since our brain is too difficult but, in general, CNN comprise of convolutional and pooling layers, which are grouped into modules.

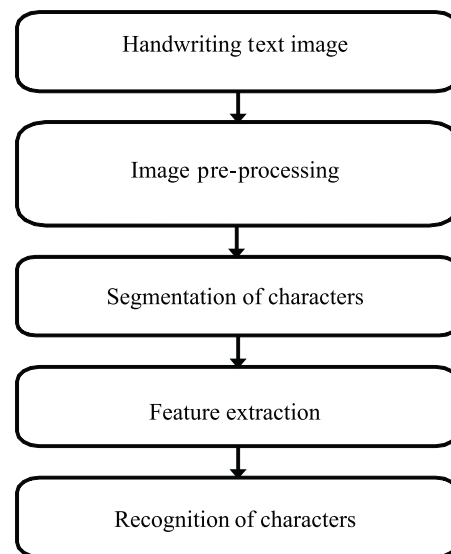


Fig 2: Steps in handwriting text recognition.

The neural networks have three layers which is input network layer, hidden network layers, and an output network layer. CNNs are motivated by the design of the human brain. Like a neuron in the brain, CNN processes and transmits the data, artificial neurons in CNNs takes inputs, process the data and sends the output. The handwritten text image is given as

an input. The input layer takes the image text as input in the type of groups for processing. CNN contains many hidden network layers, which implement feature extraction from the image through calculations. This network includes convolution, pooling, and fully connected layers. Convolution is the important layer that does feature extraction from an input handwritten text image. The individually connected layer organizes the object and recognizes it in the output layer. CNNs are forward networks in that data flow from inputs to outputs only in one direction.

The processes involved in handwriting text recognition are image pre-processing, feature extraction, and segmentation of characters. They are usually used in sequence image preprocessing for feature extraction a smoother process, but feature extraction is required for accurate classification.

A. Image pre-processing

The different preprocessing techniques are necessary for every application depending on the factors that could affect the quality of the images. The image with the text will be taken as an input. In the beginning, the pre-processing phase is applied for identifying and cropping the image borders and applying transformation to straighten the page, removing noise in the image, correcting skew and size [3].

B. Segmentation of characters

The most important stage next to image preprocessing is segmentation of the images into individual character. Character segmentation is a process that divides an image with characters into sub images of individual symbols. The segmentation is done by separating the input characters into three phases as upper partitioning, middle partitioning and lower partitioning [3].

C. Feature extraction

In feature extraction, the selection and combination of

variables into features are successfully reducing the quantity of data that must be managed and fully relating to the original data set. A convolution layer is a basic element of the CNN architecture that performs feature extraction.

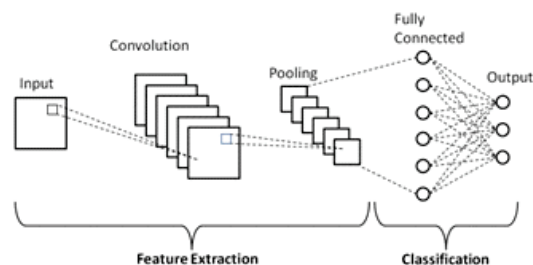


Fig 3: CNN architecture [9]

The convolutional layer is the key structure of CNN in which two or more set of data combine to perform mathematical operation. To create a feature map, the convolution is given on to the input data using a convolution layer filter. The convolution is first layer to extract features from an input image.

The quantity of shifts over the input image is called stride. The activation purpose is commonly used for Rectified Linear Unit for a non-linear operation [10].

Next a convolution operation is performing to decrease the dimensionality using pooling. This operation allows us to decrease the number of parameters to learn and decreases the processing time and also decreases the risks of over fitting in the network. The pooling layers down sampling every feature map individually, dropping the height and width, keeping the depth undamaged. No parameters are used in pooling as in the convolutional layer. It takes the extreme value in the window and slides its input. The biggest element from the feature map is designated by using this process.

D. Benefits of using CNNs

The benefits of using deep learning and CNN in the handwriting text recognition are:

- The important purpose of using CNN is the weight sharing features in which it reduces the number of spatial representation and in turn helps the network to increase simplification and also limited to over fitting.
- The convolution layers requires smaller area for feature extraction and extremely dependent on the clusters of pixels with less preprocessing.
- CNN is the important network implementation when compared with other neural networks.

V. CONCLUSION

Deep learning has made breakthroughs in image classification, particularly for character recognition. Deep learning extracts features with deep neural networks and classifies itself. Compare to traditional methods its performance increase with the quantity of data. This paper carries out the improvement in technology which helps in enhanced recognition of handwritten text using deep learning convolutional neural network.

REFERENCES

- [1] Kusetogullari, Huseyin, et al. "DIGITNET: a deep handwritten digit detection and recognition method using a new historical handwritten digit dataset." *Big Data Research* 23 (2021): 100182.
- [2] Rasheed, Aqsa, Nouman Ali, Bushra Zafar, Amsa Shabbir, Muhammad Sajid, and Muhammad Tariq Mahmood. "Handwritten Urdu Characters and Digits Recognition Using Transfer Learning and Augmentation with AlexNet." *IEEE Access* (2022).
- [3] Pande, Sandeep Dwarkanath, et al. "Digitization of handwritten Devanagari text using CNN transfer learning—A better customer service support." *Neuroscience Informatics* 2.3 (2022): 100016.
- [4] Sharma, Sandhya, et al. "Recognition of gurmukhi handwritten city names using deep learning and cloud computing." *Scientific Programming* 2022 (2022).
- [5] Gayathri, Devi S., et al. "A Deep Learning Approach for Recognizing the Cursive Tamil Characters in Palm Leaf Manuscripts." *Computational Intelligence and Neuroscience: CIN* 2022 (2022).
- [6] Gonwirat, Sarayut, and Olarik Surinta. "DeblurGAN-CNN: Effective Image Denoising and Recognition for Noisy Handwritten Characters." *IEEE Access* 10 (2022): 90133-90148.
- [7] Rahman, ABM Ashikur, et al. "Two Decades of Bengali Handwritten Digit Recognition: A Survey." *IEEE Access* 10 (2022): 92597-92632.
- [8] Chandio, Asghar Ali, et al. "Cursive Text Recognition in Natural Scene Images Using Deep Convolutional Recurrent Neural Network." *IEEE Access* 10 (2022): 10062-10078.
- [9] Phung, Van Hiep, and Eun Joo Rhee. "A high-accuracy model average ensemble of convolutional neural networks for classification of cloud image patches on small datasets." *Applied Sciences* 9, no. 21 (2019): 4500.
- [10] Teslya, Nikolay, and Samah Mohammed. "Deep Learning for Handwriting Text Recognition: Existing Approaches and Challenges." *2022 31st Conference of Open Innovations Association (FRUCT)*. IEEE, 2022.
- [11] Ali, Amani Ali Ahmed, and Suresha Mallaiah. "Intelligent handwritten recognition using hybrid CNN

architectures based-SVM classifier with dropout."
Journal of King Saud University-Computer and
Information Sciences 34.6 (2022): 3294-3300.

[12] Agrawal, Mimansha, Bhanu Chauhan, and Tanisha
Agrawal. "Machine Learning Algorithms for
Handwritten Devanagari Character Recognition: A
Systematic Review." vol 7 (2022): 1-16.

[13] Li, Qian, et al. "A Survey on Text Classification: From
Traditional to Deep Learning." ACM Transactions on
Intelligent Systems and Technology (TIST) 13.2
(2022): 1-41.

[14] Qaroush, Aziz, et al. "An efficient, font independent
word and character segmentation algorithm for printed
Arabic text." Journal of King Saud University-
Computer and Information Sciences 34.1 (2022): 1330-
1344.

[15] Boraik, Omar Ali, M. Ravikumar, and Mufeed Ahmed
Naji Saif. "Characters Segmentation from Arabic
Handwritten Document Images: Hybrid Approach."
International Journal of Advanced Computer Science
and Applications 13.4 (2022).

[16] Alzubaidi, L., Zhang, J., Humaidi, A.J. et al. Review of
deep learning: concepts, CNN architectures,
challenges, applications, future directions. J Big Data 8,
53 (2021). [https://doi.org/10.1186/s40537-021-00444-
8](https://doi.org/10.1186/s40537-021-00444-8).