

Handwritten Character Recognition using Convolution Neural Network

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Abstract: Handwritten character recognition is the renowned research area in several fields, like writers identification, bank cheques, and so on. Literature works present the handwritten character recognition for various languages. Propose a convolution neural network algorithm for handwritten character recognition. Initially, the noise in the input image is removed using the median filter, and the image is segmented. Then, the feature extraction, and recognition are extracted from the input image. System must provide the better quality of service to user and provide better accuracy for character recognition.

Keyword: convolution neural network, Handwritten character recognition

1) Introduction :

Character recognition is the ability of a machine to receive and interpret character input from multiple sources like paper documents, photographs, touch screen devices, bank cheques etc. Recognition of handwritten and machine characters is an emerging area of research and finds extensive applications in banks, offices and industries. HCR works in stages as pre-processing, segmentation, feature extraction and classification or recognition using convolution neural network.

1.1) Character recognition divided in to

1) Printed character:

i) Optical character recognition (OCR): OCR is a electronic or mechanical conversion of image of types, handwritten or printed text into machine encoded text, whether from scanned document, photo of document.

2) Handwritten character:

i) On-line character recognition: It is system in which recognition is performed when characters are under creation.

ii) Off-line character recognition: It is system in which first handwritten documents are generated, scanned, stored in computer and than they are recognized.

1.2) Neural network: A neural network works similarly to the human brain's neural network. A "neuron" in a neural network is a mathematical function that collects

and classifies information according to a specific architecture. A neural network is a type of machine learning which models itself after the human brain, creating an artificial neural network that via an algorithm allows the computer to learn by incorporating new data.

1.3) Types of neural network:

1. Feed forward neural network: unidirectional without going any loop
2. Recurrent neural network: operation perform in the form of loop
3. Convolution neural network: it's architecture also call 3 dimensional arrangement of neurons. First layer is convolutional layer; second layer is rectified layer or ReLU.

1.4) Why use neural network:

- 1) Adaptive Learning: An ability to learn how to do tasks based on the data given for training or initial experience.
- 2) Self-Organization: NN can create its own organization or representation of the information it receives during learning time.
- 3) Real Time Operation: NN computations may be carried out in parallel, and special hardware devices are being designed and manufactured which take advantage of this capability.
- 4) Fault Tolerance via Redundant Information coding: partial destruction of network leads to the corresponding degradation of performance. However, some network capabilities may be retained even with major network damage.

2) Literature review:

In this paper, the review and comparison of various handwritten optical character recognition algorithms using various classification algorithms are provided.

In this paper, the offline handwritten character recognition will be done using Convolution neural network and Tensor flow. It was concluded that feature extraction method like diagonal and direction techniques are way better in generating high accuracy results

compared to many of the traditional vertical and horizontal methods. Also using a Neural network with best tried layers gives the plus feature of having a higher tolerance to noise thus giving accurate results. In neural network the model called as feed forward is mainly trained using the back-propagation algorithm so as to classify and recognize the characters as well get trained more and more better and higher accuracy results in character recognition [1].

P300 signal classification is the most challenging task in electroencephalography signal processing as it is affected by the surrounding noise and low signal-to-noise ratio (SNR). The accuracy and the number of correctly recognised characters are same. It is observed from the table that CM-CW-CNN-ESVM achieves better result compared to the other methods. After 15 epochs, CM-CW-CNN-ESVM achieves an average accuracy of 99.0%, which is better than the other two developed networks [2].

CM channel mixing operation, CW channel wise, ESVM ensemble of SVM

The main aim of this paper is to design and develop a technique for handwritten character recognition using multiple feature set and learning-based classifier. The FLM proposed by combining the Firefly and the Levenberg–Marquardt (LM) algorithm for training the neural network. Finally, the proposed FLM-based neural network is integrated within the feed forward neural network, and the classification of character is done with 95% accuracy based on the size of training data, number of hidden neurons and number of hidden layers [3].

This paper deals with the hybrid optimization approach with the performance analysis based on the automatic classification of the handwritten English characters in an efficient manner. The proposed approach deals with the feature extraction and instance selection using independent component analysis and hybrid PSO and firefly optimization for the effectual feature selection approach and then the automatic classification is done using supervised learning process named as back-propagation neural network [4].

The main purpose of this study is to avoid the need for hand-crafted feature extraction and obtain a more stable and generalised system for word recognition. The proposed model is evaluated using a standard handwritten Bangla word database, which contains 18000 Bangla word images of 120 different categories and it obtained a higher recognition accuracy of 96.17% when compared to recent state-of-the-art methods [5].

3) Problem statement:

Several datasets are challenging due to different writing styles of the same characters, different writing persons, different writing devices, and difficulties due to background noise that appears from the printer and handwritten text.

Recognizing the different writer’s handwriting with a different style, size, and shape is another one difficult problem.

4) Proposed system:

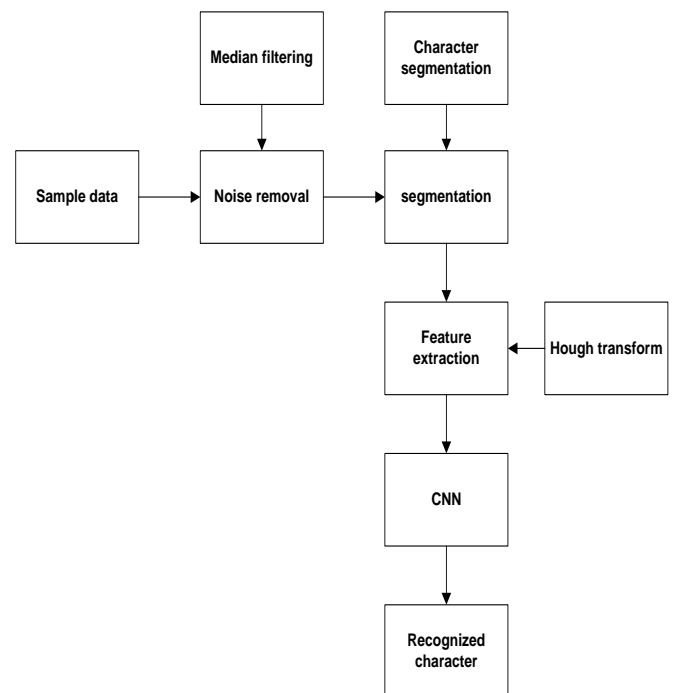


Figure 1: proposed model

HCR works in stages:

Pre processing: Pre-processing is the entry method for recognition of character and very important in deciding the recognition rate. Pre processing works to normalize the strokes and also remove variations that can reduce the rate of accuracy. Pre-processing mainly works on the various distortions like the irregular text size, points missed during the pen movement, left-right bend and uneven spaces. The image is pre-processed using different image processing algorithms like Inverting image, Gray Scale Conversion and image thinning.

Median filter is non linear digital filtering techniques often used to remove noise from image.

Segmentation: Segmentation is used to convert input image consisting of many characters into the individual characters. The techniques used are word, line and character segmentation. It is generally performed by dividing single characters from the word picture.

Moreover, content is processed in a way that is tree like. In initial scenario, row histogram is used to segment the lines. Then after, every level, characters are retrieved by technique called histogram and then finally getting it retrieved.

Segmentation steps:

1. Remove the borders
2. Divide the text into rows
3. Divide the rows (lines) into words
4. Divide the word into letters

Character segmentation

Feature extraction: The aim of feature extraction is to allow the extraction of pattern which is most important for the classification. Some of the Feature extraction techniques like Principle Component Analysis (PCA), Scale Invariant Feature Extraction (SIFT), Linear Discriminant Analysis (LDA), Histogram, Chain Code (CC), zoning and Gradient based features can be applied to extract the features of individual characters. All of these features are used to train the given system.

Hough transform is feature extraction technique use in image analysis, digital image processing. Purpose of this technique is to find imperfect instance of object within a certain class of shape by voting procedure.

Classification or recognition using convolution neural network: The decision making is done in the classification phase. For recognizing the characters, the extracted features are used. Different classifiers like Convolution Neural Networks are used. The classifiers sorts the given input feature with reserved pattern and find the best matching class for input, for which Soft Max Regression is used.

Why we use convolution neural network?

CNN use variation of multilayer perceptrons.

CNN contain one or more than one convolutional layer, these layers can either be completely interconnected or pooled.

Before passing the result to the next layer, convolutional layer uses convolutional operation on the i/p.

CNN also show great result in semantic parsing and paraphrase detection.

CNN work:

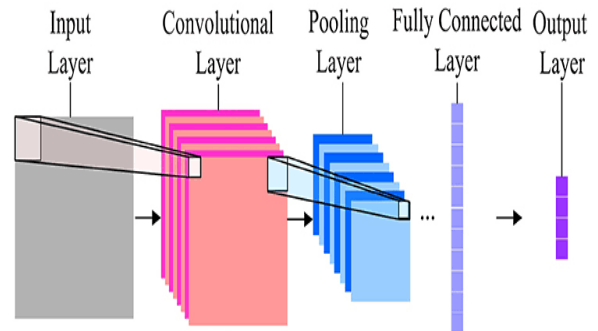


Figure 2: convolutional neural network

Convolutional layer convolve I/p and pass it's result to the next layer.

Pooling layer reduce the dimensions of data by combining the output of neuron cluster at one layer into a single neuron in the next layer.

Fully connected layer connect every neuron in one layer to every neuron in another layer.

5) Conclusion:

Character recognition is help in language translation which is complex problem in multilingual country like India. Many modern innovative applications will evolve which is the need of time in this information age. Character recognition is help in information processing to large extent.

The proposed model will use Machine Learning Technique for character recognition for various handwritten character, which will improve the better quality. Convolution Neural Network will help in better performance in recognition. This will lead to better and reliable handwritten character recognition.

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