

Hybrid Approach For Handwritten Devanagari Character Recognition Using CNN and KNN

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Abstract - Handwritten Character Recognition (HTR) plays a significant role due to growing digitalization. Searching and sharing digital evidence is hard to do. It is therefore essential that research outcomes are covered in digitized form. Character recognition is needed for this intention. There are many applications in various fields, such as banking, healthcare, meeting rooms, etc. Throughout this paper, the Marathi characters and digits are recognized by deep learning. Deep learning is a field of computer science that employs algorithms based on neural networks. We had also chosen computer vision because it operates with images effectively. The goal of this article is to address various conventional systems used to recognize character. This research we perform preprocessing and extraction of features using DCNN used for training and testing respectively and we perform the system with multiple convolutional fully connected neural networks. After extracting features from CNN in .H5 file and applying these CNN features to the KNN algorithm. The file system carried out the around 5800 training images including 58 characters that contains 10 numerals, 12 vowels and 36 consonants.

Key Words: Feature Extraction, Location Segmentation, Convolutional Neural Network (CNN), Deep Convolutional Neural Network (DCNN), K-Nearest Neighbors (KNN), Machine learning classifier, feature extraction, feature selection.

1. INTRODUCTION

A subset of machine learning that uses computational models inspired by human brain learning is deep learning. Multiple layers are part of the neural network. Convolutional layers have a framework of hierarchy that makes them especially well-suited to studying the hierarchies of information. A very complex function can be computed on a single layer, but artificial intelligence is important to extract complex characteristics. As artificial intelligence uses social hierarchies, it can be used effectively with image data, so we have chosen machine learning of handwritten identification of Marathi characters. In deep learning, the implementation is not

given as the input with already different classifiers because the implementation itself operates features are extracted and will find all possible features which could be used to get the classification model's best performance. Input to just the algorithm is then a pre - processed image. In neural networks, there are different classification algorithms, such as Recurrent Neural Network, Back Propagation Neural Network, CNN, DCNN, Deep Belief Network, Deep Neural Network, etc. It has been found after many studies that each algorithm seems to have its own pros and cons. For instance, DNN is commonly used, but the training problem persists. For sequential data, RNN is best used, whereas the CNN algorithm is the best approach for linked data, such as images. After studying the benefits and drawbacks of such neural networks, they have opted to use CNN for handwritten Marathi character recognition.

One of the pretty fascinating fields of study is handwritten character recognition. In recognition of handwriting, there are many numerous methods that are used. Numerous experiments have been performed to build a device that can provide high precision. The identification of handwritten characters is a pattern recognition field that determines the machine's ability to identify the skills that can be described. Basically, the idea is to build a framework that should be sufficiently intelligent to identify the handwriting Marathi personality. It reduces the effort to type the Marathi phrases, by understanding the letters; it also transforms the hardcopy of both the signed notes into softcopy. There have been two physical and digital pattern classification methods for the character classification task.

2. LITERATURE SURVEY

Handwritten identification of characters is an area of study in deep learning, machine vision and recognition of patterns. The handwriting recognition computer system can acquire or detect letters in paperwork, photographs, etc., and convert these into digital form. This is important because physical records cannot be carried anywhere, so it is difficult to manipulate physical documentation. These

systems are now being implemented for a few days using various deep learning techniques. The detailed state of the art of the proposed system and work done by existing authors are listed below...

[1] Xiao Niu Ching Y.Suen., Summary-Hybrid model for combining the synergy of two higher classifiers: The CNN and the Support Vector Machine (SVM), which have been shown to recognise various pattern forms of text., Gap Analysis-In this paper high values assigned to neurons at the output layer and remaining have low values & this causes difficulty in rejecting the errors in real applications.

[2] Kamble, Parshuram M., and Ravindra S. Hegadi., For handwritten Marathi characters, statistical based feature extraction of model and KNN based classification. The system involves preprocessing, Stages of segmentation, extraction of features, and classification. K-nearest neighbour (KNN) local information algorithm for HMC classification using characteristics such as perimeter, location, orientation, Euler number and eccentricity. The post-processing would undoubtedly boost the efficiency that we will do in our work.

[3] Deokate, Sarika T.and Nilesh J. Uke.For this, KNN, CNN strategy and the functioning of the Marathi Script Convolutionary Neural Networks were used and demonstrated with a discussion of its working environment., It can affect accuracy when extracting area base features.

[4] Patil, Yamini, and Amol Bhilare. ,In RNN-dependent methodology with LSTM for the identification of transcribed digits in Marathi Script.It is difficult to work on a given dataset.

[5] Deokate, S. T., and N. J. Uke.Devanagari terms and character collection consist of various stroke types, writing techniques, different page formats, and several aspects that need to be taken into account at the time the document picture is processed. The fragmented characters will be protected using the hierarchical clustering approach with the current dataset. Limited function of words and characters

[6] Gurav, Yash, et al.,To extract features and recognize the characters in a picture, deep learning techniques are applied. To extract features and classify the input images, the Deep Convolutionary Neural Network (DCNN) was incorporated. High time generation Problems when multi CNN is used

[7] Mane, D. T., and U. V. Kulkarni. ,Customized Convolutionary Neural Network (CCNN) which may automatically learn the characteristics and predict the

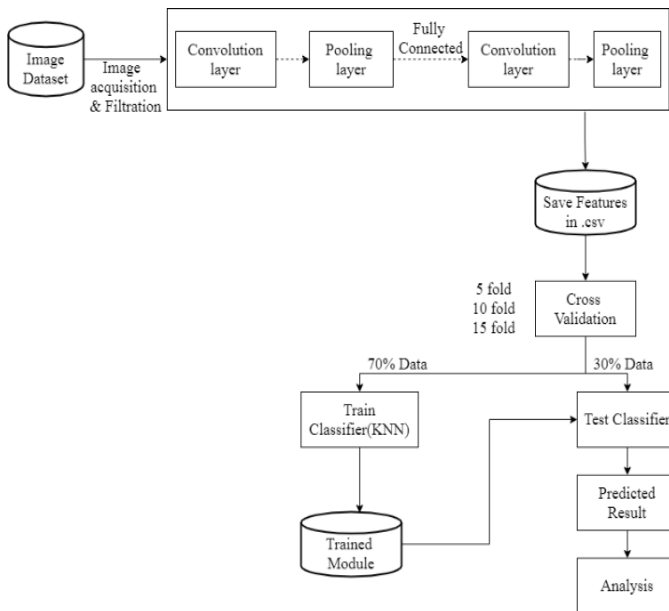
category of numbers from a large range of knowledge sets. The support vector machine (SVM) assumes a notable variable to cater to a vast measure of features, which was also used for the aim of classification. The extracted feature sets are reduced with the algorithm Principle Component Analysis (PCA).The system shows inappropriate results uncertainty.

[8] Ramteke, Surendra Pandurang, Ajay Anil Gurjar, and Dhiraj ,Sheshrao Deshmukh. , The support vector machine (SVM) assumes a notable variable to deal with a vast measure of features, which was also used for the purpose of classification. The extracted feature sets are reduced with the algorithm Principle Component Analysis (PCA).Full concentration is not adequately built to draw high-level features to generate data context information

A suggested a deep learning architecture for the popularity of handwritten characters from Marathi in this paper [9]. To boost test accuracy, they consider using the Dropout and Dataset Increment method. We heard from this paper about the Deep Convolutional Neural Network. In [10] Dr. Ajay Anil Gurjar et. al. focuses totally on the approach to the genetic algorithm and current methods for it. Performances of varied methods of classification with different features and methods of segmentation are compared. we are able to apply to classifiers like the genetic algorithm and therefore the neural network. According [11] the system attempts to introduce to image character recognition the Mutual Hidden Layer Convolutional Neural Network framework. It demonstrates that the SHL-CNN can comparatively cut recognition errors by 16 to 30% compared to the model strained by traditional characters of just one language. the product of compound character pre-processing and segmentation has been demonstrated in[12]. For better outcomes, we'll apply these techniques to our dataset. During this paper,[13] suggested an efficient method for extracting features like the Directional algorithm. Two sorts of directional characteristics are studied, one by using the distribution method of stroke length and another by using contour. To recognize handwritten Marathi characters, this method identifies a deep convolutional neural network in [14].

3. PROPOSED SYSTEM

In this research to project and develop a system for Marathi text classification using deep convolutional neural networks for large dataset. This system design with multi-feature feature extraction model that works for unstructured marathi random characters.



The above Figure 1 makes evident the basic overview of proposed system execution flow, in the unit we describe that in brief.

Step 1:- Pre-processing To prepare the data for further processing at this stage, we did some preprocessing on the images of our proposed dataset. We first converted the gray-scale image from our dataset and then resized it to res 64x64 pixels by keeping the aspect ratio locked.

Step 2:- Each Marathi manuscript was designed to draw structural/geometric features with the image's pixel-based data, such as letter structure, letter width, character height, text image ratio, horizontal, and number. These features were then embedded with pixel-based data from the image, such as the image's vertical lines, the number and location of the loops and arcs, etc., in order to obtain accurate classification results.

Step 3:- CNN's architecture is somewhat different from the model of a traditional neural network. Input values are transformed in the conventional neural network into a sequence of hidden layers by traversing. Each layer consists of a series of neurons, where each layer is entirely linked to all the neurons in the previous layer. The explanation behind the better performance of CNNs is that the intrinsic properties of images are captured by these networks. This critical CNN feature gave us the courage to use it in our proposed dataset analysis.

Step 4:- Download the dataset from open source websites like kaggle, MNIST database etc. or create your own database. Database is divided into two parts, 70% for training and 30% for testing purposes.

Step 5:- Extract various features by using CNN model In a convoluted neural network, there are four layered principles that we can understand:

- Convolution
- ReLu
- Pooling
- Fully Connected Layer

Step 6:- Those extracted features from the last Fully Connected Layer of CNN and have been stored in .csv file and forwarded to KNN classification for recognition of the entire test dataset. Finally, each of these cropped images are transformed into a row vector along with The label and a csv file is created for 5800 samples.

3.1 Algorithmic Solutions

Input: Rules of Training Training rule[], Testing Instances Testlists[], Threshold Th.

Output: WeightCalc wc=0.0

Step 1: Read every instance of testing from (TsInstnace from Ts)

$$n$$

Step 2: $TsIns = \sum_{k=0} \{Ak...An\}$

Step 3: Read each instance of the train from (TrInstnace from Tr)

$$n$$

Step 4: $TrIns = \sum_{j=0} \{Aj.....Am\}$

Step 5: $w = WeightCalc (Test_Ins, Train_Ins)$

Step 6: if (wc >= Th)

Step 7: Forward feed layer for feedback from the input layer
FeedLayer[] {Tsf,w}

Step 8: improved feed layer weight, Cweight FeedLayer [0]

Step 9: Returns Cweight

3. CONCLUSIONS

This paper provides details on the significance of handwritten Marathi character recognition and its application. This document also addresses the different methods available for the character to be remembered. This explores the different neural networks accessible in computer vision. Summary of all the works completed up to date in this region. In this paper, it was noted that the task of extracting different features is difficult as the image is often labeled as incorrect class if certain features are not identified. In character recognition, this paper has also addressed different problems, so this will influence the accuracy of the classifier. The character picture is difficult to identify if it is focused, not transparent or blurred, edge distortion or noise distortion, etc. Diverse aspects of deep learning algorithms are explored in this article. In different fields, such as the banking sector, handwriting character recognition can also be used for check processing, records management, etc. More domain areas can be explored with recognition of handwriting.

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