MACHINE PRINTED GURUMUKHI NUMERALS RECOGNITION USING CONVOLUTIONAL NEURAL NETWORKS

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Abstract - *Reading a numerals from natural images is a hard computer vision task.In this paper an attempt is made to recognize printed Gurumukhi numerals by using CNN(Convolutional Neural Networks).We use CNN for the recognition of numerals. Random generation matrix is one of the feature extraction method.CNN concentrates on the dynamic features of the image. Accuracy of the work will measured with K-means and HOG etc. algorithms.*

Key Words *Convolutional neural networks, HMM, K-means algorithm,Gurumukhi Numerals.*

1.INTRODUCTION

Recently there is growing trend among worldwide researchers to recognize handwritten Characters of many languages and scripts. Much of research work is done in English, Chinese and Japanese like languages. However, on Indian scripts, the research work is comparatively lagging. The work on other Indian scripts is in beginning stage. In this thesis work I have proposed recognition printed Gurumukhi numerals.Numerals of the Gurumukhi are arranged in sequential manner.Image of numerals is recognized to exract frames.the frames are then labeled with the help of digits from 0 to 9.
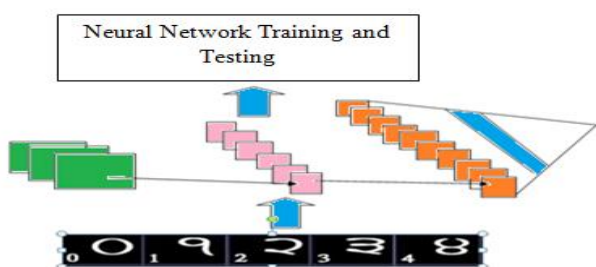

Fig -1: Recognition of Gurumukhi Numerals

Our aim is to recognize the whole image.In this paper the Gurumukhi numerals are collected for the recognition process. Fig.1 shows the hybrid approach CNN .CNN works like human eye for recognition and works on the dynamic features of the image .

The accuracy of the model is compared with HOG and K-means etc. algorithms.Similar methods have been used for voice recognition,Face recoginition and text recognition.

2. LITERATURE REVIEW

Dr. Surinder Dhanjal (2013), proposed, a new corpus in the Punjabi language has been designed. The **Malwai** dialect has been chosen because there are **twenty-two** districts in the Punjab state at present, and the Malwa region makes up the majority of the Punjab state, consisting of 12 complete or partial districts.

Bharti Mehta (2013), Different problems in the characters segmentation of handwritten text is due to the different writing style of different people because the size and shape is not fixed while we write any text. In this work, she formulate an algorithm to segment the scanned document image as a character. According to proposed algorithm, broken characters in Gurmukhi script, she used the segmentation of these characters that can become easily identify how many characters are in one word. To develop the algorithm to segment the characters from a word we are using combinations of two approaches which are Horizontal Profile Projection and Vertical Profile Projection. And get the accuracy is 93%.

Chayut Wiwatcharakoses, Karn Patanukhom (2013),They introduce a two-stage recognition for English&Thai characters. In the first stage, Fuzzy C Mean Clustering (FCM) is applied to create prototypes of every character. The class of nearest neighbor prototype is determined and used as the first stage classification output. A hybrid structure of nearest neighbor classifier and Support Vector Machine (SVM) are proposed for the second stage. Based on classification results obtained from the first stage, the suitable classifiers can be selected. For SVM classifier, possible class candidates for each prototype are analyzed from confusion matrices of the first stage result. For nearest neighbor classifier, in order to refine the result, accurate search on a limited set of training samples corresponding to the nearest prototypes obtained in the first stage is performed. According to experiments on data set of more than 500,000 character images with various font styles, sizes, and resolutions, They obtain the accuracy of 88.09% in the first stage and the result is improved to 97.06% in the secondstage. The experiments also show improvement of the proposed scheme in comparison with conventional schemes.

Romesh Laishram, Pheiroijam Bebison Singh, Thokchom Suka Deba Singh and Sapam Anilkumar (2014), They all are working on handwritten Meitei mayek alphabet OCR system.This paper emphasis on segmentation of characters.Neural netwok is used for training purpose. The trained neural network is further tested and performance analysis is observed.

Hann Meng and Daniel Morariu (2014),worked upon recognition of Khmer Characters. Artificial neural network including self-organization map and multilayer perceptron network with the learning ability could offer the solution to character recognition problem. In this paper presents KCR system implemented in Matlab environment using artificial neural networks. The KCR system described the utilization of integrated SOM network & MLP network with backpropagation learning algorithm for Khmer character recognition problem.

Michael Opitz, Markus Diem, Stefan Fiel, Florian Kleber, Robert Sablatnig (2014),developed End-to-End Text Recognition using Local Ternary Patterns, MSER and Deep Convolutional Nets. The system presented outperforms state of

the art methods on the ICDAR 2003 dataset in the text-detection (F-Score: 74.2%), dictionary-driven cropped-word recognition (FScore:87.1%) and dictionary-driven end-to-end recognition (FScore:72.6%) tasks.

Pawan Kumar Singh, Sajal Mahanta (2014),They Developed Page Segmentation Technique for BangIa documents printed in Italic style. At first, the text lines are segmented from the document pages. Next, the words are segmented from the extracted text lines. Finally, the characters are segmented from the extracted word images by using a Trapezoidal Fuzzy membership function, which has been used for the detection of Matra region. The proposed technique is tested on 16 document pages consisting of 1456 words. The average success rates of the technique for text line, word and character segmentation are found to be 99.91%, 98.63% and 89.41% respectively.

Pawan Kumar Singh, Ram Sarkar, Mita Nasipuri (2015),They identify Word-level Script for Handwritten Indic scripts like Bangia, Devanagari, Gurumukhi, Malayalam, Oriya Telugu and the Roman script. script. A set of 82 features has been designed using a combination of elliptical and polygonal approximation techniques A Multi-Layer Perceptron classifier was found to be the best classifier resulting in 95.35% accuracy. The result is progressive considering the complexities&shape variations of the Indic script.

Yuhan Xiang, Xiaowei Fu, Li Chen, Xin Xu (2015), GMM-based Image Segmentation Approach For SOFC Microstructure Characterization developed by these persons. Firstly, the spatial neighbor information is introduced into EM optimization algorithm to constrain the weighted probability distribution of each pixel. Secondly, for uncertain points whose probabilities of two components are close, the probability distribution of them is adjusted according to quantum-inspired adaptive weight. The experimental results show that the proposed method is effective to separate the three phases of electrode, and provide reliable data support for SOFC 3D reconstruction.

Zhuoyao Zhong, Lianwen Jin, Ziyong Feng (2015), proposed Multi-font Printed Chinese Character Recognition using Multi-pooling Convolutional Neural Network.Experimental results shows the CNN performance. An input character image is transformed into four distorted images and the CNN learns the original image as well as the distorted samples to classify 3755 classes (Ievel-l set of GB2312-80) of printed Chinese characters in 280 widely varying fonts and 120 manually selected fonts. Outstanding recognition rates of 94.38% and 99.74% are achieved in the former and latter cases, respectively, which indicates the effectiveness of the proposed methods.

3. PROBLEM FORMULATION

In the base paper,CNN is used for Reading Numbers in Natural Scene Images.This paper recognized street view house number data set to evaluate the performance of CNN and it gives 91.4% accuracy . Now we are going to start work upon Gurumukhi numerals using CNN technique to get optimal results of recognition .

➢ Let I is the image which contain amount of numerals. We treat the whole image as a concatenated sequence of frame images in vertical orientation.A sequence is represented as The squence is represented as $O = \{o1, o2, \cdot \cdot \cdot , oT \}$, in which oi corresponds to feature of the ith frame of all T frames.

➢ Define $Y = \{y1, y2, \cdot \cdot \cdot , yL\}$ as the label of the image. L is the amount of digits in the image, yi is the ith digit's label. Specifically, in our setting, the frames are categorized to 10 categories which means $si \in \{0, \cdot \cdot \cdot , 9\} \cup \{nul\}$. The nul category represents non-digit frames which contain pre- or post-digit background, inter-digit interval and clutter frames.

➢ Above is date set that we have discussed.

➢ Input image is read by computer one by one .

➢ Feature extraction is done by using random generation matrix and CNN.

➢ Input and output array will be generated by computer.

➢ Convolution Neural Network (CNN) requires fixed dimensional input while Gurumukhi Numerals images contain amount of digits. Our method integrats CNN with probabilistic graphical model to deal with the problem.

➢ Neural network taining and tesing is provided to system.

3.1 objectives

- Collection and preprocessing Gurumukhi numerals images.
- Feature extraction using Random generation matrix.
- Cnn is applied to create matrix.
- Analyze the performance and compare it with the existing algorithms like K-means, HOG etc.

4. METHODOLOGY

4.1 Convolutional Neural Network

Our CNN architecture is build upon Alex Krizhevsky's CovNet.We found different configurations consist of four convolutional layer,Three of them have consecutive pooling layers.One locally connected and two fully connected layers.All connections are feedforward from one layer to the next.Each convolutional layer includes local response normalization across maps.the max pooling window size is 3*3.the stride alternates between 2 and 1 at each layer.All convolutional and local connected layers contain rectifier units.

4.2 Training Procedures

1) Feature extraction: We first extract frames of each image . After that, Features are extracted by projecting each frame on the principal components. Then the feature is fed into the CNN model as observations.

2) Random Generation matrix: Randii function is used to create matrix.It's dimensions are 32*32*3, 16*16*64, 8*8*128, 4*4*128 and 1*10.

3) Neural Network Training and testing: The network needs to be trained first with some predefined standard character patterns to perform the recognition task. Leverberg Marquardt algorithm is used for this, which is considered as the unsupervised form of learning method where every neuron competes with each other in the basis of their activation value. The connection weights towards the winner neuron get adjusted during training process. Some random values are assigned initially to all the connection weights, during the training process these values are converged to some fixed values. The training process is similar to an unsupervised training method.
The network training parameters are:

    Input nodes: 10
    Hidden nodes: 10
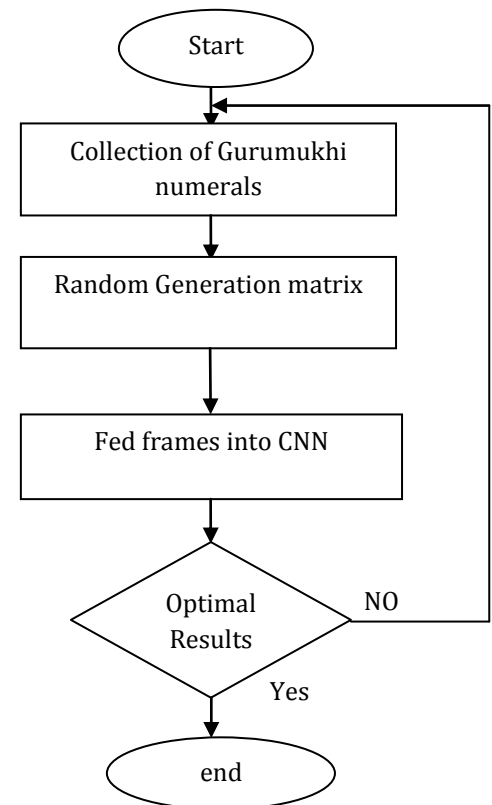   Training Algorithm: Feed forward NN

4.3 Flowchart

Fig.3 Flowchart

5. CONCLUSION

➢ New distorted sample generation technique with non-linear warping functions along the x-axis and y-axis of the original image, which significantly improved CNN performance. Finally, by applying a combination of multi-level pooling and the distorted samples technique to the SCUT-SPCCI database, we achieved outstanding recognition rates of 94.38% and 99.74% for the 3755 classes of Chinese characters in 280 fonts and 120 selected fonts, respectively.

➢ Two-stage recognition process for printed Thai and English characters using nearest neighbor classifier and SVM. KNN and SVM baselines Comparison with the existing works. The best recognition rate is 97.06% for BEST2013 dataset.

➢ HOG and SVM method overcome the main challenges associated with the natural scene images like complex background, different font styles of the text, sizes of the text and orientation of the text but it fails to overcome the problems low light, reflection and broken text etc.

- Thus, an important consideration in applying Back propagation learning is how well the network generalizes. Research has found that a network using the least number of hidden units that can successfully learn the training set.

- The CNN does not utilize color information, which can improve performance on low-contrast text.

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