Special Approach for Recognition of Handwritten MODI Script's Vowels

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ABSTRACT

The ambient study had been performed on foreign language like Arebic, chineses Japanese etc. efforts on India script is still immature. OCR of MODI script language is still not available as it is cursive type and old language i.e. Shivkalin and Peshwekalin. the challenges of recognition of character is even high in handwritten domain , due to the varying writing style of each individual. In this paper we propose a system for recognition of offline handwritten MODI script Vowels. the proposed method uses chain code and image centroid for the purpose of extracting features and a two layer feed forward network with scaled conjugate gradient for classification.

Keywords:

MODI Script, handwritten character recognition, Chain Code, Feed forword networ, Image processing.

1. INTRODUCTION

Offline handwritten recognition has been popular field of research for many years. it is still remains an open problem.The challenging nature of handwritten recognition and segmentation has attracted the attention of researchers from industry and academic peoples. recogniition, segmentation and classification of MODI script is a difficult task because the MODI handwritten characters are naturally both cursive and unconstrained. simillarly, high similarity between character and distorted and broken characters. Hence extreme variation is observed in the collected samples. The proposed work is an attempt for offline handwritten character recognition (HCR) problem by concentrating mainly on chain code histogram and normalized chain code histogram features. The work is extended by adding centroid of the image as supplementary feature and it was found that the combination improves the result. The organization of the paper is as follows.

Section II describes about Modi script. In section III, Recognition moodel is discussed. Section IV covers Preprocessing steps taken. Section V, discussed about Feature extraction methods. Classification method is explained in section VI. Result and Discussion is covered in section VII. Future work is discussed in section VIII and conclusion explain in section IX.

2. MODI SCRIPT

Modi is one of the scripts used to write the Marathi language, which is the primary language spoken in the state of Maharashtra in western India. There are several theories about the origin of this script. One of them claims that it was developed by Hemadpant (or Hemadri Pandit)

during the reign of Mahadev Yadav and Ramdev Yadav (1260–1309). Others claim that it was brought by Hemandpant from Sri Lanka. It is a popular notion that only Marathi is written in Modi. Other languages that have also been found to have been written in Modi are Urdu, Kannada, Gujarati, Hindi and Tamil.

The Modi alphabet was invented during the 17th century to write the Marathi language of Maharashtra. It is a variant of the Devanāgarī alphabet. The Modi alphabet was used until 1950 when it was replaced by the Devanāgarī alphabet. it is syllabic in nature and alphabets are classified into vowels and consonants and numerals. Notable features are that each letter has an inherent vowel (a). Other vowels are indicated using a variety of diacritics which appear above, below, in front of or after the main letter. Some vowels are indicated by modifying the consonant letter itself. Marathi, an Indo-Aryan language spoken by about 71 million people mainly in the Indian state of Maharashtra.

Fig.1 : MODI Vowels and diacritics

Fig.2: MODI Consonants

3. RECOGNITION MODEL

The important steps of Character Recognition Systeminclude Preprocessing, Feature Extraction, Classification and Post Processing. Block diagram of a typical character recognition is shown in Fig. 3. The Preprocessing steps are depicted in Section IV. Features are extracted based on statistical and structural features of images. Feature Extraction method used in this paper is described in Section V. For classification Artificial Neural Networks and Support Vector Machines are used. Post processing includes error correction and mapping of characters into Unicode representation.

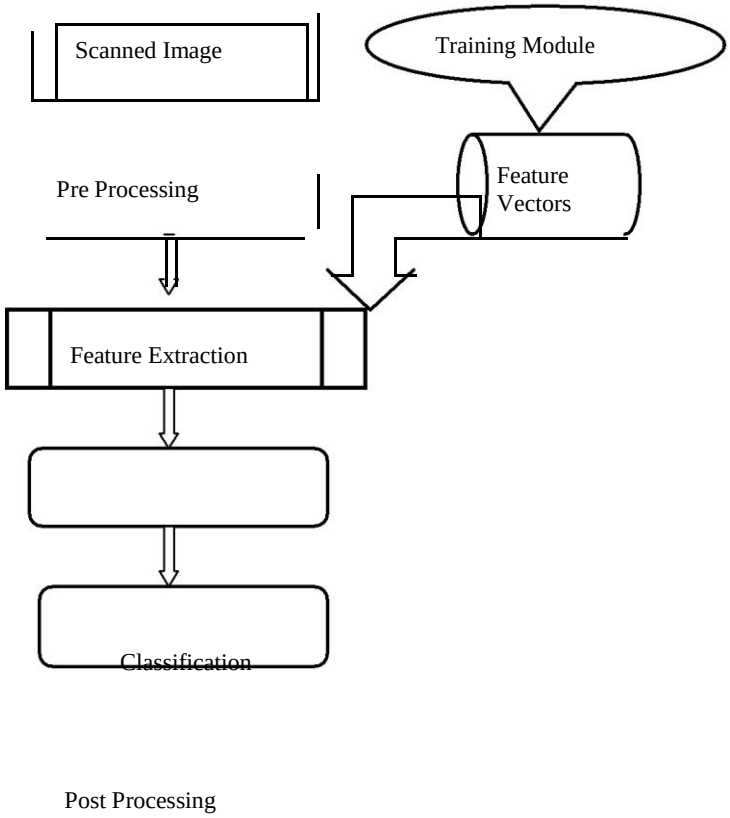

Fig.3: Block Diagram of Character Recognition

4. PREPROCESSING

Preprocessing is an essential step in Optical Character Recognition. The nature of preprocessing depends on subsequent steps. As a preliminary work, about 65 handwritten pages are collected from different persons containing characters in MODI language, without considering ink or pen variations. It contains broken and distorted characters also. Each page is scanned using 200, 300 or 600 DPI and stored either as BMP, JPG or TIF format. Each character is segmented using morphological method with a rectangular structuring element and the bounding box of each character image is stored BMP images. Each character is assigned a class id. Pre-processing steps used here are shown in Fig. 4. A median filter is applied to each segmented character image to reduce salt and paper noise. The image is then converted to binary based on Otsu's [1] method of global image threshold. Edges in each binary image are found out. Image is filled with flood fill to avoid break in boundary contour. The results of all these processing are shown in Fig.5,6,7 & 8. Character images are normalized to 56x56 using bicubic interpolation, where the output pixel value is a weighted average of pixels in the nearest 4 by 4 neighborhood. This size normalization avoids inter class variation among characters.

1. Input Image in JPG, TIF, BMP formate.
2. Noise Removal.
3. Skewing
4. Binarization of an Image.
5. Segmentation of an Image
6. Size Normalization.

Fig. 4 : Preprocessing Steps.

Fig.5:Original Image

Fig.6: Binarized Image

Fig.7: Image from canny edge detection

Fig.8: image from flood filled

5. FEATURE EXTRACTION

Feature extraction is a crucial step for any OCR system.There are several methods for the shape analysis of objects.Various feature extraction methods are covered in Trier.O.D[2]. In this paper, we are mainly concerned with the chain code based approach by Freeman [3]. Chain codes are used to represent the boundary by a connected sequence of straight line segments of specified length and direction [4]. It is an ordered sequence of *N* links{ , 1 , , } *I X I*

= .. *N* Where xi is a vector connecting neighboring contour pixels. The directions of xi are coded with integer values *I*=0,1,...,n-1.

A. Chain code calculation of Handwritten MODI characters.

For extracting chain code features, edges of each size normalized segmented binary character image is traced, starting with the bottom most, left most point in the trajectory. The direction of each segment is coded both as four directional and as eight directional as in Fig. 9. the chain proceeds in clock wise manner and it is carried out till starting point is revisited. Then the chain code histogram (CCH) is calculated from the chain code representation of the contour. The CCH is a translation and scale invariant shape descriptor. To achieve better invariance the normalized chain code histogram (NCCH) is also used.
Apply the following algorithm for all character images on the datbase.

B. Algorithm :

1. Input the Image
2. Skewing image
3. Resize character image to 56x56
4. Binarize the input image
5. Detect the edge by using Canny operator
6. fill the character to avoid break in contour
7. Extract the boundary points
8. Create N directional Chain code for
   i) N=4 (CCH4) and
   ii) N=8 (CCH8)
9. Calculate the weight of values in N directions and normalized it, for
   i) N=4 (CCH4) and
   ii) N=8 (CCH8)
10. Calculate the (x,y) points of the image centroid
11. Construct input
    Feature set I with 8(i) and 9(i)
    Feature set II with 8(i), 9(i) and 10
    Feature set III with 8(ii) and 9(ii)
    Feature set IV with 8(ii), 9(ii) and 10

Repeat step 1 to 11 for all images in the database.

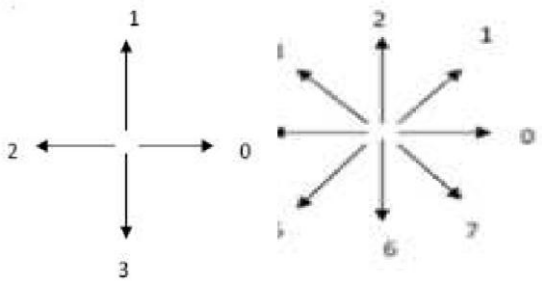

Fig. 9: Directions of four connected and eight connected chain code.

6. CLASSIFICATION

A two layer feed forword neural network as in Fig. 10 with sigmoid activation function is used for classification. The network is trained with scaled conjugate gradient (SCG) back propagation algorithm. This algorithm is based upon a class of optimization techniques in numerical analysis as the congugate gradient methods using the second order information from neural network, but requires only O(N) memory usage, where N is the number of weights in the network [5]. Mean squared error, which is the average squared difference between outputs and targets, is used as the perfomance measure.

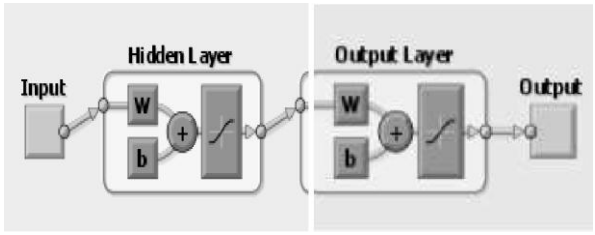

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Fig. 10: Neural Network Model

7. RESULTS AND DISCUSSION

In the first experiment 8 features as in set I is given as input to the classifier. In the subsequent experiments 10, 16 and 18 features as in feature set II, III and IV respectively are used. From theset of samples 70% are used for training, 15% for validation and 15% for testing. The training, testing and validation samples are selected at random . Mean Squared Error is used as performance measure. The outcome is tabulated in table-1. The plot of training state and performance of feature set II are displayed in Fig. 11 and in Fig. 12 and that of feature set IV are displayed in Fig. 13 and Fig. 14 respectively.

Table-1: PERFORMANCE MEASURES

No.	Feature used	Accuracy			Average Accuracy
		Training	Validation	Testing	
I	4dir CCH & 4dir NCCH4D	65.3	56.5	55.9	65.3%
II	4dir CCH, 4dir NCCH & Centroid	69.9	63.9	65.7	67.9%
III	8dir CCH, & 8dir NCCH	66.7	61.3	64.5	65.9%
IV	8dir CCH, 8dir NCCH & Centroid	73.4	75.5	71.9	73.5%

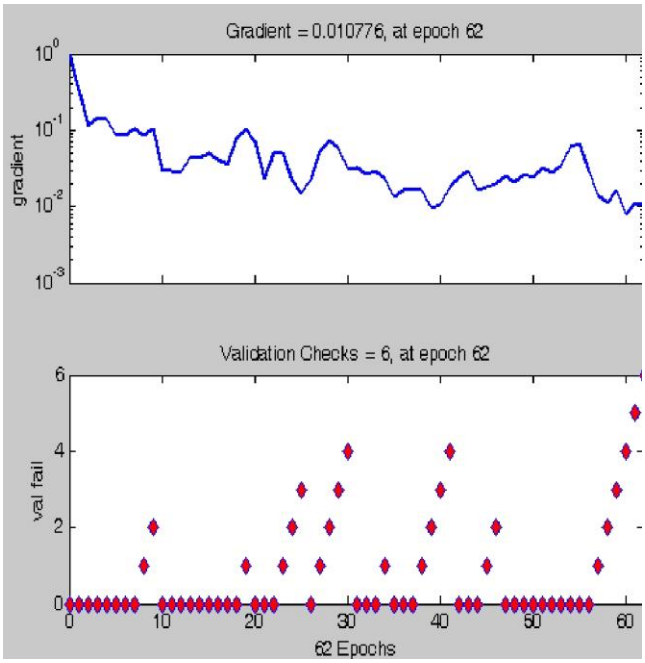

Fig. 11: Training state of feature set II

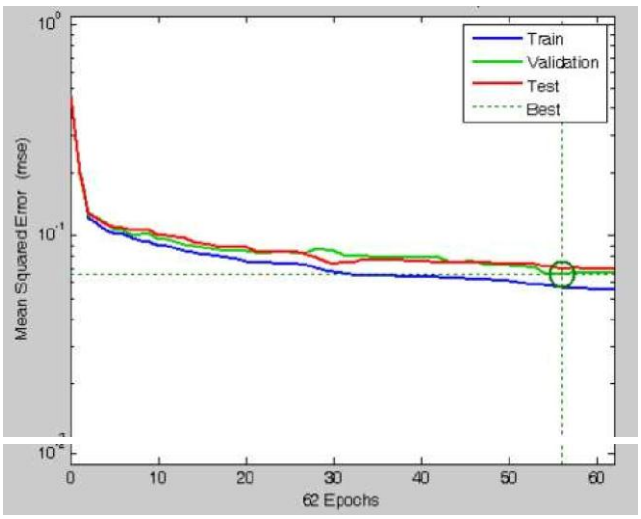

Fig. 12: Performance plot with feature set II

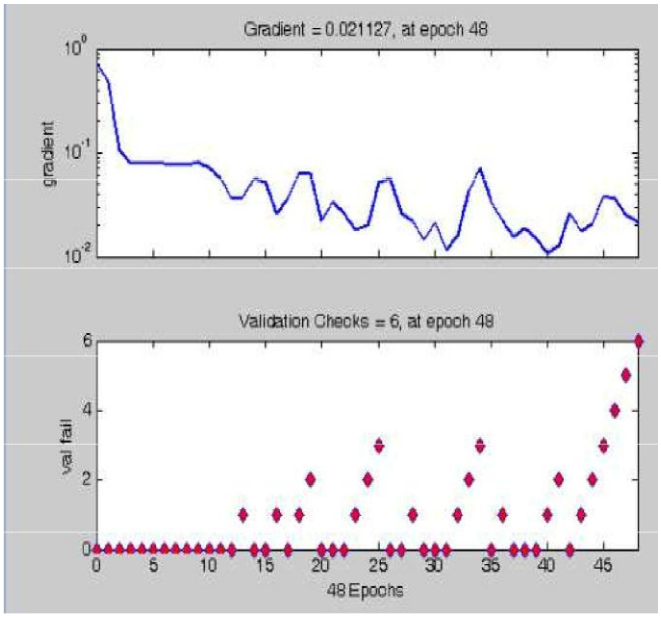

Fig. 13: Training state of feature set IV

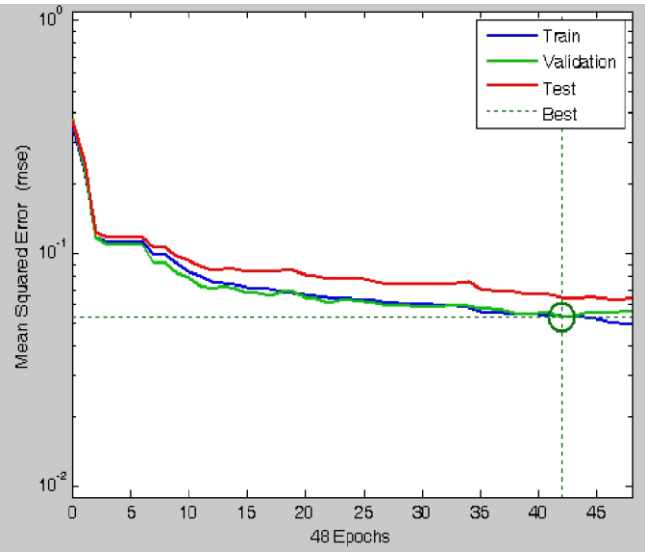

Fig. 14: Performance plot with feature set IV

8. FUTURE WORK

A large collection of handwritten samples are a prerequisite to the proper performance of any OCR. As a future plan, we would like to enhance the approach using sufficiently large number of samples and extend the work by using all characters in MODI language.

9. CONCLUSION

A novel method for modeling MODI script handwritten vowels based on both chain code histogram and normalized chain code histogram are introduced. Centroid of the image is used as an additional feature, which is found to improve the result.

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