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Directional Discrete Cosine Transform(D-DCT) Method for Classification and Recognition of Cursive English Alphabets

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ABSTRACT

In this chapter we analyze the performance of D-DCT algorithms for the recognition of cursive english alphabets, These are statistical methods suitable for the recognition of cursive English characters. These methods are used for feature extraction and classification of English characters. We have used Directional Discrete Cosine Transform Method as a classifier.

Keywords : D-DCT, Directional Discrete Cosine Transform Method, OCR

I. INTRODUCTION

A system based on Neuro-fuzzy method is proposed for the recognition of English script document. In this research, an attempt has made to apply Neuro-fuzzy based method to test the performance rate of cursive english alphabets recognition.

As only one feature descriptor cannot produce competent result, some local technique like Gaussian membership method have been used for better representation of the features. The samples are collected from different persons by allowing them to write English alphabets on a piece paper. Fuzzy Gaussian Membership method used as a classifier.

Main part in the field of document analysis is that of Optical Character Recognition (OCR), which is broadly defined as the process of recognizing either printed or text from document images and converting it into electronic form.

The OCR evaluation are mostly classified into two categories: black box evaluation and white box evaluation. In the black box case the OCR is consider as a block box where only the input and output are visible to the evaluator. In a white box situation, outputs of dissimilar modules (eg. Skew correction, zone segmentation character extraction) of the system are accessed and evaluated .

Indian scripts are always prominent by the presence of the matras in addition to main characters. whereas English script has no matras. Therefore, We can not apply these algorithms directly to Indian Scripts.. Many OCRs for Indian scripts have been reported . However, nobody have attempted to recognise the Indian Scripts character. Printed character for Devanagari script has been recognize. And attempted based on Kohenen Neural Network

(KNN) and Neural Network. These results are extended to Bangla, which also has the header line like Devanagari. Concavities and inter-sections features have been used as a structural features. A similar approach is tried for Gujarati with limited success.

Each language has its own character set. The following figure shows the sample of cursive English characters

Fig.1 Samples of cursive english alphabets

II. Neuro-Fuzzy based Methods

A. Pre-processing

In Pre-processing the raw data, depending on the data acquisition type is subjected to a number of preliminary processing steps to make it usable in the descriptive stages of character analysis. Preprocessing aims to produce data that are easy for the recognition systems to operate accurately.

B. Segmentation

In segmentation the document segmenting into its sub components. Segmentation is an important stage, For the reason that the extent one can reach in separation of words, lines or characters. It directly affects the recognition rate of the script.

To isolate characters from the string, a vertical projection of the image has taken from the top position to the bottom row of the character string. The columns that have no black pixels are treated as boundaries for extracting image boxes corresponding to character. i.e vertical projection. The columns corresponding to white space between succeeding characters have been marked.

C. Feature Extraction

Our Approach Directional Discrete Cosine Transform(D-DCT)

Since OCR engines are usually script-dependent, automatic text recognition in English script requires a pre-processor module that identifies the script. We used English script recognition technique. To handle this, words are first segmented by morphological dilation and performed connected component labeling. We then employ discrete wavelet transform, statistical filters and discrete cosine transform to extract the directional multi-resolution spatial features.

We tested the features by using Fuzzy Gaussian Membership functions as classifiers for English script. In our tests, we have achieved highest accuracies up to 92% .

In this work, we present a technique in which features are based on the Radon transform (RT), discrete wavelet transform (DWT), statistical filters (SF) and discrete cosine transform (DCT). These are collectively used to extract directional multi-resolution spatial features.

Discrete wavelet transform (DWT) performs sub-band coding on image in terms of spatial and frequency components and allows analysis of image from coarse to fine level. We consider two dimensional DWT image represented by LH, HL and HH sub-bands and they produce details in three directions namely horizontal, vertical and diagonal, whereas LL subband preserves their approximation. By decomposing detail and approximation of images again, next level details and approximation can be obtained. In our experiment, we have used (Daubechies-9) wavelets.

Our close analysis suggests that, shapes of English scripts are composed of directional graphical segments like horizontal, vertical, diagonal lines and curves. Therefore, for efficient characterisation of words, in our feature extraction technique, we combine the RT, DWT and SF.

1) The RT is use for directional energy. We compute the RT at $\theta = (0^{\circ}, 30^{\circ}, 90^{\circ}\&135^{\circ})$ directions.
2) DWT provides multi-resolution information at different scales and directions.Each word image is decomposed using DWT and further extended up to the fourth level. By doing so, we have sixteen subbands i.e., four sub-bands at each level.
3) SFs are aimed to measure the information about local variability of the energy of pixels in an image and in overall; it provides spatial characteristics of the script. SF produces three filtered images representing spatial statistics viz.

In this research, we have presented an approach to identify English script based on directional energy of the multire solution analysis, Radon transform with DWT, spatial variation measurement with discrete cosine transform and statistical filters. Effectiveness of our method is realised by considering comprehensive tests over several character set.
Further, the proposed method is robust against small skew of standard benchmark data set for cursive printed English script.

D. Classification

The objective of recognition is to interpret sequences of numerals taken from the test set. Any new character that is to be recognized is preprocessed first. To improving the performance of handwriting recognition is to recognize the characters taken from the test set.

III. Experimental Work

We had implemented following image enhancement techniques.
1. Removed noise and background from threshold image. We obtained highly acceptable results.
2. High pass filter to increase contrast of character and to illuminate background noise. We have used imadjust() - Results are quite acceptable.
3. Gaussian filter – Results are not acceptable for most of the noisy character image. It is necessary to apply image enhancement techniques before classifying cursive english alphabets.
Cursive english alphabets samples used in this experiment are given in the following table 1.
Such 5 samples of each characters are used to carry out experimental work using D-DCT in MATLAB 7.8.

IV. OBSERVATIONS

Character recognition results of cursive english alphabets using D-DCT method for sample1 to sample 5 are given in the table 1.

Table 1: Recognition Results of cursive english alphabets using D-DCT

Sample Printed Character	Sample 1 Character Recognition	Sample 2 Character Recognition	Sample 3 Character Recognition
	95.18	96.11	95.11
	95.27	95.55	89.33
	92.14	81.34	87.23
	92.73	93.44	90.34
	80.92	82.78	89.00
	92.36	91.34	91.54
	92.91	91.33	94.23

	86.21	87.55	88.22
	96.23	95.66	97.66
	98.83	98.55	97.55
Average Recognition	**92.27**	**91.36**	**92.02**

	83.21	85.55	87.22
	97.22	96.66	97.66
	96.55	92.55	96.55
Average Recognition	**92.10**	**90.43**	**90.56**

cursive english alphabets	Sample 1 Character Recognition	Sample 2 Character Recognition	Sample 3 Character Recognition
	94.22	94.12	95.55
	95.07	96.22	95.33
	94.45	94.34	94.23
	92.77	93.44	92.34
	84.22	87.78	84.00
	92.16	93.34	93.54
	91.19	92.33	91.23
	83.21	85.55	87.22
	97.22	96.66	97.66
	96.55	92.55	96.55
	84.22	87.78	84.00
	92.16	93.34	93.54
	91.19	92.33	91.23

Sample Printed Character	Sample 4 Character Recognition	Sample 5 Character Recognition
	95.23	96.55
	95.00	95.56
	91.14	92.33
	90.73	92.34
	81.11	82.23
	91.13	92.34
Average Recognition	**91.57**	**92.56**

cursive english alphabets	Sample 4 Character Recognition	Sample 5 Character Recognition
	95.11	92.13
	97.22	97.27
	92.34	92.45
	89.22	91.12
	79.44	78.92

	92.44	90.33
	93.13	92.11
	85.55	83.31
	97.76	96.88
	98.66	98.14
	95.11	92.13
	97.22	97.27
	92.34	92.45
	89.22	91.12
	79.44	78.92
	92.44	90.33
	93.13	92.11
	85.55	83.31
	97.76	96.88
	98.66	98.14
Average Recognition	**92.08**	**91.26**

As shown in the table 1 total 100 English characters were randomly selected by using simple random sampling method (lottery method), total 10 standard characters were compared with corresponding cursive english alphabets of 10 samples are compared with standard characters from standard data set of English Script. The average recognition of 104 cursive english alphabets is found to be 92%.

V. RESULTS AND CONCLUSION

In this work, an attempt is made to apply a technique based on Directional Discrete Cosine Transform(D-DCT) Method for feature extraction of cursive English alphabets. The method is found to be promising one. It was found that it was possible to enhance recognition rate if a character was divided in a systematic manner and features of each divided part are used in recognition system. D-DCT methods suggested in this research are useful, as it help in enhancement of success rate in spite of great variation in character due to different styles of handwriting. The performance rate is found to be 92%. It found better than moment of character & asymmetry parameter method introduced by R. G. Malle . where recognition rate is 85% for the recognition of characters.

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