MOMENT INVARIANT OF HANDWRITTENNUMBER RECOGNITION USING SOFT COMPUTING

Akash Singh Jadon[1], Akhilesh Pandey[2]

[1]*Department Of Computer Science Engineering, Suresh Gyanvihar University, Jaipur, Raj, (India).*
[2]*Assistance Professor, Department Of Computer Science Engineering, Gyanvihar University, (India)*

ABSTRACT

Much research work has been done in the visual field for achieving success in recognition of visual patterns and characters with an independency of its position, size and its orientation. Perusing this work to a new advancement in its area, we are representing here, an off-line number matching system which follows moment invariant method. This Number matching system implements a four-step process. In this proposed system we used moments for a numerical characters attributes of different size. One of the most fundamental problem in designing an image pattern recognition system is extracting the features from the interested objects for further classification in the same process.Using different types of pen and paper imparts different variations in the writing style, thus, making it difficult for any optical recognition system to compute moments for any number. Moreover, writer's mental condition at the time of writing also influences the character variations which increments the problem of character optimization. Deployment of the moments for characterizing object is, however, seen as a solution in this field has drawn notable attention in recent researches. In this proposed number matching system, new derived techniques are being addressed for increasing the efficiency and accuracy in moment computing. The image noise effect during image reform, selection of the optimal moment's order automatically for reforming image from numerical image, and the moments' utilization as numerical image features for crediting character has been studied as well.

Keywords: Image, Matlab, Moment Invaraint, Soft Computing

I. INTRODUCTION

Selecting a set of suitable numerical attributes related to the features which are to be extracted from the object of interest for the purpose of classification, is one of the most basic problem in designing an imagery pattern recognition system. The objects can be recognized from the imagery through many methods by identifying an unknown object as a member of a set of known objects. It is very much imperative for a given pattern recognition system to have efficient object recognition techniques which abstracts characterizations uniquely for representation and comparison. Researches on utilizing the moment for object characterization has got considerable attention in both in-variant and non in-variant tasks. The principal techniques explored include Moment Invariants, Geometric Moments, Rotational Moments, Orthogonal Moments and Complex Moments. Various forms of moment descriptors have been extensively employed as pattern features in scene recognition registration object matching as well as data compression. The mathematical concept of moments has been used in a diverse fields ranging from mechanics and statistics to pattern recognition and image understanding. Describing images with the help of moments instead of many other image features indicates the utilization of global properties of image rather than its local properties.

In a bid to create history, Hu published his first authoritative paper on the proper utilization of moment invariants for image analysis and object representation in, Hus approach was based on the work of the nineteenth century mathematicians Boole Kayley and Sylvester, on the theory of algebraic forms Hus Uniqueness Theorem states that in case of a function f(x ,y) is piecewise continuous and has nonzero values only in the geometric moments of all orders exist. . Thus, uniqueness in the moment set determination can be easily shown. As any image segment bears area and, in the relatively worse case, if it is a piecewise continuous, computing a moment set becomes possible which can be used to describe the information stored in that image segment in a unique way.Following through nonlinear combinations of all geometric moments, Hu gave a derived set of invariant moments which have the required properties of being invariant under the processes involving image translation, rotation and its scaling. However, the image reconstruction by using these moments seems as a quite difficult task.

The Rotational moment is an alternative to the typical geometric moment.These rotational moments follows the method of polar coordinates representation for any image and also, can be used to extend the workspace for defining the moment invariants to an arbitrary order in such a manner that could ensures that their respective magnitudes do not diminish notably with an increasing order. Smith and Wright used a simplified Rotational moment technique to extract invariant features off the noisy ship images of usually low resolution. For this, Boyce and Hossack took an innovative measure by deriving the Rotational moments obeying any arbitrary order that are all invariant to rotation, intensity, and radial scaling. To overcome this problem in a much better way, the method of moment matching was introduced by Teague which can be used to determine the quality of image reconstruction from the moments' sets. The method calculates a function of continuous nature whose moments exactly match the geometric moments.Since, this technique requires a credible resolution for the coupled equations which goes on increasing while considering moments of higher order, it is said to be impractical for calculation as it requires one to solve an increasing number of coupled equations when higher order moments are considered.Then, Teague approached the idea of orthogonal moments which can be taken into use for recovering the image from moments following the theory for orthogonal polynomials. Teague introduced the rotationally invariant Zernike moment, which implements the moment basis set of complex Zernike polynomials and for its basis set, it employs the Legendre moment. Various sizeable efforts have been made in multiple experimental tasks of image reconstruction conducted by Teague, and then Boyce and Hossack, The[9] and Chin, Taylor and Reeves and more recently, Khotanzad and Hon with both Zernike and Legendre methods. However, a high quality multi grey-level image is yet to be reconstructed from its original version in reality. Later, the notion of Complex moments got introducedby Abu [9]Mostfst and Psaltis as a simple and straightforward way to derive a set of invariant moments. Abu Mostafa and Psaltis used Complex moments to investigate the informational properties of moment invariants. However, while observing the Complex moments with that of Zernike moments, they came to a conclusion that the Complex moment invariants are not so much good image features. In other additional work, Abu Mostafa [9] and Psaltis [9] examined the moments' utilization in a generalized image normalization scheme for recognition of invariant patterns.They inked the classic image normalizations of area, position in the plane, rotation and intensity, in terms of Complex moments. Moment invariants were, then, shown as derivable quantities from Complex moments of the normalized image.[9].Teh and Chin performed an extensive analysis and comparison of the most common moment definitions. They examined the noise sensitivity and information redundancy of Legendre moments along with other types of moments [9].Teh and Chin concluded that higher order moments are more noise sensitive. Among

the explored techniques. Complex moments are least sensitive to noise while Legendre moments are most severely affected by noise. In terms of information redundancy Legendre, Zernike and pseudo Zernike moments are uncorrelated and have the least redundancy. In terms of overall performance Zernike and pseudo Zernike moments are the best [9].

II. LITERATURE SURVEY

Function characterization is considered as a general problem in mechanics, physics and other fields of engineering as it requires some other functional. In particular, moment functional have attracted great attention. Due to their simple mathematical structures and numerous physical significance.

Hausdorff provided a complete method for characterizing the moment functional over a class of functions consisting of unique variable.

Let {μ} be a real number sequence and let us define. Note that can be viewed as the MTh order derivative of μ.

By Hausdorffs theorem, an essential and sufficient condition that there exists a monotonic function f(x) satisfying the system.

Since then, moments and functions of moments have been in utilization in a number of applications to achieve both invariant and no invariant recognitions of two dimensional and three dimensional image patterns [9].

In this chapter, the various kinds of moments are defined and their properties are presented in a concise summary. It is taken into consideration that a real valued functions can represent an image.

The usage of Zernike polynomials in optics takes us back to the early 20th century when the applications of orthogonal moments followed by Zernike polynomials for image processing had been pioneered by Teague in [8].

The research community facing the challenge is that humans can allow neatly handwritten characters with 100% accuracy. There is no any Optical character recognition that can match that achievement even for Roman or any other Numbers. In this project, a system for off-line recognition of handwritten numbers is proposed. In [4] the first research report was on handwritten characters and numbers but after that in this area not much work has been done. Printed character recognition is attempted using Kohenen neural network and other types of neural networks in [9].

Offline numeral cognizance has many practical applications. Among the most copied practical applications of offline numeral cognizance is the reviewing of postal zip codes in addresses written or typed on wrapping. The advantage of achieving such systems in post offices is huge. Such systems would make accessible automatic sorting and routing of the millions of mails that discharge through the postal system every day, shrinking the human tasks at hand and gearing up the whole evolution. However, although prevalent research, the present method does not gives results that meet the aim accuracy. A faithful and reliable numeral cognizance system requirement to have very high accuracy.

Most of the Indian scripts are acclaimed by the existence of mitres (or, character modifiers) in addition to main numbers as across the English script that has no metres. Therefore, algorithms advanced for them are not directly associable to Indian scripts. Many OCRs for Indian scripts have been believed [2]. However, none of these has undertaken the handwritten text storing of composite characters that absorb both the main characters and mitres.

Printed character recognition is attempted using Kohenen neural network (KNN) and other types of neural networks [5, 3]. These results have been extended to Bangla [5], Structural features like concavities and

intersections are used as features. This approach was also implemented for Gujarati in Ref. [5] but with confined success. For Gurumukhi script, reasonable quantity of results have been reported. [1] Some preliminary refined results are also available in the literature on studying over two popular scripts in south India—Tamil and Kannada [1].

For this script recognition, many aspect ratios have been recently reported by Sinha et al.[7].

Through the implication of structural approach, Sethi and Chatterjee [5] have elaborated the numeral recognition. The primitives which are used includes, horizontal and vertical line segments, right and left slants. A decision tree is further employed to accomplish the task of the analysis based on the presence absence of these primitives and their interconnection.

A similar approach is applied to the constrained hand-printed characters in Ref. [9]. Neural network approach for isolated characters is also reported in Ref. [9]. A method for recognition of handwritten numbers based on the structural descriptors of a numeral's shape is given in Ref. [9]. Density, segment and moment features are used as inputs to the classifiers with feed-forward superstructure of the Kohonen modules in Ref. [7].

III. IMPLEMENTATION

1.1 Data Collection

a) Starting Design the form for collection of data from different writer because there is not any standard database of the number.
b) All the form scanned by the Canon scanner.
c) Design the database name Centre for Pattern Analysis and Recognition (CPAR).
d) The database is in development at CPAR, Sharda University, Gr. Noida.
e) Currently have more than 80000 Numbers and 1.25 lakh character.
f) We use the 3000 sample for training and 2000 sample for testing.
g) More than 100 numbers for document recognition.
h) Numbers from CPAR database are used in small scale for this project.
i) More than1300 Numbers

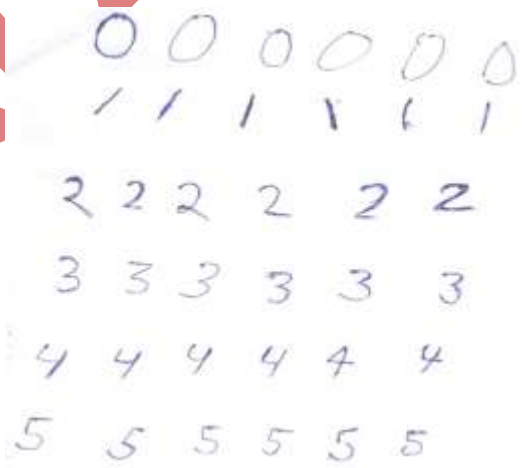

Figure 1. Data Set

3.2 Load Image

First, one can install images which are scan as producer, or identify numbers by using produce picture.

3.3 Pre-processing

After loading of the image, that image is processed again .Issue have to remove noise a techniques deal for enhancing contrast. In pre-processing level it can be normal and removed at all redundancy, error by picture and give to upcoming level.

Below are the chief pre-processing methods.

- **Binarization**

a) First, number is cached which means UN useful pixel are taken offs that image.

b) Gary scale image is the conversion image of RGB image.

c) To make that image useful is scanned and objected into number which is processed and objected in to number which is processed, which is in next upcoming level.

d) Pre-processing is used at the period when database is created .which have and there is no limitation is following:

Figure 2. Binarization Of Image '0'

3.4 Noise reduction

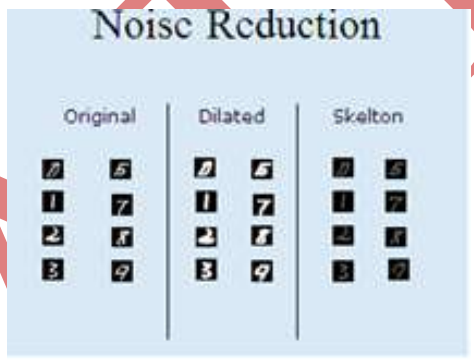

Figure 3: Noise Reduction of the Image

3.5Contour Formation of the Image

To advance boundary a technique of the contour tracing is apply to images which are digital .Commonly contour pixel is small in number representing pattern that means cost computation get lesser when one of us use extracting feature algorithm in contour but instead of it full pattern, As lot of features are shared contour original pattern .The way of extracting feature becomes easy and important when perform on original pattern in contour.

0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	4	2	0	0	0	0
0	0	0	0	2	1	1	2	2	2	0
0	0	0	0	2	1	1	1	1	2	0
0	0	0	0	0	2	1	1	2	2	0
0	0	0	0	0	2	1	1	2	0	0
0	0	0	0	2	1	1	1	2	0	0
0	0	0	2	2	2	2	2	2	0	0
0	0	0	0	0	0	0	0	0	0	0

Figure 1:- The Contour Formation Is Shown By The Movement Of Turtle In Net Logo.

IV. RESULTS

To obtaining the best result of providing handwritten Hindi number images from CPAR database. This database is specially design for the Devnagari number .For this process first of all we short out the data that are moment variant that we find out edge of image sample than trained the system according the feature of sample. Then test the system to provide little another system and test the accurateness of samples .The data sample were divided in to two parts. Number one part is for the training purpose and another part is testing purpose. By that to compute the features of the image and use for that features for testing. The differences is very minor.-

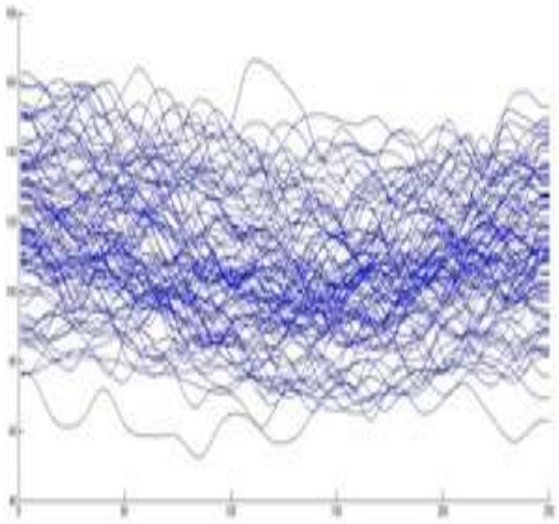

Figure 2:-Feature Vector of Image '0'

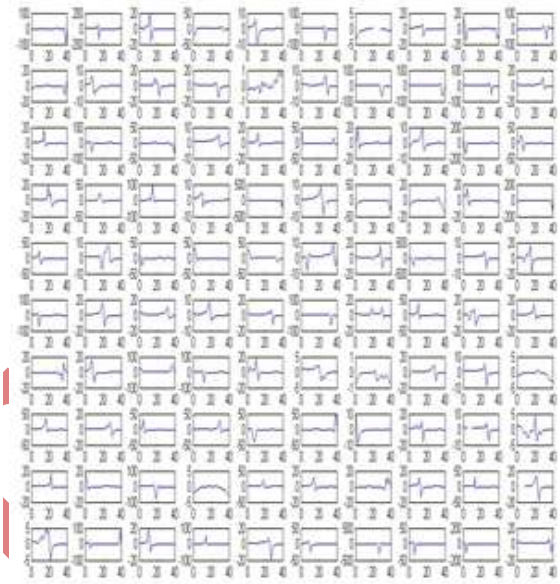

Figure 3: Subplot of Graph image '0'

VII. CONCLUSION AND FUTURE WORK

This system proposes an effective method for achieving better recognition rates for handwritten numbers. Our proposed algorithm is work on moment variant image sample. This technique based on a CPAR database that is created only for devnagari numbers. This Strategy used for number recognition is good but we can improve it by using more efficient data scanned image. Moment of number recognition is very challenging task. Variation of number effect the result

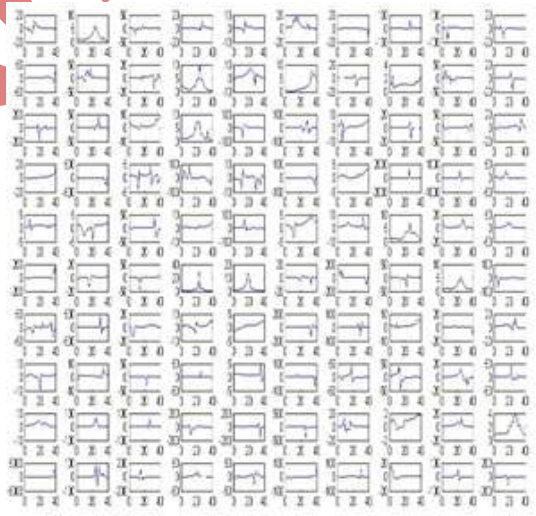

Figure 7: Subplot of Graph image '1'

Use the multiple classifier and increase the recognition result. Online recognition of numbers.

Here we used back propagation classifier for classify can be calculated for the entire symbol set and the authors hope that proposed some another feature enhancement technique will be helpful to the future work

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