

## **A LITERATURE SURVEY ON BETTER SYSTEM EFFICIENCY OF HANDWRITTEN NUMERAL RECOGNITION**

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**Abstract-** In this review paper, an extensive literature review on Neural Network based numeric recognition by describing the survey of some research articles have been involved for better analysis in order to enhance the system efficiency. Handwritten Numeric Recognition is very interesting area of Pattern Recognition and it deals with Offline Handwriting Recognition. Handwriting Recognition has kept on continuing as a method for correspondence, gathering, recording and transmitting data in everyday life since the hundreds of years even with the appearance of the new advancements. Machine recognition has numerous functional applications, perusing manually written postal envelopes, sum written in bank checks, bill handling, government records, business frames, signature confirmation, disconnected from the net archive acknowledgment and so on. This Paper portrays the best in class study of the work accomplished for the Numeric recognition.

**Keywords—** ANN, Numeric Recognition, online, offline, pre-processing, classifiers

### I. INTRODUCTION

Numeral Recognition alludes to the procedure of deciphering image of written by hand, typewritten, or printed digits into an arrangement comprehended by client with the end goal of altering, indexing/seeking, and a diminishment away size. The Numeral Recognition procedure is confused by loud inputs, picture mutilation, and contrasts between typefaces, sizes, and text styles. Numeral Recognition turns out to be more unpredictable when different scripts were utilized amid pin code or telephone number composition on the grounds that it is unrealistic for a solitary individual to have a thought of each scripting of numeric digits. For taking care of this issue, manufactured neural systems are ordinarily utilized. The product created in this venture changes over numeric picture written in five unique scripts (Hindi, English, Urdu, Tamil and Telugu) into English with the goal that it can be seen effectively.

Learning contained in paper based and written by hand reports are more profitable and valuable on the off chance that it is accessible in computerized structure. In later past there are expanding pattern to digitize composed and paper based archives, for example, books, daily papers and manually written materials for the advantage of more extensive area of the general public. It is attractive to protect these archives in advanced structures. The Optical Character Recognition (OCR) is a procedure [3] by which the printed and filtered archives are changed over to ASCII character which is perceived by a PC. The acknowledgment of characters and numeral of a dialect is a testing issue subsequent to their varieties because of diverse text dimensions and distinctive sorts of varieties presented amid composing. The character acknowledgment (CR) can be comprehensively ordered into two gatherings: disconnected from the net and on line.

In the first case, the report is produced, digitized, put away in memory and after that it is prepared yet if there should arise an occurrence of online framework, the character is handled when it is created. The components, for example, weight and speed of composing don't impact the disconnected from the net framework, yet they impact the online one. Disconnected from the net and online frameworks can be connected to written by hand characters (Fig 1(a)) and optical characters (Fig 1(b)) separately. As needs be, the acknowledgment errand can be named OCR or transcribed character acknowledgment [7].

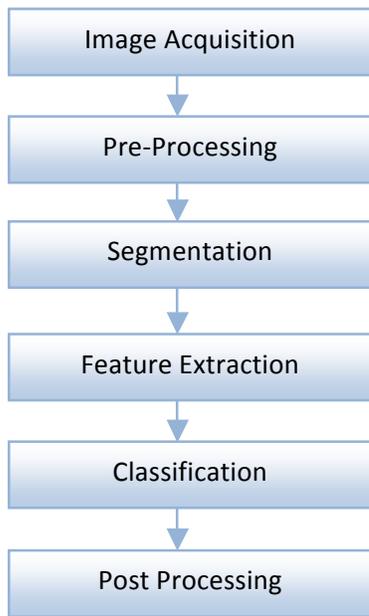


Figure 1. Basic steps involved in Numeric recognition system.

II. SYSTEM MODEL

An artificial neural system (ANN), likewise called a neural system, is a generally utilized numerical model made out of an interconnected gathering of straightforward neurons that additionally called hubs, hypochondrias, handling components or units, are associated together to shape a system with emulating an organic neural system.

Simulated neural system (ANN) utilizes a connectionist way to deal with calculation in preparing data, and is utilized with calculations intended to change the quality of the associations in the system to yield a sought sign stream. As a rule, a counterfeit neural system can be seen as a versatile framework that changes its auxiliary weights amid a learning step. neural system is broadly used to model complex connections between its inputs and yields, and complex worldwide conduct can be controlled by the associations between its handling components and component parameters in the system. Since its renaissance in mid 1980s, counterfeit neural systems (ANN) research has gotten a lot of consideration from the science and innovation hovers over the world [1]. As of not long ago, other than so much consideration has been given ANN, it has additionally been accounted for genuinely great exhibitions for its nonlinear learning capacity [2]. On the other hand, to decide number of neurons in shrouded layers is an essential piece of choosing general neural system structural planning for some commonsense issues utilizing neural systems [6].

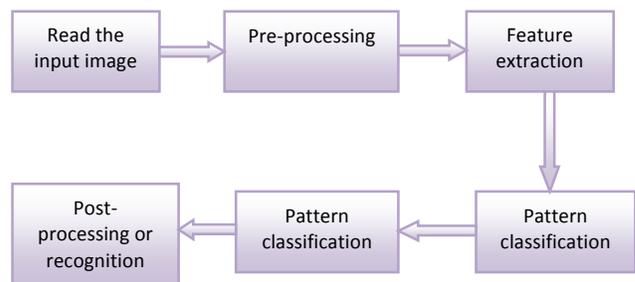


Figure 2. Components of the Numeric recognition system.

However, the most effective method to decide its structure particularly of the shrouded layer is a baffling issue.

Numerous systems [6] for deciding the suitable number of neurons to use in the concealed layers are presented with changed degrees of achievement, for example, a technique for evaluating the quantity of shrouded neurons in light of choice tree calculation in [5], a system structure mathematical statement by mistake capacity in [1], and one concealed layer train calculation technique on vitality space drawing closer methodology in [2], and a calculation utilizing an incremental preparing strategy as a part of [5], and a few rules taking into account a geometrical understanding of the multilayer perceptron (MLP) for selecting the structural planning of the MLP in [6], and utilizing the particular vector disintegration to gauge the quantity of concealed neurons in a food forward neural system in [7], and some general guideline strategies in Among the proposed answers for this issue, some either concentrate on the unique preparing techniques that needs a lot of operations and awkward for building relevance, or dependable guideline routines that shy of all inclusive statement.

In the understood issue of the length of British coastline, the creator of the paper Mandelbrot talked about the examination distributed by Richardson. Richardson had watched and found the well known recipe as takes after:

$$L(r) \approx Kr^{-1/D_f} \quad (1)$$

Deep meaning for the exponent  $D_f$  was not specified by Richardson. In the paper of, Mandelbrot discussed self-similar curves, which have fractional dimensions between 1 and 2. This introduced concept provides a new vision for describing many objects around us that have structure on many sizes, whose normal examples include coastlines, plant distributions and rivers, architecture, etc. By taking logarithm to Eq.(1) and making necessary mathematical operations, we get,

$$D_f = \log(L(r)) / \log(1/r) \quad (2)$$

Simply speaking, fractals are statistically selfsimilar. Where, self-similar means that fractals may be exactly the same measured at various scales. Inspired, we present a fractal-based solution for determining number of neurons in the hidden layers of ANN in the following section.



Figure 3 Simplified topological structure of neural networks.

### III. LITERATURE REVIEW

In the year of 2013 Yang Zong-chang., [1] In this study, to the main problem of establishing structure for the Artificial Neural Networks (ANN), from a microscopical perspective, two ideas called the fractal measurement of association multifaceted nature (FDCC) and the fractal measurement of the desire many-sided quality (FDEC) are presented. At that point a paradigm reference for setting up ANN structure taking into account the two proposed ideas is displayed that, the FDCC won't not be lower than its (FDEC), and when FDCC is equivalent or surmised to FDEC, the ANN structure may be an ideal one. The proposed measure is inspected with great results.

In the year of 2013 Selvi, P.P.; Meyyappan, T., [2] In the Study of the authors propose a method to recognize Arabic numerals using back propagation neural system. Arabic digit are the ten digits that were descended from the Indian numeral system. The recognition phase recognizes the numerals precisely. The prospect technique is implemented with Matlab coding. Model andwritten descriptions are tested with the proposed method and the results are plotted.

In the year of 2013 Sahu, N.; Raman, N.K., [3] In the Study of Character recognition systems for various languages and script has gain importance in recent decades and is the area of deep interest for a lot of researchers. Their growth is strongly intergerated with Neural Networks.

In the year of 2012 Nguang Sing Ping; Yusoff, M.A., [4] Investigated on describes the application of 13-point feature of skeleton for an image-to-character credit. The representation can be a scanned handwritten character or drawn character from any graphic designing tool like Windows Paint clash. The representation is processed through conventional and 13-point feature of skeleton methods to extract the raw data.

In the year of 2012 Pradeep, J.; Srinivasan, E.; Himavathi, S., [5] In the Study of, an off-line handwritten English character recognition system using hybrid feature extraction technique and neural network classifiers are proposed. Neural Network (NN) topologies, namely, rear spread neural network and radial basis function network are built to classify the font. The k-nearest neighbour network is also built for evaluation. The nosh onward NN topology exhibits the highest recognition accuracy and is identified to be the most suitable classifier.

In the year of 2011 Budiwati, S.D.; Haryatno, J.; Dharma, E.M., [6] Investigated on Japanese language has complex writing systems, Kanji and Kana (Katakana and Hiragana). Each one has different style of writing. One simple way to differentiate is Kanji have more strokes than Kana. Meanwhile, it needs a lot of effort to remember characters of Katakana and Hiragana, thus it will be very difficult to distinguish handwritten Katakana and Hiragana, since there are a lot of similar characters. This is the reason why we need pattern recognition.

#### IV. CONCLUSION

This paper describes the various steps involved in the character recognition network. It also reviews various character recognition network like online and offline recognition function. It is describes the various applications of the character recognition function. Last section reviews the various classifiers that can be used for character recognition.

Artificial neural network is a well-known intelligence field that composed of an interconnected group of simple artificial neurons computational model, tries to simulate some properties of biological neural networks with the aim of a wide variety of fields. In the artificial solving particular tasks, artificial neural networks have been applied successfully. However, how to determine the number of neurons in hidden layers is a very important part of deciding overall neural network architecture for many neural networks practical problems employing.

#### REFERENCES

1. Yang Zong-chang (2005 – 2013) Establishing Structure For Artificial Neuralnetworks Based-On Fractal Journal of Theoretical and Applied Information Technology 10th March 2013. Vol. 49 No.1 © JATIT & LLS.
2. Selvi, P.P.; Meyyappan, T., (21-22 Feb. 2013) Recognition of Arabic numerals with grouping and ungrouping using back propagation neural network, Pattern Recognition, Informatics and Mobile Engineering (PRIME), 2013 International Conference on , vol., no., pp.322, 327.
3. Sahu, N.; Raman, N.K., (22-23 March 2013) An efficient handwritten Devnagari character recognition system using neural network, Automation, Computing, Communication, Control and Compressed Sensing (iMac4s), 2013 International Multi-Conference on , vol., no., pp.173,177.
4. Nguang Sing Ping; Yusoff, M.A., (12-14 June 2012) Application of 13-point feature of skeleton to neural networks-based character recognition, Computer & Information Science (ICCIS), 2012 International Conference on, vol.1, no., pp. 447, 452.

- Pradeep, J.; Srinivasan, E.; Himavathi, S., (Oct. 30 2012-Nov. 2 2012.) Performance analysis of hybrid feature extraction technique for recognizing English handwritten characters, Information and Communication Technologies (WICT), 2012 World Congress on , vol., no., pp.373,377.
5. Budiwati, S.D.; Haryatno, J.; Dharma, E.M., (17-19 July 2011) Japanese character (Kana) pattern recognition application using neural network, Electrical Engineering and Informatics (ICEEI), 2011 International Conference on , vol., no., pp.1,6 17-19.