LITERATURE SURVEY ON HAND WRITTEN DIGIT RECOGNITION

S.NO	ISSN No.	TITLE	BASE PAPER LINK	AUTHOR NAME	CONTENT
1.	2393-8374	A novel method for handwritten digit recognition	http://troindia.in/journal/ijcesr/vol6iss6part2/32-36.pdf	Rohini.M , Dr.D.Surendran	Handwritten digit recognition has recently been of very interest among the researchers because of the evolution of various Machine Learning, Deep Learning and Computer Vision algorithms. In this report, We compare the results of some of the most widely used Machine Learning Algorithms like CNN- convolution neural networks and with Deep Learning algorithm like multilayer CNN using Keras with Theano and Tensorflow. MNIST is a dataset which is widely used for handwritten digit recognition. The dataset consist of 60,000 training images and 10,000 test images.The artificial neural neworks can all most mimic the human brain and are a key ingredient in image processing field.For example Convolution Neural networks with back propagation for image processing.The applications where these handwritten digit recognition can be used are Banking sector where it can be used to maintain the security pin numbers, it can be also used for blind peoples by using sound output.
2.	0975-4350	Handwritten Digit Recognition Using Machine Learning Algorithms	https://www.researchgate.net/publication/326408524_Handwritten_Digit_Recognition_Using_Machine_Learning_Algorithms	**S. M. Shamim**, **Md Badrul Alam Miah**, **Angona Sarker**, **Masud Rana,** **Abdullah Al Jobair**	Handwritten character recognition is one of the practically important issues in pattern recognition applications. The applications of digit recognition includes in postal mail sorting, bank check processing, form data entry, etc. The heart of the problem lies within the ability to develop an efficient algorithm that can recognize hand written digits and which is submitted by users by

					the way of a scanner, tablet, and other digital devices. This paper presents an approach to off-line handwritten digit recognition based on different machine learning technique. The main objective of this paper is to ensure effective and reliable approaches for recognition of handwritten digits. Several machines learning algorithm namely, Multilayer Perceptron, Support Vector Machine, Naïve Bayes, Bayes Net, Random Forest, J48 and Random Tree has been used for the recognition of digits using WEKA.
3	2456-2165	**Handwritten Digit Recognition using CNN**	IJISRT19JU358.pdf		Digit Recognition is a noteworthy and important issue. As the manually written digits are not of a similar size, thickness, position and direction, in this manner, various difficulties must be considered to determine the issue of handwritten digit recognition. The uniqueness and assortment in the composition styles of various individuals additionally influence the example and presence of the digits. It is the strategy for perceiving and arranging transcribed digits. It has a wide range of applications, for example, programmed bank checks, postal locations and tax documents and so on. The aim of this project is to implement a classificatio n algorithm to recognize the handwritten digits. The after effects of probably the most broadly utilized Machine Learning Algorithms like SVM, KNN and RFC and with Deep Learning calculation like multilayer CNN utilizing Keras with Theano and Tensorflow. Utilizing these, the accuracy of 98.70% utilizing CNN (Keras + Theano) when contrasted with 97.91% utilizing SVM, 96.67%

					utilizing KNN, 96.89% utilizing RFC was obtained
4		**A Survey on using Neural Network based Algorithms for Hand Written Digit Recognition**		**Muhammad Ramzan, Shahid Mehmood Awan**	The detection and recognition of handwritten content is the process of converting non-intelligent information such as images into machine edit-able text. This research domain has become an active research area due to vast applications in a number of fields such as handwritten filing of forms or documents in banks, exam form filled by students, users' authentication applications. Generally, the handwritten content recognition process consists of four steps: data preprocessing, segmentation, the feature extraction and selection, application of supervised learning algorithms. In this paper, a detailed survey of existing techniques used for Hand Written Digit Recognition(HWDR) is carried out. This review is novel as it is focused on HWDR and also it only discusses the application of Neural Network (NN) and its modified algorithms. We discuss an overview of NN and different algorithms which have been adopted from NN. In addition, this research study presents a detailed survey of the use of NN and its variants for digit recognition. Each existing work, we elaborate its steps, novelty, use of dataset and advantages and limitations as well. Moreover, we present a Scientometric analysis of HWDR which presents top journals and sources of research content in this research domain. We also present research challenges and potential future work.
5		**A Novel Handwritten Digit Classification System**	http://dx.doi.org/10.3390/s21186273	**Ali Abdullah Yahya**	An enormous number of CNN classification algorithms have been proposed in the literature. Nevertheless, in these algorithms, appropriate filter size selection,

		Based on Convolution al Neural Network Approach			data preparation, limitations in datasets, and noise have not been taken into consideration. As a consequence, most of the algorithms have failed to make a noticeable improvement in classification accuracy. To address the shortcomings of these algorithms, our paper presents the following contributions: Firstly, after taking the domain knowledge into consideration, the size of the effective receptive field (ERF) is calculated. Calculating the size of the ERF helps us to select a typical filter size which leads to enhancing the classification accuracy of our CNN. Secondly, unnecessary data leads to misleading results and this, in turn, negatively affects classification accuracy. To guarantee the dataset is free from any redundant or irrelevant variables to the target variable, data preparation is applied before implementing the data classification mission. Thirdly, to decrease the errors of training and validation, and avoid the limitation of datasets, data augmentation has been proposed. Fourthly, to simulate the real-world natural influences that can affect image quality, we propose to add an additive white Gaussian noise with $\sigma = 0.5$ to the MNIST dataset. As a result, our CNN algorithm achieves state-of-the-art results in handwritten digit recognition, with a recognition accuracy of 99.98%, and 99.40% with 50% noise.
6	0975-9646	**A novel method for Handwritte n Digit Recognition with Neural Networks**	https://www.google.com/url?sa=t&source=web&rct=j&url=http://ijcsit.com/docs/Volume%25202/vol2issue4/ijcsit2011020463.pdf&ved=2ahUKEwjvuYCuvIr6AhWPTGwGHa-9C-QQFnoECBEQAQ&usg=A	**MALOTHU NAGU*1, N VIJAY SHANKAR# 2,K.ANNAPUR NA**	Character recognition plays an important role in the modern world. It can solve more complex problems and makes humans' job easier. An example is handwritten character recognition. This is a system widely used in the world to recognize zip code or postal code

					for mail sorting. There are different techniques that can be used to recognize handwritten characters. Two techniques researched in this paper are Pattern Recognition and Artificial Neural Network (ANN). Both techniques are defined and different methods for each technique is also discussed. Bayesian Decision theory, Nearest Neighbor rule, and Linear Classification or Discrimination is types of methods for Pattern Recognition. Shape recognition, Chinese Character and Handwritten Digit recognition uses Neural Network to recognize them. Neural Network is used to train and identify written digits. After training and testing, the accuracy rate reached 99%.This accuracy rate is very high.
7		**Handwritten Digit Recognition Using Image Processing and Neural Networks**		**Faisal Tehseen Shah**	This working prototype system can detect handwritten digits from a scanned image of an input form by using Neural network technique. Hand writing recognition and Image detection through this methodology is very fast and effective as compared to old fashioned image pixel comparison methodology, which is comparably slow. In the initial phase for handwritten digit input we have designed a form which can take hand writing samples from different people. The form must have specific format so user can give multiple input in 10 rows, and hand write 0,1,2,3,4,5,6,7,8,9 in the corresponding sampling cells (rows* columns). The cell must also have width according to your requirement (e.g set it to 20*2 pixels). Once the blank forms have been manually filled by different people then scan these forms with the help of scanner. So now we have images of hand writing samples of digits. In the

					2nd phase, we use image slicing technique to slice sample image of size 16*16 pixel for each digit from the scanned form [1]. Each scanned form image will make nearly 100 images of 16*16 pixels. Repeat the same step for all scanned sample forms and place all these 16*16 pixel images (sample pool) into one location. In the detection phase, a three-layered neural network is used: After training, the obtained weight and bias are stored for each digit sequence(signature). It is now possible to identify the meaning of any hand written digit with the help of AI engine. So now when ever any handwritten digit will be given as sample input in to the system , the output array will automatically give the digit whose corresponding match value is detected. The above process is a blueprint of human cognitive thinking process. Index Terms— Neural Network, Hand Written, Recognition, Neurons, Training,
8		**Multi-Language Handwritte n Digits Recognition based on Novel Structural Features**	https://www.google.com /url?sa=t&source=web&r ct=j&url=https://library.i maging.org/admin/apis/p ublic/api/ist/website/do wnloadArticle/jist/63/2/a rt00004&ved=2ahUKEwj 02pvSvYr6AhVVFbcAHWi rCxs4FBAWegQICxAB&us g=AOvVaw3QynwJXDON 6433Ky_5LnTI	**Jaafar M. Alghazo, Ghazanfar Latif**	Automated handwritten script recognition is an important task for several applications. In this article, a multi-language handwritten numeral recognition system is proposed using novel structural features. A total of 65 local structural features are extracted and several classifiers are used for testing numeral recognition. Random Forest was found to achieve the best results with an average recognition of 96.73%. The proposed method is tested on six different popular languages, including Arabic Western, Arabic Eastern, Persian, Urdu, Devanagari, and Bangla. In recent studies, single language digits or multiple languages with digits that resemble each other are targeted. In this study, the digits in the languages chosen do

| | | | | | not resemble each other. Yet using the novel feature extraction method a high recognition accuracy rate is achieved. Experiments are performed on well-known available datasets of each language. A dataset for Urdu language is also developed in this study and introduced as PMU-UD. Results indicate that the proposed method gives high recognition accuracy as compared to other methods. Low error rates and low confusion rates were also observed using the novel method proposed in this study. c 2019 Society for Imaging Science and Technology. |