S.NO	TITLE	JOURNAL	AUTHOR	CHALLENGES/FUTURE SCOPE
1	Comparison of learning algorithms for Handwritten digit recognition.	International Conference on Artificial neural networks -1995	Y. LeCun, L. Jackel, L. Bottou, A. Brunot.	This paper compares the performance of several classier algorithms on a standard database of handwritten digits. We consider not only raw accuracy, but also rejection, training time, recognition time, and memory requirements.
2	Learning algorithms for classification: A Comparison on Handwritten digit recognition.	Neural networks: The statistical mechanics perspective - 1995	Corinna Cortes, John S. Denker, Harris Drucker, Isabelle Guyon.	This paper compares the performance of several classier algorithms on a standard database of handwritten digits. We consider not only raw accuracy, but also training time, recognition time, and memory requirements. When available, we report measurements of the fraction of patterns that must be rejected so that the remaining patterns have misclassication rates less than a given threshold.
3	Handwritten digit recognition : Application of neural network chips and automatic learning.	IEEE Communication Magazine - 1989	L.D.Jackel,B.Boser, J.S.Denker.	Two novel methods for achieving handwritten digit recognition are described. The first method is based on a neural network chip that performs line thinning and feature extraction using local template matching. The second method is implemented on a digital signal processor and makes extensive use of constrained automatic learning. Experimental results obtained using isolated handwritten digits taken from postal zip codes, a rather difficult

				data set, are reported and discussed.
4	Improved Handwritten digit recognition using convolutional neural networks.	Sensors -2020	Savita Ahlawat,Amit Choudhary.	Traditional systems of handwriting recognition have relied on handcrafted features and a large amount of prior knowledge. Training an Optical character recognition (OCR) system based on these prerequisites is a challenging task. Research in the handwriting recognition field is focused around deep learning techniques and has achieved breakthrough performance in the last few years. Still, the rapid growth in the amount of handwritten data and the availability of massive processing power demands improvement in recognition accuracy and deserves further investigation. Convolutional neural networks (CNNs) are very effective in perceiving the structure of handwritten characters/words in ways that help in automatic extraction of distinct features and make CNN the most suitable approach for solving handwriting recognition problems. Our aim in the proposed work is to explore the various design options like number of layers, stride size, receptive field, kernel size, padding and dilution for CNN-based

				handwritten digit recognition. In addition, we aim to evaluate various SGD optimization algorithms in improving the performance of handwritten digit recognition. A network's recognition accuracy increases by incorporating ensemble architecture. Here, our objective is to achieve comparable accuracy by using a pure CNN architecture without ensemble architecture, as ensemble architectures introduce increased computational cost and high testing complexity. Thus, a CNN architecture is proposed in order to achieve accuracy even better than that of ensemble architectures, along with reduced operational complexity and cost. Moreover, we also present an appropriate combination of learning parameters in designing a CNN that leads us to reach a new absolute record in classifying MNIST handwritten digits. We carried out extensive experiments and achieved a recognition accuracy of 99.87% for a MNIST dataset.
5	Handwritten digit recognition using Conolutional	International Journal of Innovative Reasearch in Computer and	Haider A Alwzwazy,Hayder M Albehadili.	Recently handwritten digit recognition becomes vital scope and it is appealing many researchers because of its

	Neural Networks.	Communication Engineering.		using in variety of machine learning and computer vision applications. However, there are deficient works accomplished on Arabic pattern digits because Arabic digits are more challenging than English patterns. Hence, the lacking research of using Arabic digits endeavours us to dig deeper by creating our challenge Arabic Handwritten Digits which consists of more than 45,000 samples. As a challenging dataset is used for evaluation, a robust deep convolutional neural network is used for classification and superior results are achieved.
6	Handwritten digit recognition using machine learning algorithms.	Global Journal of Computer Science and Technology.	SM Shamim,Mohammad Badrul Alam Miah.	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.
7	Automatic feature generation for Handwritten digit recognition.	IEEE Transaction on Pattern Analysis and Machine Intelligence - 1996.	Paul D Gader, Mohammed A,Khabou.	An automatic feature generation method for handwritten digit recognition is described. Two different evaluation measures, orthogonality and information, are used to guide the search for features. The features are used in a backpropagation trained neural network. Classification rates compare favorably with results published in a survey of high-performance handwritten digit recognition systems. This classifier is combined with several other high performance classifiers. Recognition rates of around 98% are obtained using two classifiers on a test set with 1000 digits per class.
8	Handwritten digits recognition	International Journal of Electrical and	Tsehay Admassu Assegie,Pramod Sekharan Nair.	Handwritten digits recognition is an area of machine learning, in

	with decision tree classification : a machine learning approach.	Computer Engineering - 2019.		which a machine is trained to identify handwritten digits. One method of achieving this is with decision tree classification model. A decision tree classification is a machine learning approach that uses the predefined labels from the past known sets to determine or predict the classes of the future data sets where the class labels are unknown. In this paper we have used the standard kaggle digits dataset for recognition of handwritten digits using a decision tree classification approach. And we have evaluated the accuracy of the model against each digit from 0 to 9.
9	Digits – a dataset for Handwritten digit recognition.	Austrian Reasearch Institute for Artificial Intelligence Technical Report -2005	Alexander K Seewald.	In this paper we describe the preprocessing steps for a contributed digit dataset, going all the way from a physical page of paper – filled out by students – past digital scanning to computerized segmentation, resizing, and blurring. Surprisingly, very little expertise can be transferred from other datasets to our new dataset for a state-of-the-art SVM classifier, although the performance for each separate dataset is acceptable. This may indicate that at least SVM, and possibly also other learners, are sensitive to small changes in preprocessing,

				emphasizing the need not only to create benchmark datasets for handwritten digit recognition, but also to document their preprocessing as detailed as possible and aim to replicate that as well. Our work is a small step in that direction.
10	Cloud bades efficient scheme for Handwritten digit recognition.	Multimedia Tools and Applications - 2020.	Zeeshan Shaukat,Saqib Ali,Allah Ditta.	Handwritten character recognition has been acknowledged and achieved more prominent attention in pattern recognition research community due to enormous applications & vagueness in application methods, while cloud computing delivers appropriate, on-demand access of network to a joint tarn of configurable computing resource & digital devices. Principally two steps, feature extraction & character recognition, are required for Handwritten Digit Recognition (HDR), which are primarily based on some classification algorithms. Previous studies show the nonexistence of higher precision and truncated computational swiftness for HDR procedure. “The projected research aimed to make the trail towards digitalization clearer by providing high accuracy and faster cloud-based computational for handwritten digits

				recognition. The current study utilized a cloud-based neural network (CNN) as a classifier, suitable parameters of dataset MNIST for testing and training purposes as a framework called DL4J for cloud-based handwritten digit recognition. The said system magnificently managed to obtained precision up to 99.41%, which is higher than previously projected systems. Additionally, the proposed method decreases cost and computational time significantly as using cloud-based architecture for testing and training; as a result, the algorithm becomes more efficient.