

LITERATURE SURVEY ON HANDWRITTEN DIGIT RECOGNITION

s.no	Paper name	Authors	techniques/methodology	limitations
1	Handwritten Digit Recognition Based on Convolutional Neural Network - 2020, <i>IEEE International journal of research in computer science</i>	jinze Li et al	This paper designs a handwritten digit recognition system based on convolutional neural network. The system adopts the method of deep learning and uses the MNIST data set as a training sample. After the training is completed, the handwritten digits in the picture can be recognized through the Softmax regression model. The training and recognition process of this system is completed by LeNet-5 based convolutional neural network repeated convolution operation and pooling operation.	The design in this project also has the problem of too long recognition time. How to improve the recognition accuracy and reduce the recognition delay is still an important issue today.
2	Handwritten Digit Recognition System - 2021 <i>International Journal of Scientific Research</i>	Shubham Mendapara, Krish Pabani, Yash Paneliya	In this project, the Handwritten Digit Recognition using Deep learning methods has been implemented. The most widely used Machine learning algorithms CNN has been trained and tested on the MNIST dataset. With extensive testing using the MNIST data, the current function suggests the role of various hyper parameters.	Accuracy is very low. It can be improved by various algorithms.
3	Offline Handwritten Digits Recognition	Lee J.Wells Shengfeng Chen Rabia Emhamd Ai Mamiook Yuwen	The main objective of this paper is to provide efficient and reliable techniques for recognition	The overall highest accuracy 96.8% is achieved in the recognition process by

	<p>Using Machine learning</p> <p><i>Proceedings of the International Journal on Industrial Engineering and Operations Management Washington DC, USA, September 27-29, 2018 .At: Washington DC, USA.</i></p>		<p>of handwritten numerals by comparing various existing classification models. This paper compares the performance of five machine learning classifier models namely Neural Network, K-Nearest Neighbor (K-NN), Random Forest, Decision Tree and Bagging with gradient boost. Results indicate that K-NN classifier outperform Neural Network with significant improved computational efficiency without sacrificing performance. The result of this paper shows that K-NN has equally high accuracy of 96.7% compared to Neural Network of 96.8%, but K-NN achieves a processing speed with almost 10 times faster.</p>	<p>Neural Network with the sacrifice of significantly extended runtime. This work is carried out as an initial attempt, and the aim of the paper is to facilitate for recognition of handwritten numeral without using any standard classification techniques. Image processing techniques Median filter, binary, Bweuler, and sharpening improve image quality, but we should be</p>
4	<p>Handwritten English Character Recognition using Multilayer Perceptron Neural Network</p> <p><i>2017 International Journal of Advance Research and Innovative Ideas in Education(IJARIIE) Vol-3 Issue-3</i></p>	Ms. Harita Dave , A/Prof. Mitesh Patel	<p>A handwritten character recognition system is presented in which first of all the original image is converted into grayscale image. After that pre-processing steps are applied on that grayscale image. Then individual characters are split from words using segmentation. Features are extracted for those characters and multilayer perceptron classifier is used for classification. At last the handwritten character is recognized</p>	<p>-Segmentation is complicated</p> <p>-Works for small amount of data</p>

			and converted into machine printable form. The result shows that the back propagation network provides good recognition accuracy of more than 70% of handwritten English characters.	
5	<p>Handwritten Tamil Recognition using a Convolutional Neural Network</p> <p><i>2018 International Journal on Information, Communication, Engineering and Technology (ICICET)</i></p>	Prashanth Vijayaraghavan, Misha Sra	<p>The characters in Tamil, a south Indian language using convolutional neural networks, are classified into 35 different classes. The system is developed using stochastic pooling, probabilistic weighted pooling, and local contrast normalization to establish a new state-of-the art of 94.4% accuracy with the IWFHR-10 dataset. Various pooling and normalization techniques were used to improve the performance.</p>	<p>-Trouble saving large amounts of data</p> <p>-Network's performance degrades if a single convolutional layer is removed and does not improve much with the addition of another convolutional + pooling layer pair</p>

6	<p>Devanagari offline handwritten numeral and character recognition using multiple features and neural network classifier.</p> <p><i>2nd International Journal on Computing for Sustainable Global Development (INDIACom), 2015</i> At: New Delhi India</p>	Vikas Jairam Dongre Vijay H Mankar	<p>This paper presents an attempt to solve the challenging problem of Devanagari numeral and character recognition. It uses structural and geometric features to represent the Devanagari numerals and characters. Devanagari alphabetic characters are used for training and testing. Experimental results show 93.17% recognition accuracy using 40 hidden neurons for numerals and 82.7% recognition accuracy using 60 hidden neurons for characters. Fivefold cross validation is used for verifying the results.</p>	<p>In this work, only basic isolated Devanagari characters are considered. In actual usage, maximum characters have connectivity with vowels or other consonants, making them conjuncts and compound characters. Recognition of conjuncts and compound characters is the next challenge in which the research is needed.</p>
7	<p>Deep Convolutional Self-Organizing Map Network for Robust Handwritten Digit Recognition</p>	Saleh Aly Sultan Almotairi	<p>The proposed DCSOM network achieves comparable results with other state-of-the-art methods while it achieves best performance on handwritten digits datasets contaminated with random and image background noise. Thus, DCSOM network can efficiently eliminate the effect of noise in the input image through its competitive learning algorithm and feature index image bank representation. However, other sever</p>	<p>The existence of random Noise may cause a Several problem in the recognition accuracy.</p>

			geometric variability like rotation can not be efficiently tackled with this architecture.	
8	Handwritten Character Recognition using Neural Network and TensorFlow	Megha Agarwal, Shalika, Vinam Tomar, Priyanka Gupta	In this paper, the offline handwritten character recognition will be done using Convolutional neural network and Tensorflow. A method called Soft Max Regression is used for assigning the probabilities to handwritten characters being one of the several characters as it gives the values between 0 and 1 summing up to 1. The purpose is to develop the software with a very high accuracy rate and with minimal time and space complexity and also optimal.	In Preprocessing works to normalize the strokes and remove variations that reduce the rate of accuracy