

# LITERATURE SURVEY

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## A Novel Method for Handwritten Digit Recognition System

### INTRODUCTION

Handwriting recognition is one of the compelling research works going on because every individual in this world has their own style of writing. It is the capability of the computer to identify and understand handwritten digits or characters automatically. Because of the progress in the field of science and technology, everything is being digitalized to reduce human effort. Hence, there comes a need for handwritten digit recognition in many real-time applications. MNIST data set is widely used for this recognition process, and it has 70000 handwritten digits. We use Artificial neural networks to train these images and build a deep learning model. Web application is created where the user can upload an image of a handwritten digit. this image is analyzed by the model and the detected result is returned on to UI.

### NEURAL NETWORK

A neural network that consists of more than three layers—which would be inclusive of the inputs and the output—can be considered a deep learning algorithm. Different types of Neural Networks in DL: Artificial Neural network (ANN) Convolution Neural network (CNN) Recurrent Neural Network (RNN).

#### Convolution Neural Network

Here we will be using Convolution neural Network concept as this concept is widely used in image and video processing projects. We'll break down the images into small patches and feed them to a CNN and train the model. CNN captures the spatial features from an image. They help us identifying the object accurately, the location of an object, as well as its relation, with other objects in an image.

### EXISTING SOLUTIONS

S. No	TITLE	BASE PAPER LINK	AUTHOR NAME	CONTENT
1.	<b>A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION USING DEEP LEARNING</b>	<a href="http://troindia.in/journal/ijcesr/vol6iss6part2/32-36.pdf">http://troindia.in/journal/ijcesr/vol6iss6part2/32-36.pdf</a>	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 consists of 60,000 training images and 10,000 test images. The artificial neural networks can all most mimic the human brain and are a key ingredient in image processing field.
2.	<b>A Literature Survey on Handwritten Character Recognition</b>	<a href="http://ijcsit.com/docs/Volume%207/vol7issue1/ijcsit2016070101.pdf">http://ijcsit.com/docs/Volume%207/vol7issue1/ijcsit2016070101.pdf</a>	Ayush Purohit, Shardul Singh Chauhan	Handwriting recognition has gained a lot of attention in the field of pattern recognition and machine learning due to its application in various fields. Optical Character Recognition (OCR) and Handwritten Character Recognition (HCR) has specific domain to apply. Various techniques have been proposed to for character recognition in handwriting recognition system. Even though, sufficient studies and papers describes the techniques for converting textual content from a paper document into machine readable form. In coming days, character recognition system might serve as a key factor to create a paperless environment by digitizing and processing existing paper documents. This paper presents a detailed review in the field of Handwritten Character Recognition
3.	<b>A novel method for Handwritten Digit Recognition with Neural Networks</b>	<a href="https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.228.158&amp;rep=rep1&amp;type=pdf">https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.228.158&amp;rep=rep1&amp;type=pdf</a>	MALOTHU NAGU, N VIJAY SHANKAR, K. ANNAPURNA	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.
4.	<b>REVIEW ON HANDWRITTEN</b>	<a href="https://www.ijnrd.org/papers/IJNRD1704024.pdf">https://www.ijnrd.org/papers/IJNRD1704024.pdf</a>	PRIYA, RAJENDRA SINGH, DR.	Handwritten Digit Recognition System involves reception and interpretation of handwritten digits by a machine. Due to

	<b>DIGIT RECOGNITION</b>		SONI CHANGLANI	<p>variation in shape and orientation of handwritten digits, it is difficult for a machine to interpret handwritten digits. Handwritten digit Recognition has a wide area of research due to its vast applications like automatic bank cheques processing, billing and automatic postal service. In this thesis, an Offline Handwritten Digit Recognition System is presented. The recognition system is broadly divided into 2 parts, first part is feature extraction from handwritten images and the second one is classification of feature vector into digits. We propose descriptors for handwritten digit recognition based on Histogram of Oriented Gradient (HOG) feature. It is one of the widely used feature vector for object detection in computer vision. For classification of features, linear Proximal Support Vector Machine Classifier is proposed. This is a binary class classifier which is further converted to a 10-class classifier by means of One against all algorithms. Due to small training time, PSVM classifier is preferable over standard Support Vector Machine (SVM) Classifier. The handwritten images both for training and testing are taken from MNIST database. The performance of the system is measured in terms of Sensitivity, Accuracy, Positive Predictively and Specificity</p>
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