A Novel Method for Handwritten Digit Recognition System

Introduction

Handwritten digit Recognition has a wide area of research due to its vast applications like automatic bank cheques processing, billing and automatic postal service.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 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 analysed by the model and the detected result is returned on to the UI. Feature extraction is the process of gathering data of different samples so that on the basis of this data we can classify samples with different features. Feature extraction from preprocessed handwritten characters plays the most important role in character recognition. 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.

Keyword: Handwritten digit recognition ,Feature extraction, MNIST database.

Objectives:

1. To create a model that could predict the handwritten digits in a more accurate way.
2. To ensure an effective and reliable approach for recognition of handwritten digits and make banking operations easier and error free.

Literature Survey:

S.NO	Author name	Paper Title	Journal/Conference title	Page No/ Volume No	Year of publication	Description
1	Ayush Purohit, Shardul Singh Chauhan	A Literature Survey on Handwritten Character Recognition	International Journal of Computer Science and Information Technologies	Vol. 7 (1)	2016, 1-5	Optical Character Recognition (OCR) and Handwritten Character Recognition (HCR) have specific domains to apply. Various techniques have been proposed for character recognition in the handwriting recognition system. Even though sufficient studies and papers describe the techniques for converting textual content from a paper document into machine readable form.
2	Jinze Li, Gongbo Sun, Leiye Yi, Qian Cao, Fusen	Handwritten Digit Recognition System Based on Convoluti	IEEE International Conference on Advances in Electrical		2020	This paper mainly introduces an offline recognition system for handwritten digits based on

	Liang, Yu Sun.	onal Neural Network	Engineering and Computer Applications (AEECA)			convolutional neural networks. The system uses the MNIST dataset as a training sample and pre-processes the picture with the Opencv toolkit. Then it uses LeNet-5 in the convolutional neural network to extract the handwritten digit image features, repeatedly convolution pooling, and pull the result into a one-dimensional vector. And finally find the highest probability point to determine the result to achieve handwritten digit recognition with the Softmax regression model.
3	Anuran Chakrabo rty, Rajonya De, Samir Malakar, Friedhel m Schwenk er and Ram	Handwritt en Digit String Recogniti on using Deep Autoenco der based Segmenta tion and ResNet based	25th Internationa l Conference on Pattern Recognition (ICPR)		2021	This paper uses a deep autoencoder based segmentation technique for isolating the digits from a handwritten digit string, and then we pass the isolated digits to

	Sarkar	Recognition Approach				a Residual Network (ResNet) based recognition model to obtain the machine-encoded digit string. The proposed model has been evaluated on the Computer Vision Lab (CVL) Handwritten Digit Strings (HDS) database, used in HDSRC 2013 competition on handwritten digit string recognition, and a competent result with respect to state-of-the-art techniques has been achieved.
4	Mayank Jain,Gagandeep Kaur,Muhammad Parvez Quamar, Harshit Gupta	Handwritten Digit Recognition Using CNN	2021 International Conference on Innovative Practices in Technology and Management (ICIPTM)		2021	Handwritten digit recognition can be performed using the Convolutional neural network from Machine Learning. Using the MNIST (Modified National Institute of Standards and Technologies) database and compiling with the CNN gives the basic structure of my

						project development. MNIST data contains about 70,000 images of handwritten digits from 0-9. So, it is a class 10 classification model. This dataset is divided into 2 parts i.e. Training and Test dataset. Image representation as 28*28 matrix where each cell contains grayscale pixel value.
5	Huimin Xiao, Chen Liu	Handwriting Digit Recognition Based on Extension Engineering	Chinese Control and Decision Conference.		2009	The complicated training algorithm is needed in the traditional handwritten digits recognition, the complexity of the algorithm is very high, and the extensibility to huge databases is small. In this paper, the handwriting digit is recognized by means of extension engineering. The classical domains and the extensional domains of handwriting digit character are constructed. The

						integrated correlative degrees of the measuring digits and 10 basic digits are calculated and handwriting digits are classified and recognized. According to the calculated correlative degrees and the recognized results, extension engineering is an effective method to handwriting digit recognition.