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Handwritten Digit Recognition Using Machine Learning

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- **ABSTRACT**:-

  ➤ Handwritten character recognition is one of the practically important issue in pattern recognition application.

  ➤ The application of digit recognition includes in postal mail sorting, bank check processing, from data entry, etc.

  ➤ The heart of problem lies within the ability to develop an efficient algorithm that can recognize hand written digit & which is submitted by users by the way of a scanner, tablet, & other digital devices.

- ## KEYWORDS:-

Pattern recognitions, handwritten recognition, digit recognition, machine learning, WEKA, offline handwritten recognition, machine learning algorithm, neural network, classification algorithm.

- ## INTRODUCTION:-

Handwritten digits recognition is a well-researched subarea within the field that is concerned with learning models to distinguish pre-segmented handwritten digits.

1. The main application of machine learning method over the last decade has determined efficacious in conforming decisive systems which are competing to human performance & which accomplish far improved than manually written classical artificial intelligence systems used in the beginnings of optical character recognition technology.
2. A great attempt of research worker in machine learning ^ data mining has been contrived to achieve efficient approaches for approximation of recognition from data.

- ## GOALS & OBJECTIVES:-

The goal is to design a system which can detect the correct handwritten digit

- ## SCOPE:-

> Facial imotion Recognition is used in car board system depending on information of the mentality of the driver can be provided to the system to initiate his/her and the customer safety.

> Development of a facial emotion recognition system implementing the computer visions and enhancing the advanced feature extraction and classification.

> This system can be used in digital in security systems which can identify a person in any form of expression he presents himself.

- ## **ALGORITHM:-**
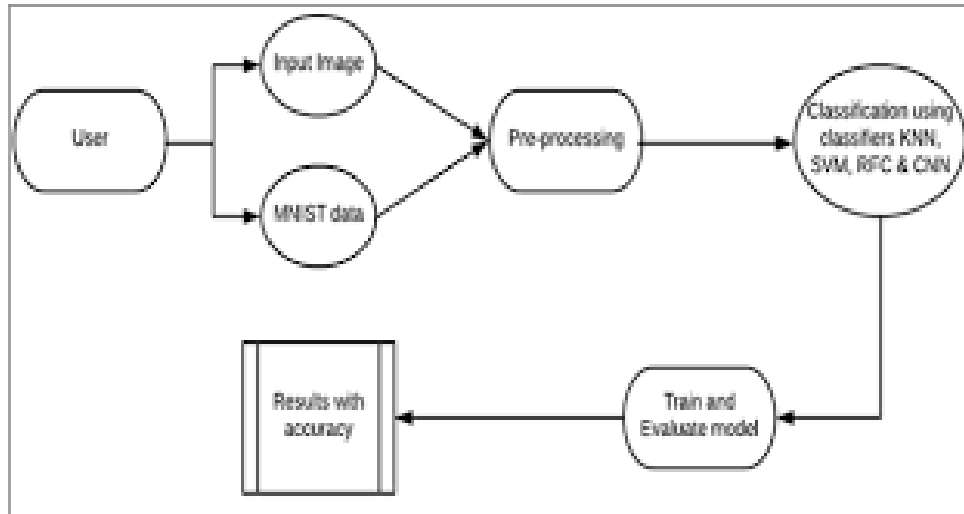
- ## **MOTIVATION:-**

Hand writing recognition of characters has been around since the 1980s.The task of handwritten digit recognition, using a classifier, has great importance and use such as – online handwriting recognition on computer tablets, recognize zip codes on mail for postal mail sorting, processing bank check amounts, numeric entries in forms filled up by hand (for example - tax forms) and so on. There are different challenges faced while attempting to solve this problem. The handwritten digits are not always of the same size, thickness, or orientation and position relative to the margins. Our goal was to implement a pattern classification method to recognize the handwritten digits provided in the MINIST data set of images of hand written digits (0-9).

- ## **SYSTEM OVERVIEW:-**

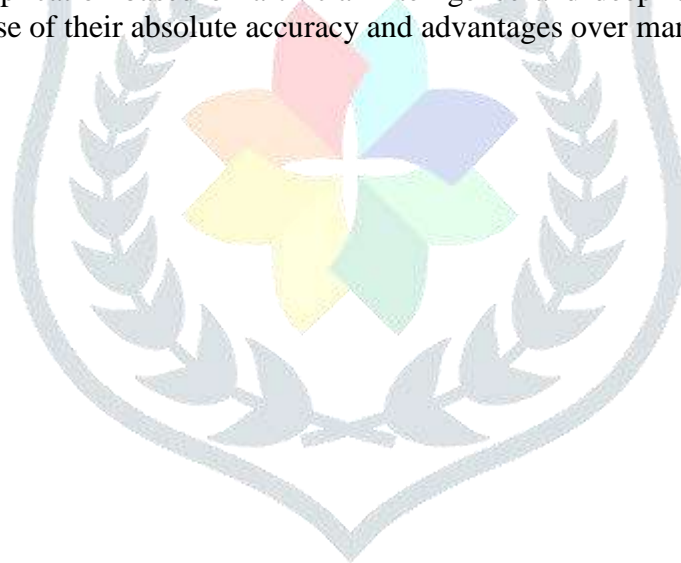   Our approach to solve this problem of handwritten numeral recognition can   be broadly divided into three blocks:

   i) Pre-Processing/Digitization

   ii) Feature Extraction using PCA

   iii) Classification using 1-Nearest Neighbor algorithm

- ## **FUTURE ENHANCEMENT:-**

The future development of the applications based on algorithms of deep and machine learning is practically boundless. In the future, we can work on a denser or hybrid algorithm than the current set of algorithms with more manifold data to achieve the solutions to many problems. In future, the application of these algorithms lies from the public to high-level authorities, as from the differentiation of the algorithms above and with future development we can attain high-level functioning applications which can be used in the classified or government agencies as well as for the common people, we can use these algorithms in hospitals application for detailed medical diagnosis, treatment and monitoring the patients, we can use it in surveillances system to keep tracks of the suspicious activity under the system, in fingerprint and retinal scanners, database filtering applications, Equipment checking for national forces and many more problems of both major and minor category. The advancement in this field can help us create an environment of safety, awareness and comfort by using these algorithms in day-to-day application and high-level application (i.e., corporate level or Government level). Application-based on artificial intelligence and deep learning is the future of the technological world because of their absolute accuracy and advantages over many major problems.

- **Literature Review**: -

Sr. No.	Paper	Methodology Used
1.	Mahmoud M. Abu Ghosh, Ashraf Y. Maghari – A Comparative Study on Handwriting Digit Recognition Using Neural Networks – 2017 IEEE	In this paper, the three NN approaches are compared and evaluated in terms of many factors such as accuracy and performance
2.	Oliveira, A.L.I., Mello, C.A.B., Silva, E.R. – Optical Digit Recognition for Images of Handwritten Historical Documents – 2006 IEEE	In this paper, using under sampled bitmaps combined with SVMs the best classification result is given.
3.	Cheng-Lin Liu, K. Nakashima, H. Sako, H. Fujisawa – Handwritten digit recognition using state-of-the-art techniques – 2017 IEEE	In this paper, the tested databases are CENPARMI, CEDAR, and MNIST. On the test dataset of each database, 56 recognition accuracies are given by combining 7 classifiers with 8 feature vectors.
4.	Qianjun Shuai, Xingwen Wu, Libiao Jin – Handwritten Tibetan Digital Words Recognition Based on improved Convolutional Neural Network – 2019 IEEE	In this paper, the image features extracted from the neural network are input into the SVM classifier for classification and recognition.

- ## REFERANCE :-

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[2] "What can a digit recognizer be used for?": https: //www.quora.com/What−can−a−digit−recognizer− be − used − f or

[3]" Handwritten Digit Recognition using Machine Learning Algorithms", S M Shamim, Mohammad Badrul Alam Miah, Angona Sarker, Masud Rana & Abdullah Al Jobair.

[4]" Handwritten Digit Recognition Using Deep Learning", Anuj Dutt and Aashi Dutt.

[5]" Handwritten recognition using SVM, KNN, and Neural networks", Norhidayu binti Abdul Hamid, Nilam Nur Binti Amir Sharif.

[6]" Recognition of Handwritten Digit using Convolutional Neural Network in Python with TensorFlow and Comparison of Performance for Various Hidden Layers", Fathma Siddique, Shadman Sakib, Md. Abu Bakr Siddique.

[7]" Advancements in Image Classification using Convolutional Neural Network" by Farhana Sultana, Abu Sufian & Paramartha Dutta.