LITERATURE SURVEY:

[1] In research done on handwritten digits Recognition the model was implemented with an ANN which can identify handwritten digits from 0 to 9. The proposed neural system was trained and tested on a dataset achieved from MNIST. Their proposed method utilized the image pixels for its feature extraction process. ANN carried out the classification, and the overall classification accuracy is 99.60 percentage. 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 algorithm. 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.

[2] Handwritten digit recognition is a popular issue among researchers. There are many papers and articles published about this topic. These are some researches that are done on handwritten digit recognition using different machine learning algorithms. Convolutional Neural Network (CNN) has high accuracy because of its accuracy it is being used on a large scale in image processing, video analysis. CNN is even being used in natural language processing and sentiment recognition by varying different parameters .The main objective of this research is to design an expert system for Handwritten digit recognition using neural network approach. Other objectives include: To address the issue of accuracy in Handwritten digit recognition systems by developing a system that will use efficient technology for recognizing Handwriting characters and words from image media. To investigate and demonstrate the usefulness of neural network technology in development of efficient Handwriting character recognition systems.

[3] In research done on handwritten digits Recognition the model was implemented with an ANN which can identify handwritten digits from 0 to 9. The proposed neural system was trained and tested on a dataset achieved from MNIST. Their proposed method utilized the image pixels for its feature extraction process. ANN carried out the classification, and the overall classification accuracy is 99.60 percentage

[4] The handwritten digits recognition model with CNN implemented using different numbers of hidden layers and epochs found that we can reach ideal accuracy with respect to the number of epochs and hidden layers [3]. It is difficult to get a good performance as more parameters are needed for the large-scale neural network. In research, it is discovered that deep nets perform better when they are prepared by basic backpropagation. Their architecture brings about the most minimal error rate on MNIST contrast with NORB and CIFAR10.

[5] Renata F. P. Neves have proposed SVM based offline handwritten digit recognition. Authors claim that SVM outperforms the Multilayer perceptron classifier. Experiment is carried out on NIST SD19 standard dataset. Advantage of MLP is that it is able to segment non-linearly separable classes. However, MLP can easily fall into a region of local minimum, where the training will stop assuming it has achieved an optimal point in the error surface. Another hindrance is defining the best network architecture to solve the problem, considering the number of layers and the number of perceptron in each hidden layer. Because of these disadvantages, a digit recognizer using the MLP structure may not produce the desired low error rate.

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[4] Fathma Siddique, Shadman Sakib, M.A.B," Recognition of Handwritten Digit using Convolutional Neural Network in Python with Tensorflow and Comparison of Performance for Various Hidden Layers". Preprints, Issue 2019.