**Literature Survey:**

Prepare below table after reading and analysing IEEE Papers:

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| **Sr. No** | **Title of Paper** | **Name of Authors** | **Published Year** | **Remarks** |
| 1 | Handwritten Digit Recognition Using CNN | Mayank Jain, Gagandeep Kaur, Muhammad Parvez Quamar, Harshit Gupta | 2021 | **Methodology:** 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. CNN consists of 4 hidden layers which help in extraction of the features from the images and can predict the result. The layers of CNN are (a) Convolutional Layer (b) ReLu Layer (c) Pooling Layer (d) Fully Connected Layer.  **Algorithms**: Deep learning algorithm (CNN approach)  **Advantages:** the fundamental favourable position of CNN contrasted with its archetypes is that it consequently recognizes the significant highlights with no human management.  **Disadvantages:** Computational Complexity: CNNs can be computationally intensive, particularly when dealing with large images or videos. This can be a challenge for real-time applications, where quick processing is required.  **Applications:** CNNs are commonly used for image classification tasks, where the goal is to classify an image into one of several pre-defined categories. |
| 2 | Bangla Handwritten Digit Recognition Using an Improved Deep Convolutional Neural Network Architecture | Chandrika Saha, Rahat Hossain Faisal, and Md. Mostafijur Rahman | 2019 | **Objective:** The main objective of this paper is to classify Bangla handwritten digits using a seven-layer D-CNN.  **Methodology:** Deep Convolutional Neural Network (DCNN) based Bangla handwritten digits recognition scheme. The proposed method applies a seven layered D-CNN containing three convolution layers, three average pool layers and one fully connected layer for recognizing.  Rigorous experimentation on a relatively large Bangla  digit dataset namely, CMATERdb 3.1.1 provides considerable recognition accuracies.  **Algorithms**: Deep Convolutional Neural Network(D-CNN).  **Advantages:** Applying D-CNN on relatively large dataset  can increase the recognition accuracy for Bangla alphabet.  **Disadvantages:** DCNNs require a large amount of computational power and memory to train, especially for large datasets and complex architectures. This can be a challenge for real-time applications and for systems with limited resources. |
| 3 | Handwritten Digit Recognition base on improved LeNet5 | Naigong Yu, Panna Jiao, Yuling Zheng | 2015 | **Methodology;** LeNet5 performs as a trainable feature extractor and SVM works as a recognizer. To accelerate the networks convergence speed, the stochastic diagonal Levenberg-Marquadt algorithm is introduced to train the network. MNIST digit database to test and evaluate the proposed method performance.  **Algorithms**: LeNet5 CNN and SVM methods, stochastic diagonal Levenberg-Marquardt algorithm to accelerate learning in certain cases.  **Advantages:** It is combination of the CNN and SVM which are the best classifier in handwritten character recognition field. The improved LeNet5 required only 25-30 epochs for convergence, which is much less time than other method.  **Disadvantages:** LeNet-5 was designed for image classification tasks with relatively simple datasets, and its capacity is limited compared to more recent DCNN architectures. This can limit its performance on more complex tasks and datasets.  **Applications:** LeNet-5 and SVM has been used in a variety of applications, including:  Handwritten digit recognition, Face recognition and Speech recognition. |
| 4 | HDSR-Flor: A Robust End-to-End System to Solve the Handwritten Digit String Recognition Problem in Real Complex Scenarios | ARTHUR FLOR DE SOUSA NETO, BYRON LEITE DANTAS BEZERRA, (Member, IEEE), ESTANISLAU BAPTISTA LIMA , AND ALEJANDRO HÉCTOR TOSELLI | 2020 | **Objectives:** handwritten text lines recognition, and its main objectives are:  • Improve state-of-the-art recognition rate in the HDSR research field.  • Able to handle very low volumes of data in various HDSR scenarios.  • Offer a low complexity model through the low number of trainable parameters (thousands).  **Methodology;** the three steps are composed by capture, propagation, and decoding of features,  (i) the CNNs layers extract the most relevant features from the input images through the Gated mechanism proposed by Dauphin et al. (ii) the BGRU layers propagate the extracted resources along the sequence, instead of the traditional BLSTMs; and (iii) CTC calculates the loss value for the training process and decodes the model output in the final text using Beam Search algorithm, instead of the decoding process through HMM and language model.  **Algorithms**: Deep Learning Model, Gated Convolutional Neural Network (Gated-CNN) and Bidirectional Gated Recurrent Unit (BGRU).  **Advantages:** Handling variable-length sequences: Gated-CNNs and BGRUs are both designed to handle sequences of data, which makes them well suited for NLP tasks where the input is a sequence of words or characters.  **Disadvantages**: Difficulty in interpretation: Deep learning models like Gated-CNN-BGRU can be difficult to interpret, as the decisions made by the model are often based on complex, non-linear interactions between the input and the model parameters. This can make it difficult to understand why a model is making a particular prediction. |
| 5 | Capsule-Based Persian/Arabic Robust Handwritten  Digit Recognition Using EM Routing | Ali Ghofrani, Rahil Mahdian Toroghi | 2019 | **Methodology;** The training of the architecture is performed using Hoda dataset, which has been provided for Persian/Arabic handwritten digits. The output of the system, clearly outperforms the results achieved by its ancestors, as well as other previously presented recognition algorithms.  **Algorithms**: capsule network (CapsNet) which has recently emerged as a more advanced architecture than its ancestor, namely CNN (Convolutional Neural Network).  **Advantages:** Improved robustness: CapsNets have improved robustness compared to traditional convolutional neural networks (CNNs). This is because the dynamic routing mechanism in CapsNets allows the network to identify the most important features in an image  **Disadvantages**: Lack of interpretability: CapsNets, like other deep learning models, can be difficult to interpret, as the decisions made by the model are often based on complex, non-linear interactions between the input and the model parameters. This can make it difficult to understand why a model is making a particular prediction.  **Applications:**  Image classification, Object detection, Text classification, Text generation |