

**TEAM ID: PNT2022TMID13244**

# **A NOVEL METHOD FOR HANDWRITTEN DIGIT RECOGNITION**

**Team Leader:**

**ARUNSUNDAR (621319104006)**

**Mentor:**

**Mr. L.NIVETHA , AP/CSE**

**Team Members:**

**R.NISHANTH(621319104039)**

**N.PRAKASH(621319205040)**

**S.SANTHRU(621319205049)**

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# ABSTRACT

Character recognition plays a crucial role within the modern world. It will solve additional advanced issues and makes human's job easier. Associate example is written character recognition. This can be a system wide employed in the world to recognize zip code or postcode for mail sorting. There are different techniques which will be accustomed acknowledge written characters. Shape recognition, Chinese Character and written Digit recognition uses Neural Network to acknowledge them. Neural Network is employed to coach and identify written digits.

# INTRODUCTION

- A handwritten digit recognition system was to visualize artificial neural networks.
- It is already widely used in the automatic processing of bank cheques, postal addresses, in mobile phones etc.
- To perform digit recognition, some basic knowledge on neural network and image processing is needed.
- But, the customer may use it without any prior knowledge in image processing or neural network.
- Some of the existing systems include computational intelligence techniques such as artificial neural networks or fuzzy logic.

## LITERATURE SURVEY-5

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Handwriting Text Recognition Based on Faster R-CNN.	J. Pradeep	2020	IEEE	Region Proposal Networks (RPN) are a novel network structure that are used for HCR.	This system mainly focuses maintaining accuracy and also text recognition speed is also increased.	If two words are too near, it recognizes as one word.

## LITERATURE SURVEY-6

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Exploration of CNN Features for Online Handwriting Recognition.	Subhasis Mandal, S.R. Mahadeva Prasanna and Suresh Sundaram	2020	IEEE	A CNN architecture capable of processing online handwriting without having to convert it to an image.	The proposed CNN characteristics are shown to be effective in character and large vocabulary word recognition challenges.	If two words are too near, it recognizes as one word.

## LITERATURE SURVEY-7

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
An enhanced offline printed Arabic OCR model based on bio-inspired fuzzy classifier.	Darwish, S.M, Elzoghaly	2020	IEEE	Fuzzy logic algorithm: the Fuzzy K-Nearest Neighbor classifier (F-KNN) in a unified framework to enhance the identification accuracy.	The strength of the fuzzy KNN classifier depends primarily on the method of constructing the membership function, which was done through the semantic fusing of both histogram.	More complex Arabic font's datasets, especially Diwani font, and trying to solve the problem to results.

## LITERATURE SURVEY-4

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
An Neural Network based Handwritten Character Recognition system	S. Mori, C. Y. Suen and Kamamoto	2020	IEEE	It is a type of handwriting recognition that consists of various stages like preprocessing, classification and post-processing stages.	This paper presents a novel neural network based off-line character recognition system.	Does not include feature extraction.



## LITERATURE SURVEY-9

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Analogizing Time Complexity of KNN and CNN in Recognizing Handwritten Digits.	Dubey A, Rocha & Goyal	2020	IEEE	The K-Nearest Neighbor Algorithm is a classifier that calculates the Euclidean distance between data set input photos.	On this dataset, KNN and CNN perform similarly with their respective algorithms, with CNN producing higher accuracy than KNN.	We must presume that a data point should be categorized in the same way as nearby data points.

# LITERATURE SURVEY-

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Handwritten Digit Recognition Using K-Nearest Neighbor Classifier.	Babu, Venkatesh and Chintha	2021	IEEE	To discover minimum distances, a Euclidean minimum distance criterion is utilized, and the digits are classified using a KNN classifier.	The recognition method has an average accuracy of 96.94 percent.	The time it takes to classify or estimate something is slow, especially when the training set is huge.

## LITERATURE SURVEY-

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Data Augmentation for Recognition of Handwritten Words and Lines using a CNN-LSTM Network.	Curtis Wigington, Seth Stewart, Brian Davis, and Bill Barrett	2021	IEEE	On both word and line images, a unique profile normalization technique was used, and existing text images were enhanced with regular grid.	These techniques are independent of the network & might be used to improve the performance of different HWR networks.	It's possible that more time and resources may be required.

# LITERATURE SURVEY-

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Offline Handwritten Mathematical Expression Recognition using Convolutional Neural Network.	Lyzandra and Maruska Mascarn	2021	IEEE	It is scanned and the image is transmitted to the identification system to recognize the Handwritten Mathematical Expression that is written on it.	A system that can detect HME that is not connected to the internet. Isolated symbols will benefit the most from this system.	Symbols that have been merged, connected, or joined are not recognized appropriately.

## LITERATURE SURVEY-

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Optical Character Recognition using KNN on Custom Image Dataset.	Hazra, T. K., Singh, D. P., & Daga, N.	2021	IEEE	It works well with multimodal classes due to the fact that its conclusion is based on a small neighborhood of comparable targets.	Regardless of whether the target class is multi-modal, the technique can lead to high precision in any instance.	Because we need to compute distance for each query instance of all training samples, the computation cost is rather large.

## LITERATURE SURVEY-14

Title of the Paper	Author	Year of Publication	Publisher	Methods	Advantages	Limitations
Comparisons on KNN, SVM, BP and the CNN for Handwritten Digit Recognition.	Wenfei liu, Brunei Darussl	2022	IEEE	It is based on geometric measurement , and it is used to calculate the distance between distinct feature values in model for classification.	The outcomes of the simulation experiments, states that CNN algorithm out performs the KNN method in terms of recognition rate.	The KNN method is a sluggish algorithm that does a lot of calculation and uses a lot of memory during classification.

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Thank You