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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# Handwritten Character Recognition Using Deep Learning Neural Network

Prof. Jalindar Nivrutti Ekatpure<sup>1</sup>, Bharati Rajesh Shinde<sup>2</sup>, Dipti Raju Waidande<sup>3</sup>,  
Saniyz Raju Kazi<sup>4</sup>

Associate Professor, Department of Computer Engineering, S B Patil College of Engineering Indapur,  
Maharashtra, India<sup>1</sup>

U.G. Student, Department of Computer Engineering, S B Patil College of Engineering Indapur, Maharashtra, India<sup>2</sup>

U.G. Student, Department of Computer Engineering, S B Patil College of Engineering Indapur, Maharashtra, India<sup>3</sup>

U.G. Student, Department of Computer Engineering, S B Patil College of Engineering Indapur, Maharashtra, India<sup>4</sup>

**ABSTRACT:** Many researchers are operating to alter the method of reading, understanding, and interpretation of the written word. Word recognition is a very important area of Document Analysis and Recognition. Deep learning is a very important topic in pattern recognition and in machine learning. It has the potential to resolve complicated machine-learning problems. The availability of tools that helps in pattern recognition provides an incredible chance for the next Generation application. Convolution neural networks usedata-driven learning and extraction of hierarchical features from training Convolution layers in CNN. This system presents the machine learning algorithm for Handwritten word recognition. CNN tends to work better with raw input pixels. The system accepts the whole scan images as raw input and will do further process providing the required output. Our proposed system's purpose of this project is to take handwritten English characters as input, process the character, train the neural network algorithm, to recognize the pattern, and modify the character to a beautied version of the input. Keywords: Machine learning, Deep learning, Convolutional Neural Networks (CNN), Image recognition.

**KEYWORDS:**Machine learning, Deep learning, Convolutional Neural Networks (CNN), Image recognition, etc

## I. INTRODUCTION

Handwritten digit recognition is the ability Computer to recognize human Handwritten digits. It is a hard task for the machine because handwritten digits are not perfect and can be made with many different flavors. Handwritten digit recognition is the image of a digit and recognizing the digit present in the image handwriting recognition is a machine's ability to receive and interpret handwritten input from multiple sources like paper documents, photographs, touch screen devices, etc. Recognition of handwritten and machine characters is an emerging area of research and finds extensive applications in banks, offices, and industries. The main aim of this project is to design an expert system for, "HCR(English) using Neural Network". that can effectively recognize a particular character of type format using the Artificial Convolutional Neural Network approach. Neural computing Is a comparatively new field and design components are therefore less well specified than those of other architectures. Neural computers implement dataparallelism. Neural computers are operated in a way that is completely different from the operation of normal computers. Neural computers are trained so that given a certain starting state (data input); they either classify the input data into one of the numbers of classes or cause the original data to evolve in such a way that a certain desirable property is optimized. Handwritten Character Recognition works bit by bit as preprocessing, segmentation, feature extraction, and recognition using neural networks. Preprocessing includes a series of operations to be applied to the document image to form it prepared for segmentation. throughout segmentation, the document image is divided into individual character or nu- meric images then the feature extraction technique is applied to the character image. Finally, a feature vector is conferred to the chosen algorithmic rule for recognition. Here these extracted options are provided to Neural Network for recognition of character.



**II. PROPOSED SYSTEM**

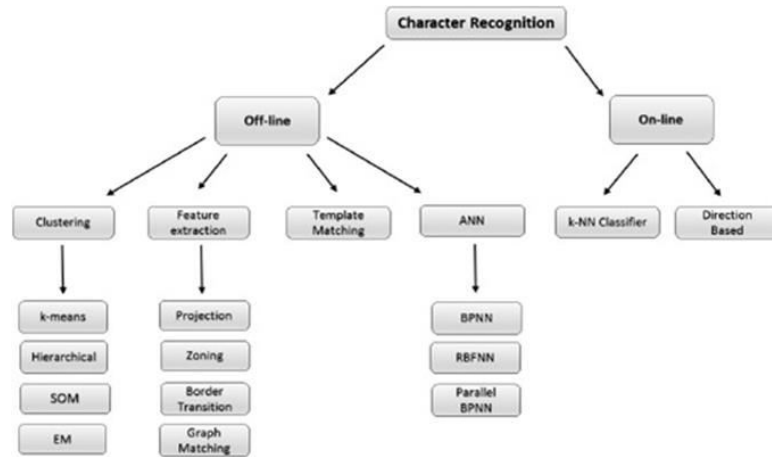


Fig.1.SystemArchitecture

**III. BLOCK DIAGRAM**

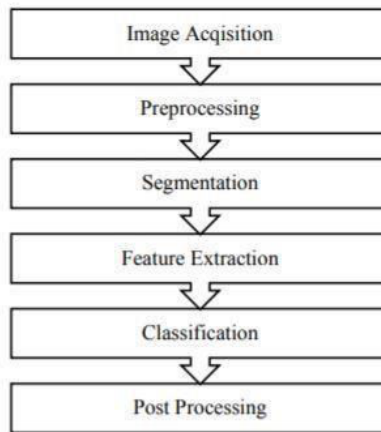


Fig.2.BlockDiagram

IV. ER DIAGRAM

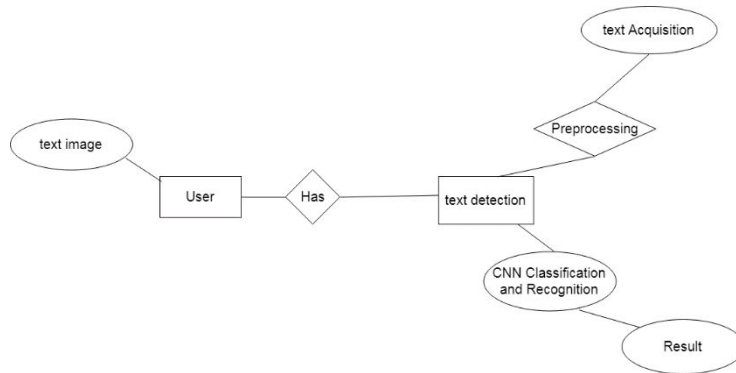


Fig.3.ERDiagram

V. DATA FLOW DIAGRAM

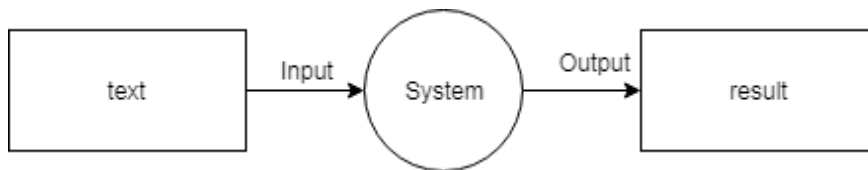


Fig.4.DFDLevel0

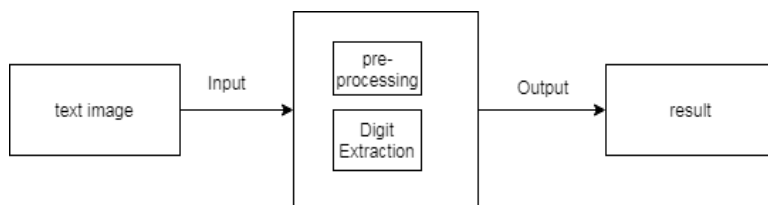


Fig.4.DFDLevel1

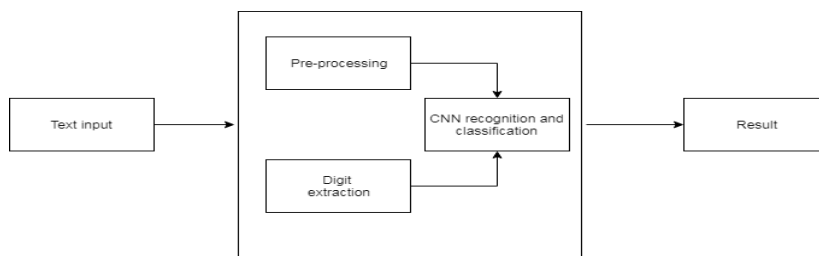


Fig.4.DFDLevel2

## V. USE CASE DIAGRAM

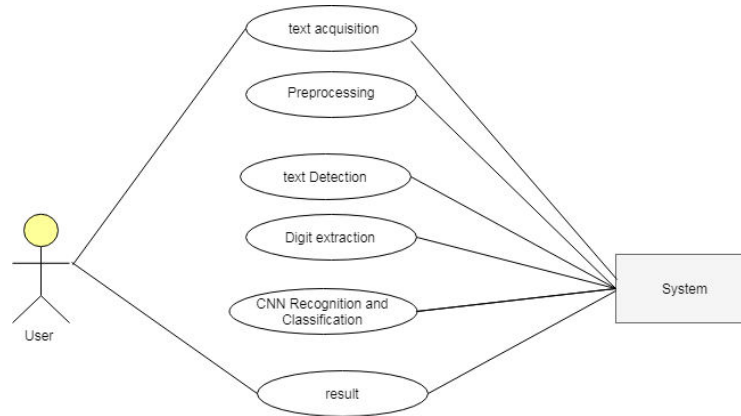


Fig.7.Usecase Diagram

## VI. ADVANTAGES

1. helps to transform the writings in the papers to a text document format which can also be said as readable electronic format.
2. Despite of rough handling, one can read the OCR information with a high degree of accuracy. Flatbed scanners are very accurate and can produce reasonably high-quality images.
3. The processing of OCR information is fast. Large quantities of text can be input quickly.
4. A paper-based form can be turned into an electronic form which is easy to store or send by mail.
5. It is cheaper than paying someone a amount to manually enter a large amount of text data. Moreover, it takes less time to convert into electronic form.
6. The latest software can re-create tables as well as the original layout.

## VII. APPLICATION

1. Postal mail sorting.
2. Bank check processing
3. Form data

## VIII. COMPARISON

Feature extraction techniques can be important in character recognition because they can enhance the efficiency of recognition in comparison to pixel-based approaches. This study aims to investigate novel feature extraction techniques to use them for representing handwritten characters. In this system, three feature extraction methods (Gradient, DCT, and DWT) are used to compare the effectiveness of handwriting characters. The system is started by acquiring an image containing characters. The characters are processed into several phases: binarization, noise filtering, normalization, and feature extraction before recognition. A multilayer neural network is used for the recognition phase; a feed-forward backpropagation algorithm is applied for training the network. This paper aims to compare different feature extraction methods in terms of recognition accuracy and training time.



## VIII. CONCLUSION

Although machine learning is a field within computer science, it differs from traditional computational approaches. Many regional languages throughout the world have different writing styles which can be recognized with HCR systems using proper algorithms and strategies. We have learned to recognition of English characters. It has been found that recognition of handwritten characters becomes difficult due to the presence of odd characters or similarity in shapes for multiple characters. The scanned image is pre-processed to get a cleaned image and the characters are isolated into individual characters. Preprocessing work is done in which normalization, and filtration is performed using processing steps that produce noise-free and clean output. Managing our evolution algorithm with proper training, and evaluation of another step-wise process will lead to the successful output of the system with better efficiency.

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