

# SURVEY ON OBJECT DETECTION TECHNIQUES BASED ON GPU FOR MARATHI CHARACTER RECOGNITION

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## ABSTRACT

*Character recognition is right now achieving attention of most of the researchers because of its huge applications in various sectors like human-robot interaction, data entry for business documents, etc. Recognition of characters is tricky task, but Deep learning approach can be adequately used as a solution for various such problems. Discrepancy in writing style makes handwritten character recognition one of the most burdensome work. There are plenty ways to write a single letter or a digit which automatically increases the size of the dataset to be used. The goal of this work is to integrate machine learning techniques to improve the character recognition process.*

**Keywords** – Character recognition, feature extraction, image segmentation

## INTRODUCTION

The reforming of the technology behind optical character recognition (OCR) has encouraged it to become one of those technologies that have found many of uses in the whole industrial field. Today, the recognition system is available for several languages and have the capability to recognize the characters in real time, but there are some languages for which this technology has not developed much. All these improvements have been feasible because of the addition of concepts like artificial intelligence and deep learning. Deep Neural Networks have proven to be the best choice when it comes to a task involving recognition. There are many algorithms and models that can be used for this purpose.

Although Existing System gives more than 90.00% efficiency for marathi single characters, it is not effectively efficient for marathi compound characters. Efficiency of Existing recognition system gets reduced when different handwriting styles are included. Often seen that the existing system predicts wrong output when two similar marathi handwritten characters are scanned. Dozens of Marathi Compound words cannot get recognized properly due to poor handwritten styles that symbolize lack of dataset. No complete OCR for Marathi is yet available which works in a noisy

environment. One of the poor recognition rate in OCR system is error in character segmentation. It is seen that the text from a source with a font size of less than 12 points results in more errors.

Figure below demonstrates how ambiguity is created with similar letters because of different writing styles.

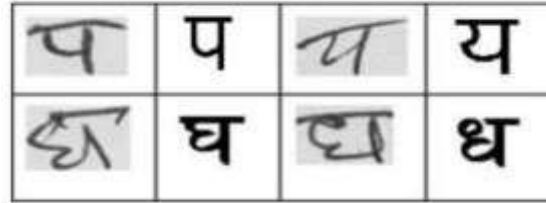


Fig 1. ambiguity due to different writing styles

In this paper we have studied different datasets and different character recognition techniques to yield better accuracy and expected outcomes.

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**LITERATURE SURVEY**

Sr. No.	Paper Title	Publications Details	Methodology Used	Dataset Used	Accuracy (%)	Research Gap
1	An End-to-End Approach for recognition of Modern and Historical handwritten Numeral Strings	Author – Andre G. Hochuli, et.al Year – 2020 Journal – Research Gate	YOLO Deep Convolutional Network	ORAND-CAR Datasets	95.78	The proposed approach performs well on long strings composed of up to 20 digits
2	Recognition method for steel billet identification number based on yolo deep convolutional network	Author – Dali Chen, et.al Year – 2020 Journal – IEEE	YOLO Deep Convolutional Network	Images of handwritten steel billet identification number collected at the scene consisting of 120 images in total.	97.00	The proposed approach performs well on Steel Billet Numbers Only.
3	Handwritten Marathi Character Image Recognition using Convolutional Neural Network	Author – Bhawna Jain, et.al Year – 2019 Journal –IEEE	1.Convolutional Neural Network 2.TensorFlow library	A dataset of 125 samples is collected, each containing 56 handwritten Marathi characters.	98.27	Improve accuracy to make it more efficient and extend it to use for other Languages.
4	Deep Learning Based Real Time Devanagari Character Recognition	Author – Aseem Chhabra Year – 2019 Journal – Springer	1.Convolutional Neural Network 2.K Nearest Neighbors 3.Random Forest 4.Extra Tree Classifier	Devanagari Handwritten Character Dataset (DHCD)	97.25	Transfer learning is not possible. Model fail to recognized words and sentences and store it in a file.
5	Automatic classification and	Author – Chen Jun, et.al	Faster RCNN	A dataset of 522 samples	93.00	Model focuses only

	recognition of complex documents based on Faster RCNN	Year – 2019 Journal – IEEE		is collected.		on automatic classification and recognition of complex documents regardless of efficiency.
6	A Deep Learning Approach for Optical Character Recognition of Handwritten Devanagari Script	Author – Brijeshwar Dessai Year – 2019 Journal – Springer	1.Noise Removal 2. Skeletonization 3. LeNet	Dataset of 15 Devanagari characters was created manually by making different individuals to write the character.	89.34	System is not that much efficient for compound handwritten Characters.
7	Visualizing and Under-standing Customized CNN for Re-cognition of handwritten Marathi numerals	Author – D. T. Mane, et.al Year – 2018 Journal – Science direct	1.Splitting 2.Resizing 3.Multifactorial Analysis 4.Automatic Feature Ex- traction 5.Customized CNN(CCNN)	Dataset of 2000 images containing Marathi numerals from 0-9, collected from people belonging to different age groups	94.93	Quality can be utilized, by learning features from data-set and providing them as input to various classifiers to improve the accuracy by providing a base to the initialization of weights that can optimize proposed model further.
8	Character Segmentation in Text line via CNN	Author – Xiaohe Li, et.al Year – 2017 Journal – ICSAI	1.Training data using weakly labelled data via P-N learning 2.CNN 3.SVM	1. SVHN 2. IIIT	99.60	It will fail to recognized Devanagari characters due to various strokes.
9	A Study for	Author –Satish	MLP Classifier	A database	86.50	The

	Handwritten Devanagari Word Recognition	Kumar Year – 2016 Journal – IEEE		of more than 3500 hand- printed  Devanagari words collected from more than 200 writers.		segmentation rate for tilted headline and touching characters needs to improve.
10	Online Handwritten Character Recognition of Devanagari and Telugu Characters using SVM	Author – srinivasa Chakravarthy. et.al Year – 2006 Journal – Research gate	1.Normalization 2.Smoothing 3.Interpolation 4.SVM 5.HMM	Devanagari stroke dataset	97.27	High Dependency upon stroke recognition

## LIVE SURVEY

DetReco: Object- Text Detection and Recognition Based on Deep Neural Network - In this article, we propose a new object-text detection and recognition method termed “DetReco” to detect objects and texts and recognize the text contents. The proposed method is composed of object-text detection network and text recognition network. YOLOv3 is used as the algorithm for the object-text detection task and CRNN is employed to deal with the text recognition task. The experiments show that the proposed method achieves 78.3 mAP (mean Average Precision) for general objects and 72.8 AP (Average Precision) for texts in regard to detection performance. Furthermore, the proposed method is able to detect and recognize affine transformed or occluded texts with robustness. In addition, for the texts detected around general objects, the text contents can be used as the identifier to distinguish the object. [1]

A Method for Detecting Text of Arbitrary Shapes in Natural Scenes That Improves Text Spotting – In this, the text detection component, which is UHT, short for UNet, Heatmap, and Textfill. UHT uses a UNet to compute heatmaps for candidate text regions and a textfill algorithm to produce tight polygonal boundaries around each word in the candidate text. The method trains the UNet with ground truth heatmaps that are obtain from text bounding polygons provided by ground truth annotations. The text spotting framework, called UHTA, combines UHT with the state-of-the-art text recognition system ASTER. [2]

IIT Madras team develops easy OCR system for nine Indian languages - At IIT-Madras a team of researchers developed a technique for reading documents in Bharati script using a multi-lingual Optical Character Recognition(OCR) system. Bharati script is a unified script for nine Indian languages. This includes Devanagari, Bengali, Gurmukhi, Gujarati, Oriya, Telugu, Kannada, Malayam and Tamil. In collaboration with TCS, Mumbai they created universal finger-spelling language for nine Indian languages using which a person with hearing disability can generate signatures or sign languages. [3]

## ALGORITHMIC SURVEY

Sr. No.	Paper Title	Publications Details	Algorithm	Functions	Accuracy (%)	Research Gap
1	Handwritten Marathi Character Image Recognition using Convolutional Neural Network[4]	Author – Bhawna Jain, et.al Year – 2019 Journal – IEEE	1.Convolutional Neural Network 2.TensorFlow library	1.Noise removal 2.Smoothing 3.Grey scale	95.78	Model fail to recognized sequence of handwritten characters.
2	End to End Information extraction by Character Level Embedding and Multistage Attentional UNet[5]	Author –Tuan Anh Nguyen Dang, et.al Year – 2019 Journal – IEEE	1.Coupled UNet 2.Resblock	1.Attention mechanism 2.Box convolution with the multi-stage encoder-decoder Architecture 3.Multi task training scheme	92.5	To open-source our datasets and provide the proposed methods as new baselines to promote the current active research in document analysis area.
3	Deep Learning Based Real Time Devanagari Character Recognition [6]	Author – Aseem Chhabra Year – 2019 Journal – Springer	1.Convolutional Neural Network 2.K Nearest Neighbors 3.Random Forest 4.Extra Tree Classifier	1. Two convolution layers and two max pool layers in the feature extraction section followed by a SoftMax layer	97.25	Model focuses only on automatic classification and recognition of complex documents regardless of efficiency.

				for final classification. 2. Changed the size of kernel in convolutional layer.		
4	Automatic classification and recognition of complex documents based on Faster RCNN [7]	Author – Chen Jun, et.al Year – 2019 Journal – IEEE	Faster RCNN	Regional proposal network (RPN)	93.00	Model focuses only on automatic classification and recognition of complex documents regardless of efficiency.
5	UOLO - automatic object detection and segmentation in biomedical images.[8]	Author – Teresa Araujo, et.al Year – 2018 Journal – Springer	1. YOLO 2. UNet	1. DNN that extracts features from an image 2. A feature interpretation block that predicts both labels and bounding boxes for the objects of interest.	93.5	UOLO is robust for segmentation but up till now it is only used for biomedical images and not for text.
6	Handwritten Marathi Compound Character Segmentation with Morphological Operation [9]	Author – Mrs. Snehal S. Golait, et.al Year – 2016 Journal – Elsevier	Minutiae Algorithm	1. Skew correction 2. Morphological Processing 3. Wavelet Transform 4. Modified wavelet features	98.00	Characters used for experiment were enclosed in the bounding region of a fixed size and the system will fail if shirolekha or modifiers attached to the compound characters.

## CONCLUSION

This paper presents the precise survey on several character recognition techniques. One can get clear idea about these techniques along with their advantages and accuracies. A new researcher can study this paper and use it to generate new character recognition system. A lot of work is done on devanagari characters but compounded character have a bright scope for research.

## ACKNOWLEDGEMENT

I would like to express my gratitude to my project guide Prof. V. M. Lomte for her unwavering support and would like to thank her for his guidance during every step of the project.

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