A Convolutional Neural Network based Approach for Recognizing Malayalam Handwritten Characters

Jabir Ali V

**Abstract**— Optical character recognition has leveraged its capabilities to reduce tedious manual work of converting images containing charcters to texts for recent decades, recognition of handwritten texts is harder than recognizing printed texts as different handwritten script may have different style of writings, slants etc, The Convolutional Neural Network(CNN) has been successfully used to recognize charcters in many languages. This paper proposes a CNN architecture for classification of handwritten characters in Malayalam language. Malayalam is a south Indian language which is used by 33.3 million people in the state of Kerala. This CNN Model has shown a tesing accuracy of 97.26% for the classification of 44 handwritten Malayalam characters by using a dataset having seventy three thousand training images and eighteen thousand testing images. In addition, this paper put forward an algorithm to process an image containig handwritten Malayalam characters and output the corresponding Malayalam characters.

**Index Terms**— Classification, Convolutional Neural Network, Dataset Augmentation OCR, Optimizer, Segmentation

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# 1 Introduction

OPTICAL character recognition is the process of converting images containing printed, typewritten or handwritten characters into machine encoded format. OCR has leveraged its capabilities to reduce the tedious manual work work of converting images of printed or handwritten texts to digital form for the recent decades. Different methods have been used in OCR such as Bayesian theory, Hidden Markov Model, Template Matching and Neural Networks. The recognition task of handwritten characters is rather complex and is a great challenge to researchers as the solution should be able to cope with the challenges in identifying the characters from a variety of writing styles, slants of personal intrest. Especially in a language like Malayalam which is having a complex structure and very identical nature of character set.

Convlolutional Neural Network (CNN) is a popular deep learning method which has successfully used in many classification problems, It has a great capability to find patters in two dimensional data and were applied in the area of natural language processing, image classification, face recognition, autonomous driving etc. The proposed method uses a new CNN architecture to do the classification task. Unlike other classical machine learning such as SVM and Random Forest, the feature extraction task is implicitely done in CNN by using the gradient descent algorithm proposed by Yann LeCunn.This paper also propose method to do the task of segmentation of words and characters from a document image and to make character prediction from the CNN Model created.

# 2 Malayalam Language

Malayalam is the main language of kerala, a south Indian state. Malayalam is spoken by around 33 million people in kerala and it is one among the twenty two scheduled languages in India. Like other south Indian languages such as Tamil, Kannada and Telugu, Malayalam language has a complex structure. It contains core characters and vowel diacritics. In addition to this, the script is formed mostly by curves and holes. There are characters which looks very similar and having only small distinguishable difference. The modern Malayalam script contains 13 vowel letters and 36 consonants. Apart from this basic characters there are characters which are formed by the combination of other consonants called conjunct consonants. Here a dataset of 44 basic Malayalam characters shown in Fig 1.

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# 3 Literature Review

Shailesh Acharya et al proposed a Large Scale Handwritten Devanagari Character Recognition that used The Deep learning technique convolutional neural network for classifying Devanagari handwritten characters. The employed increment of dataset and added a dropout layer in order to reduce over fitting. They used two models of the network. First model consisted of three convolution layers and one fully connected layer and the second model was a shallow network. The highest testing accuracy for first model was 0.982681 and for the second model was 0.98471.

G Raju et al. put forwarded a Malayalam character recognition system which uses gradient based features and Run Length count. The authors also have proposed another character recognition scheme using the fusion of local and global

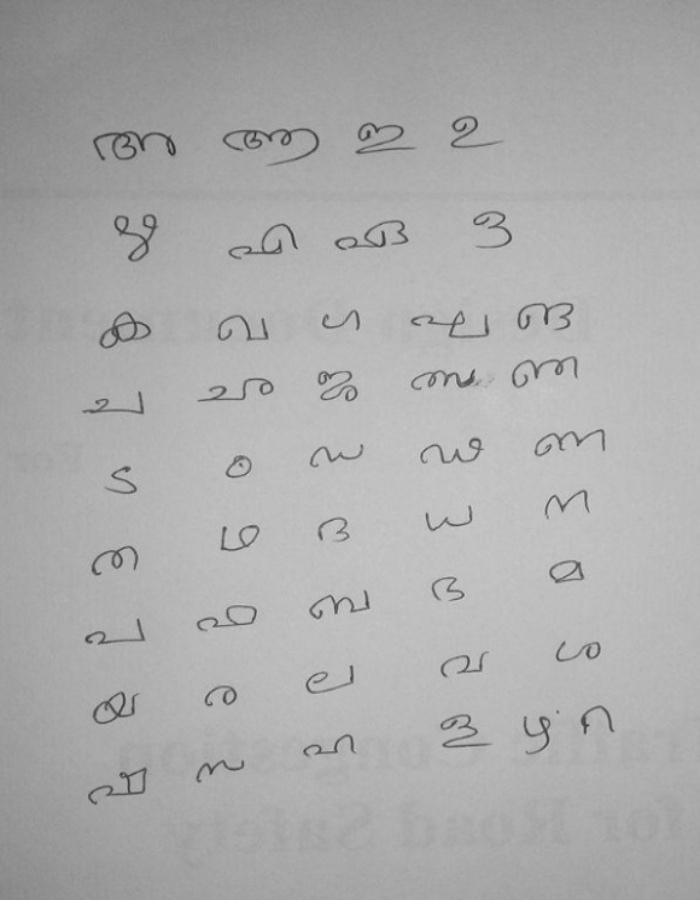


Fig.1

features for the recognition of isolated Malayalam characters.

. Arora et al. proposed a multiple classifier system using chain code histogram and moment invariants for the recognition of Devanagari character recognition.

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Fig. 1. Magnetization as a function of applied field. Note that “Fig.” is abbreviated. There is a period after the figure number, followed by one space. It is good practice to briefly explain the significance of the figure in the caption.

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Units for Magentic Properties



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aGaussian units are the same as cgs emu for magnetostatics; Mx = maxwell, G = gauss, Oe = oersted; Wb = weber, V = volt, s = second, T = tesla, m = meter, A = ampere, J = joule, kg = kilogram, H = henry.

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