Bengali handwritten character recognition using convolutional neural network approaches

*Abstract*—Bengali character recognition is a complex task due to its complex alignment and similarity between the characters. Several researches were done using convolutional network to recognize Bengali handwritten characters. In our proposed method we are planning to create a novel convolutional neural network-based architecture that will outperform previous deep learning-based models associated with Bengali handwritten digit recognition.

Keywords—bengali handwritten character recognition, convolutional neural network, deep learning

# Introduction

Convolutional neural networks become very popular in recent years due to its major success in solving various problems in computer vision. From recognizing cats and dogs from images to generating captions from the image, convolutional neural networks are now widely used in various machine learning problems. Convolutional neural networks achieved outstanding success on MNIST [1] dataset for recognizing hand written English numerical digits.

Bengali is the 7th most widely speaking languages in the world. It is the official language of Bangladesh and second most widely speaking language in India. More than 250 million people speaks in Bengali worldwide. Due to its popularity Bengali handwritten character recognition is an important task. However, few researches have been done for Bengali handwritten digit recognition

Bengali language has 10 numerical digit, 11 vowels, 39 consonants and more than 30 compound letters. Figure 1

1. Example of Bengali characters [4]

shows the sample of Bengali characters.

A research [2] was held to recognize Bengali handwritten digit using autoencoder and convolutional neural network. The dataset that were used in this paper was CMATERDB 3.1.1 [3] and this dataset was published by the Indian Statistical Institute (ISI). In the paper, they fed the convolutional neural network the compressed features learnt by the autoencoder and thus they leverage the weight learn during unsupervised learning. This research achieved 99.50% accuracy on the numerical digits.

Another research [4] used BanglaLekha-Isolated dataset [5] to recognize Bengali numerals, vowels, consonant and compound characters. They used a two-layer convolutional neural network in their research and achieved 98.66% accuracy on numerals (10 classes), 94.99% accuracy on vowels (11 classes), 91.60% accuracy on compound letters (20 classes), 91.23% accuracy on alphabets (50 classes), and 89.93% accuracy on whole dataset which contains almost all Bengali characters (80-character classes)

There is another research [6], where they have used BanglaLekha-Isolated, CMATERdb and the ISI [7] dataset to train a convolutional neural network. They created a 13 layer convolutional neural network with 2 sublayer and used several data augmentation technique in their research and achieved an validation accuracy of 98%, 96.81%, 95.71% and 96.40% respectively on CMATERdb, ISI, BanglaLekha-Isolated dataset and mixed dataset.

# Proposed method

In my proposed idea I am aiming to use the BanglaLekha-Isolated dataset which contains 84 different Bengali characters comprising of 50 Bengali alphabets, 10 Bengali numerals and 24 compound letters. The entire dataset consists of 166,106 handwritten Bengali character which was collected by 2000 individual person.

I will build a novel convolutional architecture which will outperform all the previous research associated with Bengali handwritten digit recognition using convolutional neural network. I will use different image pre-processing and image augmentation technique to get a better accuracy on the dataset. If needed, I will use transfer learning strategy to this dataset.

# Future plan

## Week 3 [Jan 28 - Feb 3]

#### Investigate more relevant researches for this topic.

## Week 4 [Feb 4 – Feb 10]

Dataset analyzing and pre-processing.

## Week 5 [Feb 11 – Feb 17]

Implementing the pipeline to train a convolutional neural network

## Week 6 [Feb 18 – Feb 24] Playing with different convolutional neural network architecture.

## Week 7 [Feb 25 – March 3] Playing with different convolutional neural network architecture.

## Week 8 [March 4 – March 10] Compare previously trained convolutional network for a performance analysis

## Week 9 [March 11 – March 17] Train a final convolutional neural network

## Week 10 [March 18 – March 24] Create different graphs and charts for the final presentation

## Week 11 [March 25 – March 31]

Prepare the final presentation slide.

##### References

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