

Bangla Handwritten Mathematical Expression Recognition

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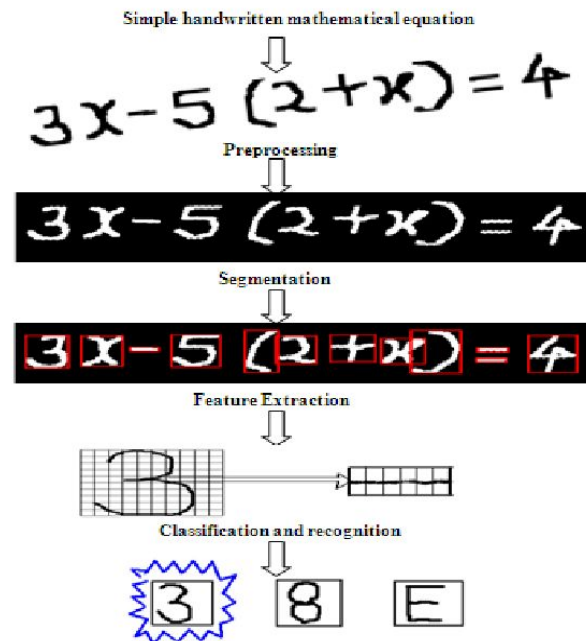
- ❑ Introduction
- ❑ Why this Work?
- ❑ Related works
- ❑ Methodology
- ❑ Result and Discussion
- ❑ Conclusion

Agenda

Introduction

Handwritten digits and symbols are challenging to recognise for their **diverse shapes and sizes**.

Here is an example of english script:



- ❑ We aim to address the absence of comprehensive works for Bangla Script providing more large and diverse datasets

Why this work?

Educational support

Empowering students and educators with accurate recognition for effortless learning

Limited Bengali Studies

Address the scarcity of research in Bengali script, especially in mathematical expression recognition

Language Gap

Bridging language-specific challenges in recognizing complex mathematical symbols

Related works

01

OCR-Based Papers

- Multilingual focus
- Neglects complex characters

02

Digit Recognition Based Papers

- Style Diversity
- Limited to Digits

03

Handwritten Expression Recognition Papers

- Complex symbol handling
- Limited Bengali Research

Methodology

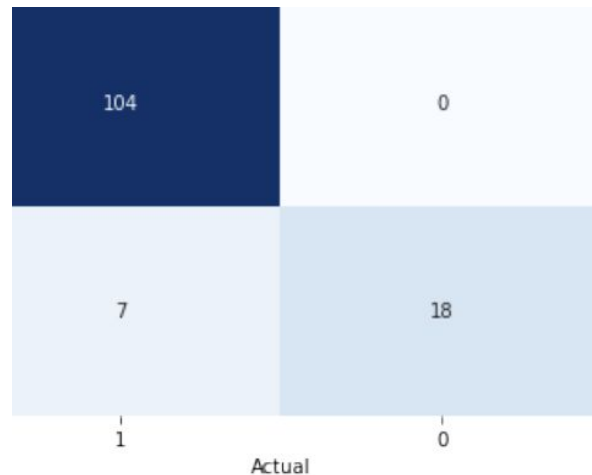
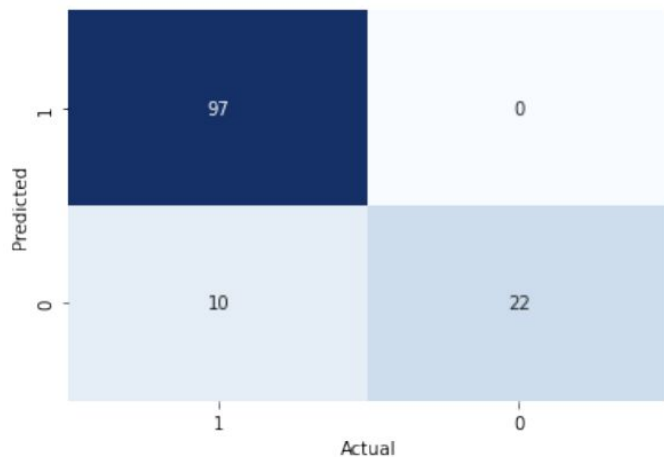
- 01 Data Collection** Added more collected around 5000 bangla handwritten digits and symbols
- 02 Data Preprocessing**
 - Eliminated noise and ensured quality
 - Shuffled and split into training and validation subsets
- 03 Workspace detection** Identified valid rectangular boxes in scanned worksheets
- 04 Analysis Module** Detected, localized and analysed characters
- 05 Character Recognise** Utilized **DCCNN** (Deep Columnar Convolutional Neural Network)
 - Model trained for many epochs with data augmentation

Results and Discussion

Performance metrics

Accuracy, Precision,
Recall, F1 score

Model	Accuracy	Precision	Recall	F1 score
CNN	92.25	1	0.9065	0.9510
ResNet-18	94.27	1	0.9369	0.9674



- ❑ **An approach for accurate symbol recognition**
- ❑ **Has Educational & Real-World Impact**
- ❑ **Accuracy may decrease with unclear or closely spaced expressions**
- ❑ **Has potential future research opportunities**

Conclusion



Thank You