Bangladesh Army University of Science and Technology (BAUST), Saidpur

Department of Computer Science and Engineering (CSE)

Course Title: Machine Learning Sessional

Course Code: CSE 4140

Project Title: Hand written Bangla Digit recognition System

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Hand Written Bangla Digit Recognition System

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Introduction

- Bangla digit recognition is challenging due to writing variations.
- CNNs improve accuracy by learning features automatically.

Problem Statement

- Traditional ML methods struggle with handwriting variations.
- Goal: Build a robust CNN-based Bangla digit recognition system.

Objectives

- To develop a CNN-based model for handwritten Bangla digit recognition.
- To preprocess and prepare the dataset for optimal model training.
- To evaluate model performance using standard metrics such as accuracy and F1-score.
- To create a reliable system suitable for real-world applications.

Methodology

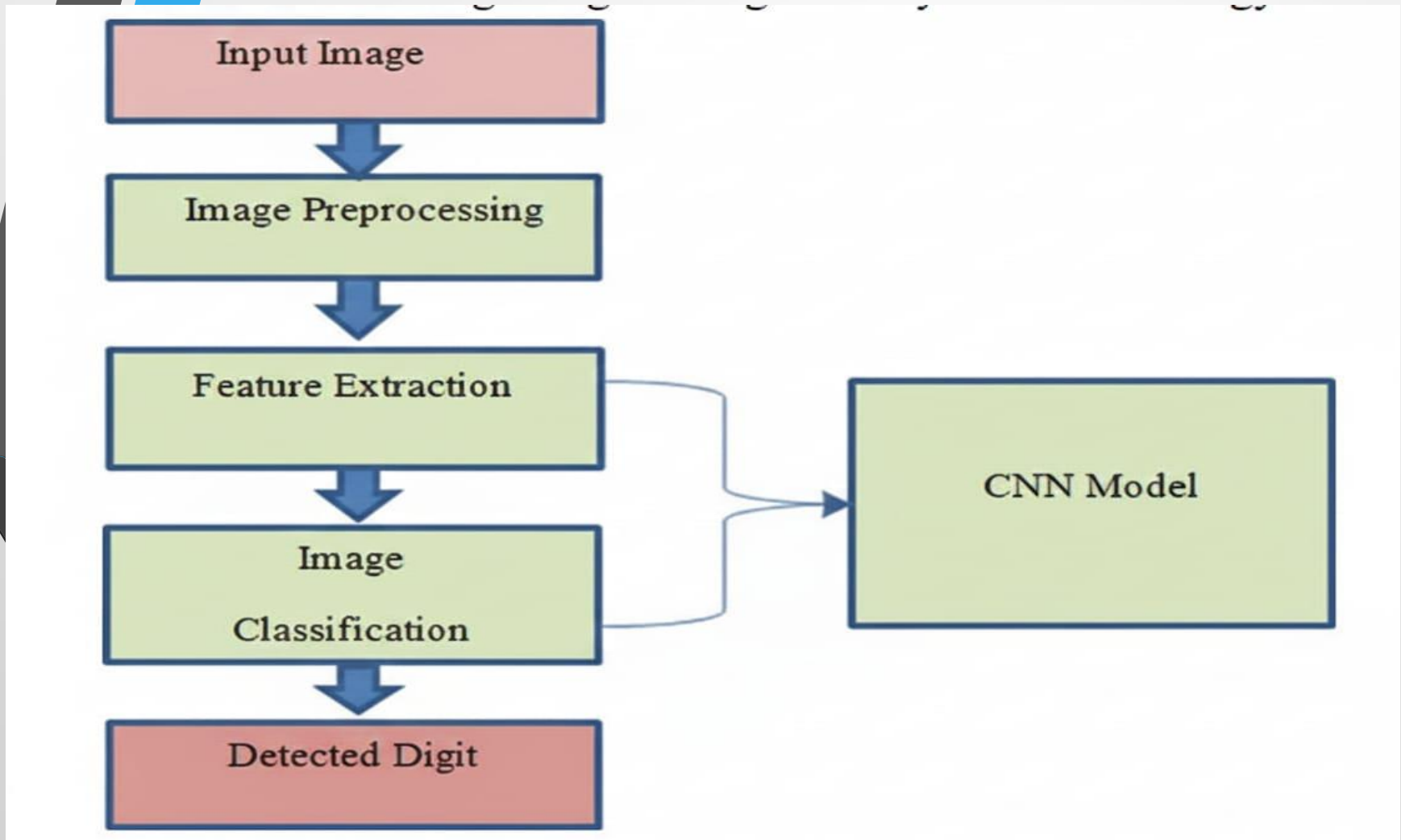


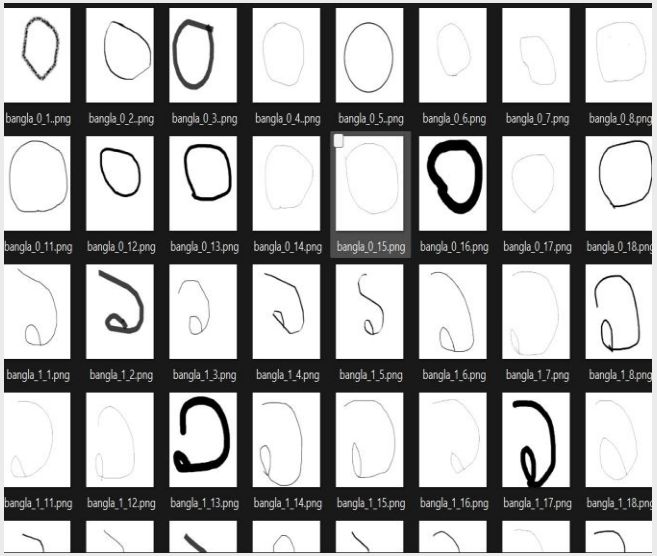
Fig :Hand Written Bangla Digit Recognition System

Dataset Description

We have used our own dataset-10 different Bangla handwritten digits.

Each folders contain an equal

number of simple images.



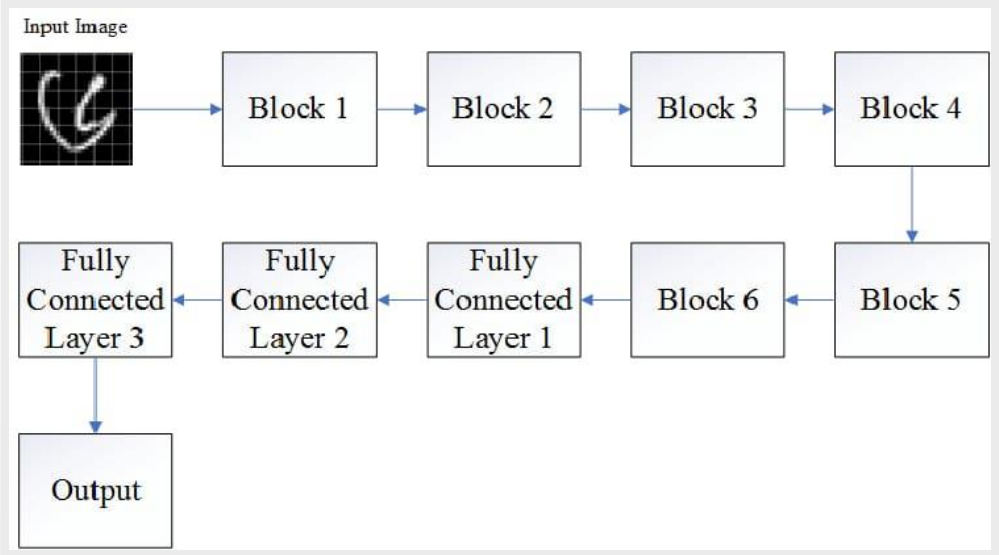
Preprocessing Steps

Grayscale conversion, normalization, resizing (28x28).

Noise removal, thresholding, augmentation.

CNN Architecture

- Conv layers with ReLU, max-pooling.
- Dense layers and Softmax output for 10 classes.



Training Details

- Batch size: 64, Epochs: 30, LR: 0.001
- Optimizer: Adam, Loss: Categorical Cross-Entropy

Results

- Achieved 95%+ accuracy.
- Confusion mainly between visually similar digits.

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Cross-Validation Summary:
Mean Accuracy: 0.3350 (+/- 0.1700)

Average Classification Report:
o (0):
  Precision: 0.1111
  Recall: 0.1500
  F1-score: 0.1187
o (1):
  Precision: 0.3524
  Recall: 0.2500
  F1-score: 0.2462
o (2):
  Precision: 0.4333
  Recall: 0.4000
  F1-score: 0.4143
o (3):
  Precision: 0.1515
  Recall: 0.4500
  F1-score: 0.1983
o (4):
  Precision: 0.5000
  Recall: 0.3000
  F1-score: 0.3410
o (5):
  Precision: 0.1667
  Recall: 0.1000
  F1-score: 0.1238
o (6):
  Precision: 0.1667
  Recall: 0.2000
  F1-score: 0.1771
o (7):
  Precision: 0.4600
  Recall: 0.6000
  F1-score: 0.4978
o (8):
  Precision: 0.3683
  Recall: 0.5500
  F1-score: 0.4378
o (9):
  Precision: 0.2557
  Recall: 0.3500
  F1-score: 0.2924
```

Future Work

- Extend to full Bangla character recognition.
- Use advanced architectures or ensembles.
- Deploy on mobile/embedded devices.

Conclusion

- The CNN model achieved strong accuracy in recognizing handwritten Bangla digits.
- Preprocessing and optimized hyperparameters improved overall performance.
- The system is reliable and can be expanded for larger character sets.

References

[1] S. Islam and M. Hasan, ”Bangla handwritten digit recognition using

CNN,” IEEE Access, vol. 7, pp. 12094–12103, 2020.

[2] C. K. Roy et al., ”NumtaDB: Bangla handwritten digit dataset,” Journal

of Computer Vision, vol. 5, no. 2, pp. 55–65, 2018.

[3] I. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. MIT Press

Thank you