

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
BANGLADESH ARMY UNIVERSITY OF SCIENCE & TECHNOLOGY (BAUST)
SAIDPUR CANTONMENT, NILPHAMARI

(Project/Thesis Proposal)

Application for the approval of B.Sc. Engineering Project/Thesis
(Computer Science & Engineering)

Session:

Date: January 28, 2024

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4. Name of the Department : Computer Science & Engineering
Program : B.Sc. Engineering

**5. Date of First Enrolment
in the Program :** January 28, 2024

6. Tentative Title : Air written Bangla number classification using Deep Learning

7. Introduction

Bangla digits form the numerical system integral to the Bengali script, representing the numeric values from 0 to 9. Embedded within the linguistic and cultural fabric of the Bengali language, these digits hold significance beyond their quantitative utility. The shapes and patterns of Bangla digits contribute to the script's visual appeal and cultural identity. In everyday life, these digits find application in diverse contexts, from arithmetic to digital communication. Understanding Bangla digits not only facilitates numerical comprehension but also enriches the appreciation of the script's historical and cultural context. In this exploration, we delve into the distinct characteristics and practical implications of Bangla digits, unraveling their role in the linguistic landscape of the Bengali-speaking community.

As the seventh most spoken language globally, Bangla presents a unique challenge in the realm of handwritten digit recognition, particularly when it comes to air-written numerals.

Unlike Latin-based digits, intricate Bangla script and the dynamic nature of air writing pose significant obstacles. This thesis proposal aims to tackle these challenges by developing robust and accurate methods for classifying air-written Bangla numbers.

8. Background and Present State of the Problem

Background: In the rapidly advancing field of machine learning and computer vision, handwritten character recognition has been a persistent challenge. Focusing on Bangla numerals, this study introduces a distinctive element— "air writing," where characters are traced in the air through hand movements. Unlike traditional methods reliant on static images, air writing adds a dynamic and expressive layer to character creation.

The traditional approaches to recognizing Bangla numerals primarily involve static datasets, which might not adequately capture the variability introduced by air writing. This dynamic form of expression presents a unique challenge due to the diversity in strokes and movements, demanding a novel approach to classification.

Present State: As of the present state, the existing models for recognizing Bangla numerals are primarily designed for static datasets, lacking the adaptability needed for the dynamic nature of air writing. Convolutional Neural Networks (CNNs), known for their effectiveness in static character recognition, are being explored for Bangla numerals. However, applying CNNs to the continuous and dynamic nature of air writing presents a set of challenges related to temporal aspects and continuous motion.

This study aims to bridge this gap by developing CNNs tailored to the temporal dynamics of air writing. The goal is to create a model that can effectively classify Bangla numerals in the dynamic and continuous context of air writing, contributing to the broader field of character recognition and preserving linguistic heritage in a modern technological landscape. This text is for citation [?].

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9. Objective with Specific Aims and Possible Outcome

The creation and implementation of a machine learning-based system that is able to detect Bangla Digit from air written is the primary objective of this Thesis. The following are specific goals and potential outcomes:

- To built a model that can detect air written Bangla digit more efficiently.
- Analyzing the accuracy and performance of the model under a variety of conditions

10. Outline of Methodology Design

The methodology design will involve a combination of data collection and preprocessing, CNN-based Bangla Digit image classification, analysis and optimization of the proposed system, and real-world applications and deployment. Here is an outline of the methodology design for this Bangla Digit Image classification research:

- **Collecting Data:** Gathering a different dataset of pictures containing people with and without facial coverings. The dataset will be divided into training, validation, and testing sets.
- **Data preparation:** Preparing the dataset for model training by cleaning, adding annotations, and expanding it.
- **Choosing a Model:** We choose different types of pre-trained model and compare between them

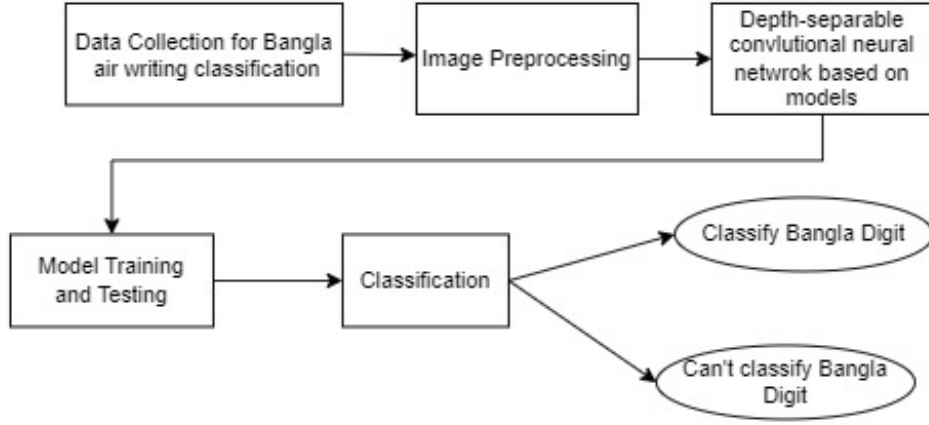


Figure 1: Workflow

11. Resources Required to Accomplish the Task

1. Air Writing Bangla Number Dataset:

- A diverse dataset capturing various hand movements in the air for each Bangla numeral
- A diverse dataset capturing various hand movements in the air for each Bangla numeral.
- Annotated dataset indicating the corresponding labels for each air-written Bangla numeral.
- Ensure diversity in writing styles, speeds, and variations to make the model robust.

2. Hardware Resources:

- High-performance GPUs for efficient training of deep learning models. GPUs significantly accelerate the training process.
- Sufficient RAM to handle the computational requirements during training and evaluation.

3. Software Libraries and Tools:

- Python: The primary programming language for machine learning projects.
- TensorFlow or PyTorch: Deep learning frameworks to build and train neural network models. TensorFlow has extensive community support and is widely used.
- OpenCV: For image processing tasks, especially if preprocessing or augmentation of the air-written Bangla numeral images is required.
- NumPy: Fundamental package for scientific computing with Python, often used for numerical operations in machine learning.

4. Data Preprocessing and Augmentation:

- Implement data preprocessing techniques to enhance the quality of the dataset.
- Augmentation methods like rotation, scaling, and flipping to introduce variability and improve model generalization.

5. Convolutional Neural Network (CNN) Architecture:

- Design a CNN architecture suitable for sequential data, capturing the temporal aspects of air writing.
- Layers like Convolutional Layers, LSTM (Long Short-Term Memory) or GRU (Gated Recurrent Unit) layers for sequential modeling.

12. References

- [1] C. Saha, “Real time bangla digit recognition through hand gestures on air using deep learning and opencv,” *International Journal of Current Science Research and Review*, 2022.
- [2] H. Mahmud, R. Islam, and M. K. Hasan, “On-air english capital alphabet (eca) recognition using depth information,” *The Visual Computer*, vol. 38, no. 3, pp. 1015–1025, 2022.
- [3] S. Ismail, “Air writing for bangla digits and alphabets using android device.”

[1] [2] [3]

13. Cost Estimation

- (a) **Cost of Materials:**
- (b) **Cost of Repot Printing and Binding:**
- (c) **Others:**

14. Committee for Advance Studies and Research (CASR)

Meeting No:

Resolution No:

Date:

15. Number of Under-Graduate Students Working with the Supervisor at Present:

12

Signature of the Students	Department of CSE
• •	• _____
• • •	Signature of the Supervisor Signature of the Co-Supervisor (if applicable)
• •	• _____
• •	Signature of the Head of the Department