Sri Lanka Institute of Information Technology

Faculty of Computing
IT2011 – Artificial Intelligence and Machine Learning
Year 2 Semester 1

Progress Review and Evaluation

Group ID: 2025-Y2-S1-MLB-B1G2-07

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Project Overview

Objective

> The project aims to bridge communication gaps between the hearing-impaired community and non-signers by developing a real-time sign language detection system using machine learning.

Dataset Summary

> **Name**: **Sign Language Digits Dataset**
> **Source**: https://www.kaggle.com/datasets/ardamavi/sign-language-digits-dataset
> **Type**: Image dataset (Computer Vision)
> **Records**: 2,062 labeled images
> **Features**: 64×64 grayscale pixels
> **Target Variable**: 10 classes (digits 0–9 in sign language)
> **Distribution**: ~204–208 images per class (balanced)

Dataset details

Type	Images
Samples	2062 samples
Features	10 variables

Structure:

- Images are organized into **10 folders**, one for each digit (0–9).
- Each folder contains ~204–208 images of that sign gesture.

Image Format:

- Size: **64×64 pixels**
- Mode: **Grayscale (1 channel)**
- File format: `.png`

Data Quality:

- Balanced dataset (almost equal samples per class).
- Clear and consistent labeling.

Group Members Roles

Member 1 –Remove unreadable images

IT24104081
Gurusingha R.N

Duplicate images were identified and removed, resulting in a final clean dataset of **2,062 images**.

Member 2 – Auto annotation

IT23379138
Rajamuni R.D.V.R

We used **MediaPipe Hands** to automatically detect bounding boxes for the sign gestures in our dataset.

- The model scans each image and extracts the **normalized bounding box coordinates** around the hand (x1n, y1n, x2n, y2n).
- Results are saved into a CSV file (bboxes_auto.csv) containing the image path, class label, and bounding box coordinates.
- **Detection Results**:
  - **Detected**: 1,717 images
  - **Missed**: 345 images (**16.7%**)
- Warnings shown during execution were only library deprecation notices and do not affect the results.

Member 3 - Hand Cropping & Resizing

IT24610827
Lahiruni K.L.M

To standardize inputs for training, we cropped the detected **hand regions** from each image and resized them to a fixed **128×128 resolution** using square bounding boxes with letterboxing.

- Each cropped image was saved into class-specific folders (crops_128/0, crops_128/1, …).
- A total of **1,717 cropped hand images** were successfully generated.
- This ensures the model trains only on the **relevant hand area**, reducing background noise and improving recognition accuracy.

Member 4 – Quality filtering

IT24104068
Chandrasiri R.M.D.S

To improve dataset reliability, we applied **quality checks** on the cropped hand images:

- **Blurry images** were detected using the Laplacian variance method.
- **Too dark images** were filtered out using a brightness threshold.
- Only clear and well-lit images were kept.

Output:

- **Kept**: 1,716 images
- **Dropped**: 1 low-quality image
- Final clean dataset saved in: `crops_128_clean/`

This ensures that the model is trained only on **high-quality samples**, leading to better accuracy and generalization.

Member 5 - Train/Validation/Test Split

IT24104110
Thulmanthi W.A.S

To prepare the dataset for model training, we performed a **stratified split** to maintain class balance across subsets:

- **Training set**: 1,372 images (80%)
- **Validation set**: 172 images (10%)
- **Test set**: 172 images (10%)
- Distribution per class remains consistent, ensuring fair evaluation.

The splits were saved as CSV files (`train.csv`, `val.csv`, `test.csv`) for easy loading during training.

Member 6 - Outlier Detection

IT24104133
Vaaranan J

We performed an **outlier check** based on image aspect ratios to ensure consistency across the dataset.

- Images with extreme aspect ratios were considered potential outliers.
- After evaluation, **0 outliers were removed**, confirming the dataset was already clean and balanced.

Noted - We shared the same Jupyter Notebook Files to preprocess the dataset and members parts are divided by comment from their IT number and name.