# Sign Language MNIST Classification - Detailed Documentation

This project demonstrates how to classify American Sign Language (ASL) alphabets using deep learning.   
It uses the Sign Language MNIST dataset and implements a fully connected neural network using TensorFlow and Keras.

## Overview

The purpose of this project is to recognize hand gestures representing ASL alphabets (A–Y, excluding J and Z)   
using a neural network model. It showcases preprocessing, model training, and evaluation in a structured pipeline.

## Dataset

The dataset used is Sign Language MNIST, which contains grayscale images (28×28 pixels) of hand gestures labeled   
according to ASL alphabets. The dataset includes 27,455 training samples and 7,172 testing samples.

Files: sign\_mnist\_train.csv, sign\_mnist\_test.csv

## Model Architecture

The model is built using TensorFlow’s Sequential API and consists of three fully connected layers:  
- Dense(128, activation='relu', input\_shape=(784,))  
- Dense(64, activation='relu')  
- Dense(24, activation='softmax')  
  
The model uses Adam optimizer with sparse\_categorical\_crossentropy loss and tracks accuracy as a metric.

## Training Configuration

- Epochs: 20  
- Batch size: 128  
- Training accuracy: ~78%  
- Testing accuracy: ~75%

## Installation

To install the required dependencies:  
 pip install tensorflow numpy pandas matplotlib scikit-learn

## How to Run

1. Clone the GitHub repository.  
2. Open 'SL\_MNIST.ipynb' in Jupyter Notebook or VSCode.  
3. Run all cells sequentially to preprocess, train, and evaluate the model.

## Results

The model achieved approximately 75% accuracy on the test set. Accuracy and loss can be visualized using matplotlib.

## Future Work

- Integrate CNN for higher accuracy.  
- Implement real-time recognition using webcam (OpenCV + TensorFlow).  
- Add motion gestures (J, Z).  
- Create a web-based interface with Flask or Streamlit.

## References

- Sign Language MNIST Dataset (Kaggle)  
- TensorFlow Documentation  
- Keras API Reference

## Author & License

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