SpringfieldVision: Machine and Deep Learning for Simpsons Character Classification

Problem Statement

- The goal of this project is to develop a machine learning and deep learning pipeline to classify images of characters from The Simpsons TV show. Using a dataset of labeled images featuring five characters—Abraham Grampa Simpson, Bart Simpson, Homer Simpson, Lisa Simpson, and Marge Simpson—this project aims to create accurate models that can distinguish between these characters.

Methodology

Two types of models were implemented:

Artificial Neural Network (ANN): The ANN consisted of fully connected layers with dropout for regularization and a softmax activation function for classification. Designed to serve as a baseline model for comparison with more complex architectures.

Convolutional Neural Network (CNN): The CNN architecture used convolutional layers, max pooling, batch normalization, and dropout layers to capture spatial patterns in the images. The CNN was chosen for its superior ability to handle image data and achieve higher accuracy.

Model Training: Both models were trained using: Adam optimizer for efficient gradient updates. Loss functions: Categorical Crossentropy for one-hot encoded labels. Sparse Categorical Crossentropy for integer labels in some experiments. Accuracy was used as the primary evaluation metric during training and validation.

Evaluation Metrics:

Loss and Accuracy Graphs: Monitored training and validation performance over epochs to detect overfitting or underfitting.

Confusion Matrix: Provided insights into class-specific performance, highlighting misclassifications and model bias toward specific classes (e.g., Homer Simpson).

Mean Absolute Error (MAE): Used for additional evaluation of prediction precision.