Playing Card Classification Project

Introduction

The goal of this project is to develop an artificial intelligence model that can recognize and classify images of various playing cards. The primary objective is to achieve the highest classification performance by applying different machine learning and deep learning techniques in the field of computer vision. For this purpose, traditional machine learning algorithms like K-Nearest Neighbors (KNN) and Gaussian Naive Bayes (GNB), as well as deep learning methods such as Convolutional Neural Networks (CNN), have been utilized.

Method

The methods used in this project can be categorized into two main sections: traditional machine learning and deep learning.

Traditional Machine Learning Methods

- **K-Nearest Neighbors (KNN)**: This algorithm classifies based on the neighborhood relations. Each example in the training dataset is classified according to a specified number of neighbors.
- **Gaussian Naive Bayes (GNB)**: A version of the Naive Bayes algorithm that operates under the assumption that the features of each class are normally distributed.

Deep Learning Method

- **Convolutional Neural Network (CNN)**: A deep learning model commonly used for high accuracy in image data. The CNN model used in this project consists of two convolutional layers, max pooling layers, and dense (fully connected) layers. This structure extracts important features from the image to perform the classification.

Data Processing and Model Training

1. **Data Preparation**: The dataset, downloaded from Kaggle, is divided into training, test, and validation sets. Each image is 60x60 pixels in size and has three color channels.
2. **Dataset Loading**: The dataset is loaded and resized using TensorFlow's image_dataset_from_directory function.
3. **Data Preprocessing**: For the CNN model, images are normalized so that pixel values range from 0 to 1.
4. **Model Training**: Images are flattened and converted to numpy arrays for KNN and GNB models. The CNN model is trained with optimized dataset loading.

Dataset Information

The dataset used contains images of playing cards belonging to 53 different classes:

- **Training Set**: 7624 images
- **Test Set**: 265 images
- **Validation Set**: 265 images

Each class represents a different playing card, categorized by type and suit (e.g., 'ace of clubs', 'king of hearts').

Experimental Results

The results obtained in this project are as follows:

Traditional Machine Learning Models

- **K-Nearest Neighbors (KNN)**:
  - Test Accuracy: 36.98%
- **Gaussian Naive Bayes (GNB)**:
  - Test Accuracy: 23.02%

Deep Learning Model (CNN)

- **Training Set Accuracy**: 96.29%
- **Validation Set Accuracy**: 73.58%

The loss and accuracy values during the training process of the CNN model:

Discussion

The results indicate that the deep learning-based CNN model has significantly higher accuracy rates compared to traditional machine learning models. This highlights the superior capability of CNN models in processing image data. CNN models demonstrate better performance especially in high-dimensional and complex datasets compared to traditional methods. Moreover, accuracy rates can be further improved with more data and advanced model configurations.