Project Overview

The project involves developing a Convolutional Neural Network (CNN) model for age and gender prediction based on facial images. The model takes an image as input and predicts the age and gender of the person in the image.

Data Preparation

The data used in this project is a CSV file containing pixel values of images and corresponding age and gender labels. The ‘pixels’ column, which contains pixel values of images in string format, is converted into a numpy array of float32 type. The data is then reshaped to match the size of the images, which is 48x48 pixels with 1 channel (grayscale). The ‘age’ and ‘gender’ columns are set as target variables for different models.

The dataset is split into training and testing sets, with 80% of the data used for training and 20% for testing. The training data is further split into training and validation sets, with 90% of the data used for training and 10% for validation.

Model Architecture

Two models are developed in this project:

1. **Gender Prediction Model**: This model is a CNN composed of several layers including Conv2D for convolution, MaxPool2D for max pooling, BatchNormalization for batch normalization, Dropout for dropout, Flatten to flatten the input, and Dense for fully connected layers. The final layer uses a softmax activation function for binary classification (male or female).
2. **Age Prediction Model**: This model is also a CNN with a similar architecture to the gender prediction model. However, the final layer uses a ReLU activation function to predict a continuous variable (age).

Training

The models are trained using the Adam optimizer and a learning rate of 0.0001. The gender prediction model uses categorical cross-entropy as the loss function, while the age prediction model uses mean squared error. Both models use ImageDataGenerator for data augmentation, which includes techniques such as rotation, zooming, and shifting. This helps to increase the diversity of data available for training models, without actually collecting new data.

Evaluation

The models are evaluated on the test set. The gender prediction model is evaluated using accuracy as the metric, while the age prediction model is evaluated using mean absolute error (MAE).

Visualization

Several visualization techniques are suggested for better understanding of the models:

1. **Class Activation Maps (CAMs)**: Visualize which regions in the image were relevant to making the classification decision.
2. **Prediction Error Analysis**: Plot the errors (difference between predicted and actual values) to understand the models' performance.

Conclusion

This project demonstrates the application of Convolutional Neural Networks in predicting age and gender from facial images. The models show promising results, but there is room for improvement. Future work could explore different model architectures, hyperparameter tuning, or use of a larger or more diverse dataset.