Face Mask Detection

Introduction

The goal of this project was to develop a deep learning model capable of detecting whether a person is wearing a mask or not. The model was built using the MobileNetV2 architecture as a feature extractor, with a custom classifier trained on top of it. The dataset was preprocessed with data augmentation techniques to enhance model generalization, and the model was trained and evaluated using various performance metrics.

Data Preprocessing and Augmentation

To improve model robustness and reduce overfitting, data augmentation was performed on the training data using the `ImageDataGenerator` class. The following transformations were applied:

Rescaling: Normalized pixel values by scaling them between 0 and 1.

Rotation: Random rotations up to 20 degrees.

Zooming: Random zoom within a 15% range.

Width and Height Shifts: Random translations up to 20%.

Shearing: Shear transformation within a 15% range.

Horizontal Flipping: Random horizontal flips.

Fill Mode: Used nearest-neighbor interpolation for missing pixels after transformation.

The validation and test datasets were only rescaled without augmentation to ensure consistency during evaluation.

Model Architecture

The model utilized the MobileNetV2 network, pre-trained on ImageNet, as a feature extractor. The top fully connected layers were removed, and a custom classification head was added. The classifier consisted of:

- **AveragePooling2D** layer to reduce dimensionality.
- **Flatten** layer to convert the feature maps into a 1D vector.
- **Dense** layer with 128 neurons and ReLU activation.
- **Dropout** layer (0.5) to reduce overfitting.

- **Output Dense** layer with a single neuron and sigmoid activation for binary classification.

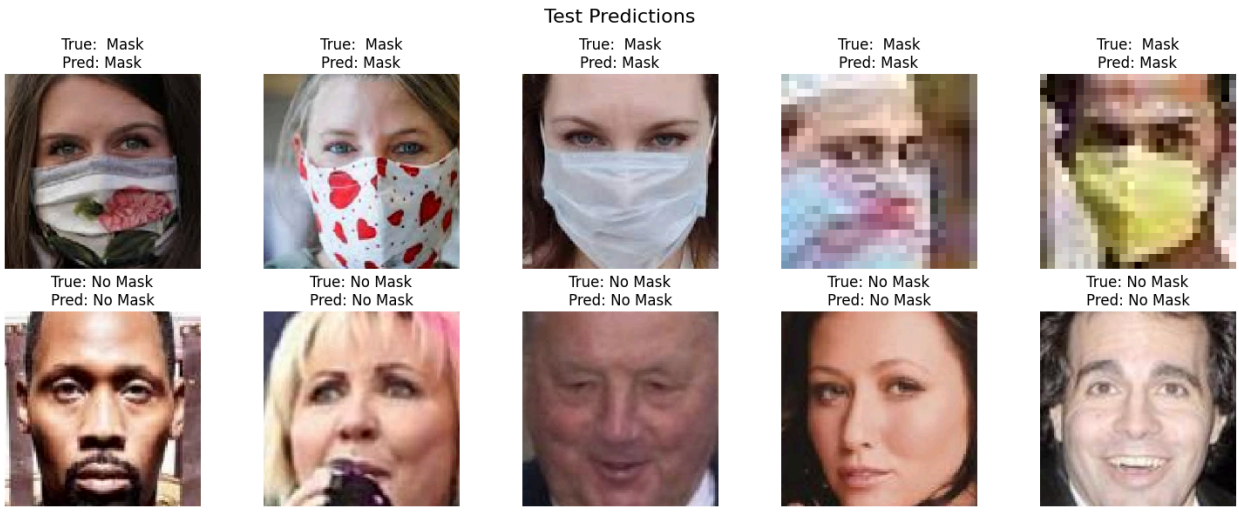
Training and Evaluation

The model was trained using the following settings:

- **Batch size**: Defined dynamically for training, validation, and test generators.
- **Epochs**: 10
- **Early Stopping**: Implemented to halt training if validation loss did not improve for 5 consecutive epochs.

Results

The model performed exceptionally well in distinguishing individuals wearing and not wearing masks, achieving an accuracy of 99.29%, as shown in the image below.



However, some limitations were observed. When testing the model on my own picture without a mask, it was misclassified as wearing one. To investigate further, I conducted additional experiments using pictures of my friends, both with and without masks. In these cases, the model performed correctly, indicating that the issue might be specific to certain features in my image.

Upon closer examination, it appears that the model struggles with differentiating between **hijabs and face masks**. Since hijabs cover a portion of the lower face, the model may be interpreting the fabric as a mask, leading to incorrect classifications. This suggests a potential **bias in the training data**, where the model was likely exposed to a limited variety of head coverings, causing it to misinterpret similar visual patterns.

Wrong Prediction (Because Of Hijab)	Correct Predictions