Face translation using CycleGAN

1. Introduction

This project focuses on a deep learning model to translate human faces to animal faces, and vice-versa, using a **Cycle-Consistent Generative Adversarial Network (CycleGAN)**. The goal is to generate realistic images of a target domain without requiring paired training data (e.g., an image of a person and the corresponding image of that person as an animal). This approach addresses the challenge of creating a meaningful mapping between two distinct image domains.

2. Methodology

The core of this project is the implementation of a CycleGAN model using the **Keras and TensorFlow libraries**.

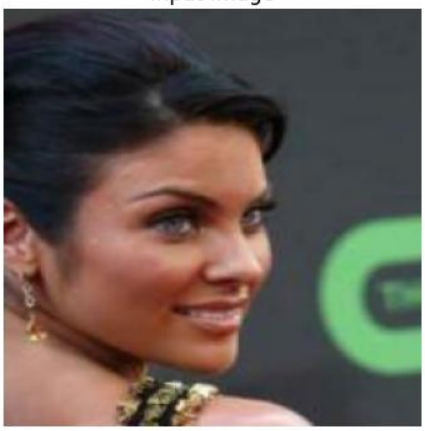
The methodology includes:

- **Data Preparation**: The notebook prepares a dataset of human faces and a dataset of animal faces. Human faces are sourced from the **CelebA and UTK Face Cropped datasets**, while animal faces come from a "cat_dog" dataset. These datasets are unzipped, organized into "humans" and "animals" folders, and then loaded using tf.keras.preprocessing.image_dataset_from_directory.
- **Data Preprocessing**: The images are preprocessed to be suitable for model training. This includes resizing them to 256x256 pixels, performing random horizontal flips for data augmentation, and normalizing the pixel values to a range of [-1, 1].
- **Model Architecture**: The CycleGAN model is constructed with two generators (one for humans to animals, one for animals to humans) and two discriminators (one for human images, one for animal images).
- **Training**: The model is trained on the prepared human and animal face datasets. The training process involves optimizing the adversarial loss (to make the generated images realistic) and cycle-consistency loss (to ensure the model can translate an image back to its original state).

3. Results

The notebook demonstrates the model's ability to translate faces. A visualization shows a set of input images and their corresponding translated outputs. Specifically, four human face images are translated into the style of animal faces.

Input image



Translated image

Input image

Translated image

Input image

Translated image

Input image

Translated image

4. Key Findings & Discussion

- **Unpaired Image Translation**: The project successfully demonstrates the effectiveness of the CycleGAN architecture for unpaired image-to-image translation between human and animal faces.
- **Visual Quality**: The translated images retain the core features of the original subjects while convincingly adopting the facial characteristics of the target animal.
- **Model Application**: The notebook provides a complete and reproducible workflow for building and training a CycleGAN model for face translation, which could be extended to other image-to-image translation tasks.

5. Conclusion

This project provides a clear and practical example of implementing a CycleGAN for face translation. The model effectively learns the mapping between human and animal faces, offering a robust solution for unpaired image translation problems in computer vision. Future work could involve training with a larger variety of animal faces or different image sizes to further enhance the model's performance and generalization.