AI 2024, Assignment 6:

Diffusion Models

In this assignment, you will explore the use of Diffusion models to generate and transform images based on the "Face of Pixiv Top Daily Illustration 2020" dataset. Diffusion models are generative models that iteratively add and remove noise from data, allowing for realistic image synthesis.

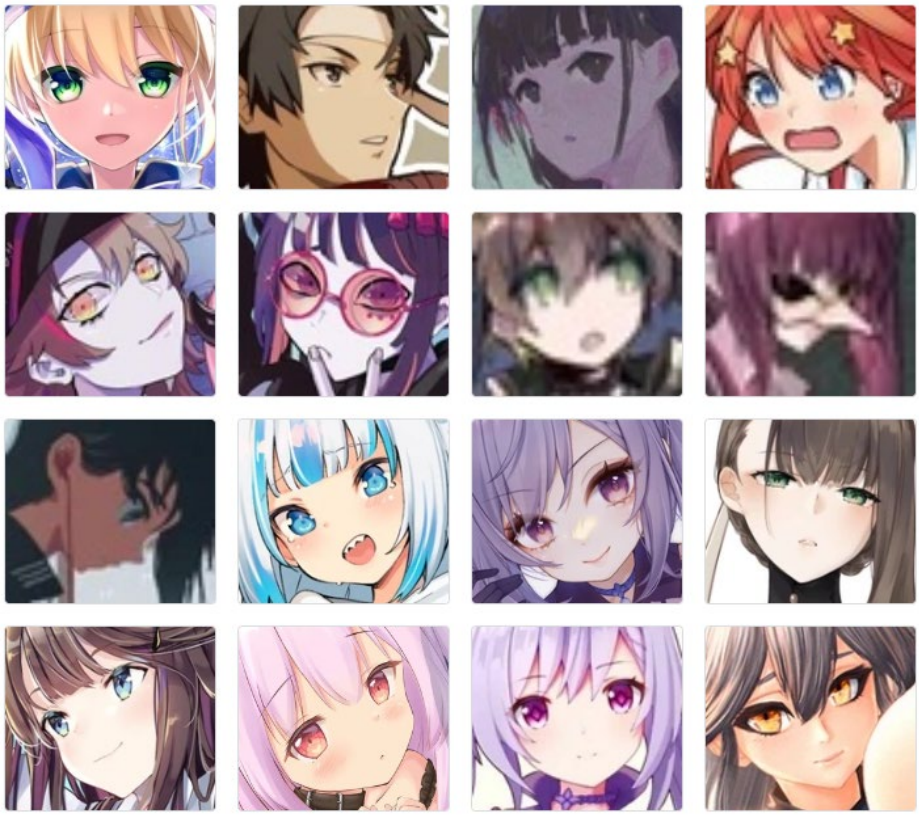
What are Diffusion Models?

Diffusion models are probabilistic generative models that gradually corrupt data by adding noise and then learn to reverse the corruption. Once trained, the model can generate new images from random noise, producing high-quality, diverse samples. Diffusion models consist of two main phases:

1. Forward Diffusion: Incrementally adds noise to the data over several steps until it becomes indistinguishable from random noise.
2. Reverse Process: The model learns to remove noise at each step, recovering the original data or generating new data from pure noise.

Face of Pixiv Top Daily Illustration 2020

https://www.kaggle.com/datasets/stevenevan99/face-of-pixiv-top-daily-illustration-2020



Dataset Overview:

The "Face of Pixiv Top Daily Illustration 2020" dataset contains top-rated illustrations from Pixiv in 2020, focusing on facial illustrations. The dataset includes a variety of artistic styles and features, making it ideal for training diffusion models for high-quality image generation and transformation tasks.

Task Requirements:

1. Model Design: Implement a Diffusion model using TensorFlow or PyTorch to generate facial illustrations based on the Pixiv dataset.
2. Data Preprocessing: Load and preprocess the images, including resizing, normalizing, and noise addition.
3. Training: Train the Diffusion model to progressively denoise the images, adjusting hyperparameters like noise schedule and learning rate.
4. Evaluation: Evaluate the model's generated images by comparing the quality and style fidelity to the original Pixiv illustrations.
5. Visualization: Visualize the noise-removal process and the final generated illustrations, and plot the training loss curves.

Deliverables:

1. Code Implementation: Submit the Diffusion model code with relevant comments.
2. Report: Include a detailed report discussing the model performance, challenges encountered, and quality of generated images.
3. Visualizations: Provide charts of loss curves and sample images generated at various noise-removal stages.