Assignment 1: Custom LoRA Training and Analysis (20 marks)

Train custom LoRA adapters on Stable Diffusion v1.5 and analyse rank parameter effects.

Dataset Selection

Choose **ONE** of the following datasets:

1. **AFHQ Animal Faces**
   - **Source**: AFHQ on Kaggle
   - **Content**: high-quality animal faces at consistent 512×512 (Select one category)
2. **Cartoon Images with Captions**
   - **Source**: `Norod78/cartoon-blip-captions`
   - **Content**: Cartoon/animated images with BLIP-generated captions
3. **Microsoft Fluent UI Emojis**
   - **Source**: `Norod78/microsoft-fluentui-emoji-512-whitebg`
   - **Content**: Microsoft's Fluent UI emoji set at 512×512 with white backgrounds

Part 1: Implementation (10 marks)

- Implement LoRA training pipeline from scratch (build on Exercise 3)
- Train LoRA models with ranks from this selection: `r=4`, `r=16`, `r=32`, `r=64` (choose at least 2)
- Use data from your chosen dataset (minimum 500 images)
- Document all hyperparameters used

Part 2: Analysis (8 marks)

- Generate 50 images per rank and evaluate using CLIP Score
- Compare training time, memory usage, and file sizes
- Plot rank vs. performance
- Plot loss curves for different ranks

- Include analysis: What went wrong, what worked, what didn't, etc.

Part 3: Reproducibility (2 marks)

- The trained LoRA weights should be executable using your evaluation script
- **Your evaluation script must output a visual comparison showing images from baseline SD and your LoRA side-by-side**
- If reproduction works successfully, you receive the full 2 marks

Upload Requirements

- Code with training pipeline and evaluation scripts
- Trained LoRA weights
- Brief report containing the analysis (Maximum 5 pages)
- Zip these files together and submit the `*.zip` file.