AAI-521 Final Team Project

Extra Credit (Optional Approach):

An alternative option for the final project is developing an AI system that restores and enhances old, damaged, or low-resolution images using generative AI models. The system will leverage pre-trained models from Hugging Face to perform tasks such as denoising, super-resolution, colorization, and inpainting. The objectives of this model are:

- **Image Denoising:** Remove noise from images while preserving important details.
- **Image Super-Resolution:** Enhance the resolution of low-resolution images.
- **Image Colorization:** Automatically colorize black and white or grayscale images.
- **Image Inpainting:** Fill in missing or damaged parts of images seamlessly.

For training this model can consist of original high-quality images and their corresponding noisy, low-resolution, grayscale, or damaged versions. Publicly available datasets like ImageNet, COCO, or custom datasets can be used. This means a separate sets of images for validating and testing the models can be used. You can use Hugging Face Trasformers for accessing the pre-trained generative models (e.g., Denoising, Super-Resolution, Colorization, Inpainting). Examples of Hugging Face models include Denoising Diffusion Probabilistic Models (DDPMs), VQ-VAE-2 for super-resolution, and other generative models for inpainting. Fine-tune the selected models on the prepared dataset to adapt them to the specific tasks and use transfer learning techniques to improve model performance. The rest of the steps include:

1 - Implementation of Enhancement Tasks:
Image Denoising:
- Load a pre-trained denoising model from Hugging Face.
- Fine-tune the model on the noisy image dataset.
- Evaluate and refine the model performance.

Image Super-Resolution:
- Load a pre-trained super-resolution model from Hugging Face.
- Fine-tune the model on the low-resolution image dataset.
- Evaluate and refine the model performance.

Image Colorization:
- Load a pre-trained colorization model from Hugging Face.
- Fine-tune the model on the grayscale image dataset.
- Evaluate and refine the model performance.

Image Inpainting:
- Load a pre-trained inpainting model from Hugging Face.
- Fine-tune the model on the damaged image dataset.
- Evaluate and refine the model performance.

2 - Integration and Deployment:
- Integrate the fine-tuned models into a single system.
- Develop a user interface (UI) for users to upload images and select enhancement tasks.
- Deploy the system as a web application using frameworks like Flask or Django.

3 - Evaluation and Testing:
- Evaluate the system using the test dataset.
- Conduct user testing to gather feedback and make improvements.