Neural Style Transfer Project Proposal

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Problem Statement

Our project aims to implement neural style transfer using PyTorch's `fast_neural_style`. The system will take content images and style reference images as input, producing transformed images that preserve original content structure while adopting the artistic style characteristics. We will deploy our final product as an interactive Gradio web application where users can upload content images and apply various pre-trained style models.

Technical Approach

We will leverage the PyTorch `fast_neural_style` implementation based on Johnson et al.'s feed-forward neural network approach, which enables real-time style transfer by training style-specific transformation networks. Our technical workflow includes:

- Training multiple style transfer models using different artistic styles

- Analyzing the neural network architecture and components

- Exploring hyperparameter impacts on stylization quality

- Implementing a user-friendly Gradio interface

Experiments and Results

Experimental Setup: We will train our models using the Microsoft COCO dataset with approximately 118K images. For style images, we will curate a collection of distinct artistic styles, including works by famous painters (e.g., Van Gogh, Picasso) and different artistic movements.

Implementation Details: We will use the existing PyTorch `fast_neural_style` codebase as our foundation but will implement:

- Custom style selection interface

- Analysis tools to visualize feature activations

- Gradio web interface for deployment

Planned Experiments:

- Training models on diverse artistic styles and analyzing transfer quality

- Investigating effects of content weight vs. style weight on output quality

- Testing variations in transformer network architecture

- Measuring inference time across different hardware setups

Expected Outcomes: We expect our experiments to reveal which artistic styles transfer more effectively, optimal hyperparameter settings for balancing content preservation and style adoption, and performance metrics for real-time style transfer. We will define success as:

- A set of well-trained style transfer models covering diverse artistic styles

- A functional Gradio web application allowing real-time style transfer

- Comprehensive understanding of the neural style transfer mechanism

- Documentation of experimental findings