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Department of Computer Science and Engineering

Final Project Proposal

CSE 429: Computer Vision and Pattern Recognition

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Project Title:

Flask-based Application for Generating Synthetic Hand-Sketched Images Using VAE, DCGAN, and WGAN

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Problem Statement

The primary goal of this project is to implement and compare three deep generative models—Variational Autoencoder (VAE), Deep Convolutional Generative Adversarial Network (DCGAN), and Wasserstein GAN (WGAN)—for the task of generating hand-sketched facial images. After evaluating their performance, the models will be integrated into a Flask-based web application that allows users to generate sketch-style images through a simple, static web interface.

The expected input is the user's selection of one of the three models. The desired output is a synthetic, sketch-like image of a human face generated and displayed on the same page. This project demonstrates the capabilities of generative models in computer vision and provides a user-friendly interface for interactive AI image synthesis.

Approach

Our approach consists of two main components: deep model development and web-based deployment.

Model Implementation: Each model (VAE, DCGAN, and WGAN) is implemented using PyTorch. They are trained independently using the CUHK Face Sketch (CUFS) database, which contains paired face photo and sketch images. The models learn to generate realistic sketch-style images from random latent vectors.

Web Application: A Flask backend serves as the controller for model loading, image generation, and user interaction. The frontend is built using basic HTML and CSS. User input (model selection) is sent to the Flask server, which processes the request and returns a generated image to be displayed in the browser.

Experiments and Results

Dataset: CUHK Face Sketch Database (CUFS), containing aligned photo-sketch pairs.

Image Resolution: 128×128 grayscale sketches.

Frameworks Used: PyTorch for deep learning models, Flask for the web server, and static HTML/CSS for the interface.

Training: Each model is trained on the CUFS dataset with appropriate loss functions (reconstruction loss for VAE, adversarial loss for DCGAN/WGAN). Preprocessing includes grayscale conversion and normalization.

Success Criteria: All models produce visually plausible and diverse sketch images. The web interface responds correctly to user input and displays generated images without the

need for client-side scripting. The results allow a clear qualitative comparison between the three architectures.

Planned Experiments: Train each model independently and generate sample outputs. Generate images using identical random inputs across models to compare their generative behavior. Conduct visual evaluation of image sharpness, coherence, and realism.

Expected Outcomes: We expect WGAN to generate the most stable and high-quality sketches, followed by DCGAN. VAE may offer less detailed images but greater training stability. The web application will serve as a useful tool to interactively explore and compare the models' outputs, demonstrating their practical application in AI-based sketch generation.