



PAINTDIFFUSION

A Hybrid Generative AI Framework for Sketch-to-Image Synthesis

Objectives

- Convert rough sketches into realistic images
- Combine VAE, Transformer, Diffusion, and GAN techniques
- Preserve structural details from sketches
- Improve image realism and texture sharpness
- Support user control via guidance parameters
- Enable efficient processing on available hardware

Key Features

- Latent space generation reduces VRAM usage
- Mixed precision execution speeds up inference
- Classifier-free guidance controls image style/strength
- Stable, predictable results with diffusion models
- Edge detection ensures sketch fidelity



Applications

- Digital art
- Concept design
- Animation pre-visualization
- Film/Gaming asset creation
- AR/VR environments
- AI-assisted drawing tools

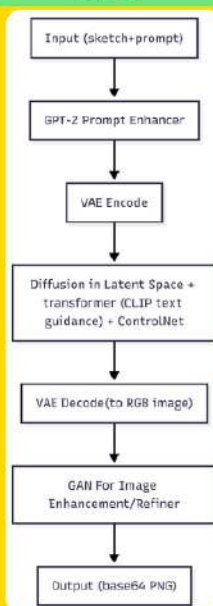
Future Enhancements

- Text + Sketch multimodal fusion
- Full-scene image generation
- Optimized inference via model quantization
- Mobile/real-time deployment

Ethical Considerations

- Avoid misuse of realistic AI-generated images
- Address dataset bias
- Transparency in generated content
- Ensure responsible deployment

FLOW



Result



COMPARATIVE ANALYSIS

Aspect	Variational Autoencoder (VAE)	SRGAN (Super-Resolution GAN)	Diffusive Model	GPT-2 (Transformer-based)	ControlNet (Conditional Diffusion)
FID ↓	45.70	28.10	3.60	7.50	4.20
IS ↑ (mean ± std)	5.20 ± 0.30	8.10 ± 0.40	25.50 ± 0.20	7.40 ± 0.30	8.10 ± 0.30
Precision ↑	0.62	0.71	0.88	0.84	0.86
Recall ↑	0.58	0.69	0.83	0.76	0.81
PPDS ↓	0.28	0.21	0.09	0.11	0.10
Loss	0.0775 / 0.0225	0.5526 / 0.0607	0.0088	0.045	0.0088 (similar to Diffusion)
Visual Quality	Low realism, blurry edges	Improved sharpness, minor artifacts	Photorealistic, excellent texture	High-quality, smooth tone balance	Realistic, well-aligned with input sketch
Best Use-case	Basic reconstruction, unsuitable to color	Enhancing details in low-res images	High-fidelity image synthesis	Semantic-guided or text-driven generation	Conditional sketch-to-image generation

Student Details

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