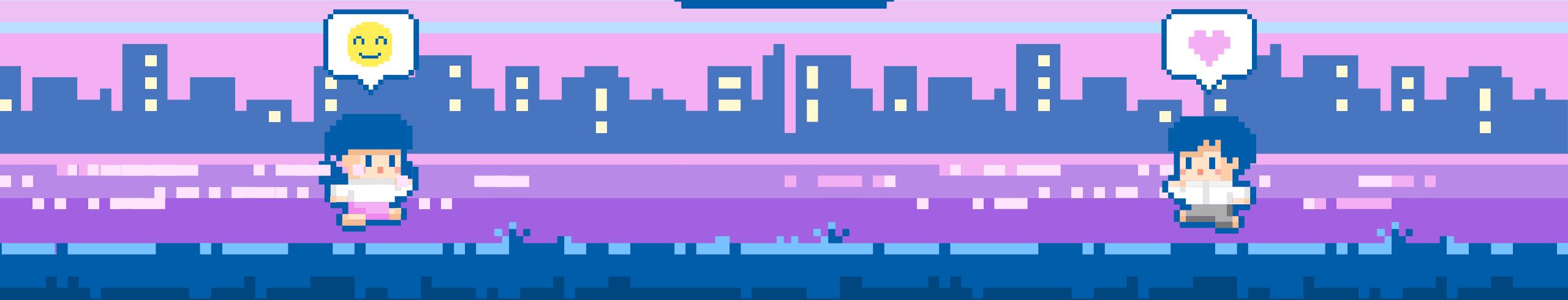


Transforming
Photography into
Pixel Art
using CYCLEGAN

START

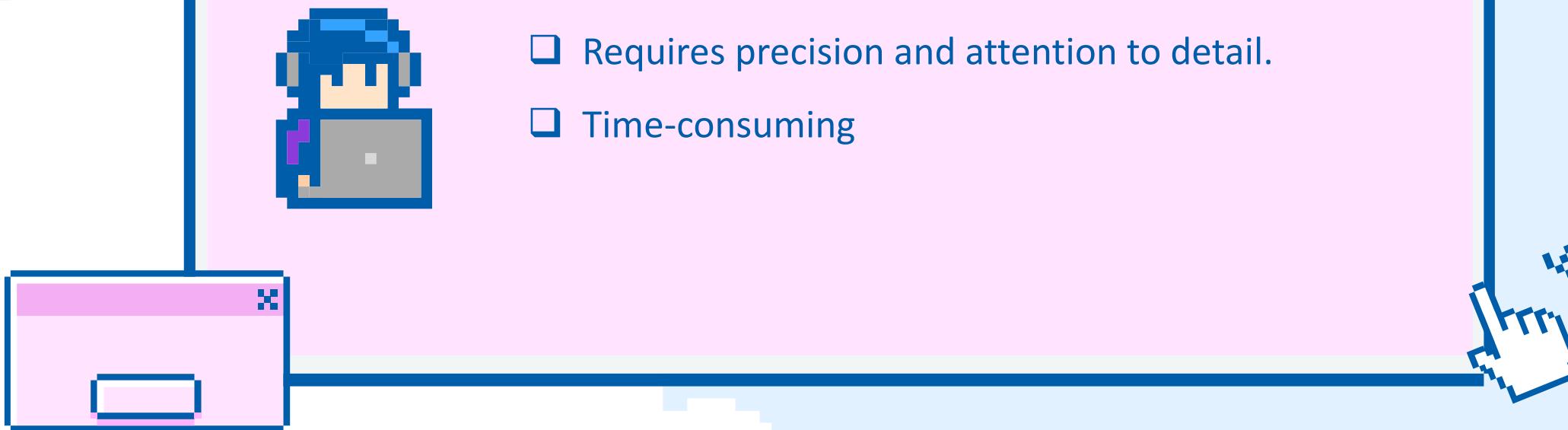


Motivation



Creation Challenges

- Requires precision and attention to detail.
- Time-consuming



GOALS



- Bridging the gap in pixel art creation.
- Simplifying the process for developers, and enhancing experience for players.
- Keeping pixel art thriving in gaming.

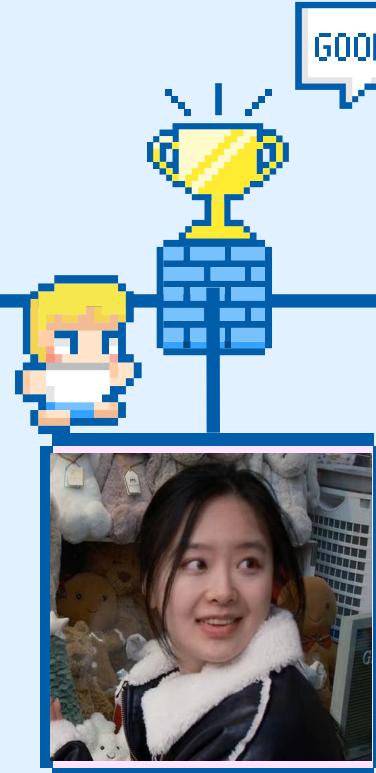




TEAM



Joy Xu



Yang Xu



Julian Bian

Problem statement



Definition



Transforming standard photographs into pixel art using CycleGAN.

Importance



Pixel art creation is time-consuming and skill-intensive. Automating this process saves valuable time and resources.

Limitations



Existing methods may not efficiently or effectively convert photos to high-quality pixel art.

Advantage



CycleGan enables high-quality pixel art transformations from unpaired images, efficiently learning to generate detailed art.

Input/Output



Input

Photographs in standard image formats
(e.g., JPEG, PNG) from any source.



Output

The transformation of input images in
to pixel art representations.

Input/Output



Input



Output

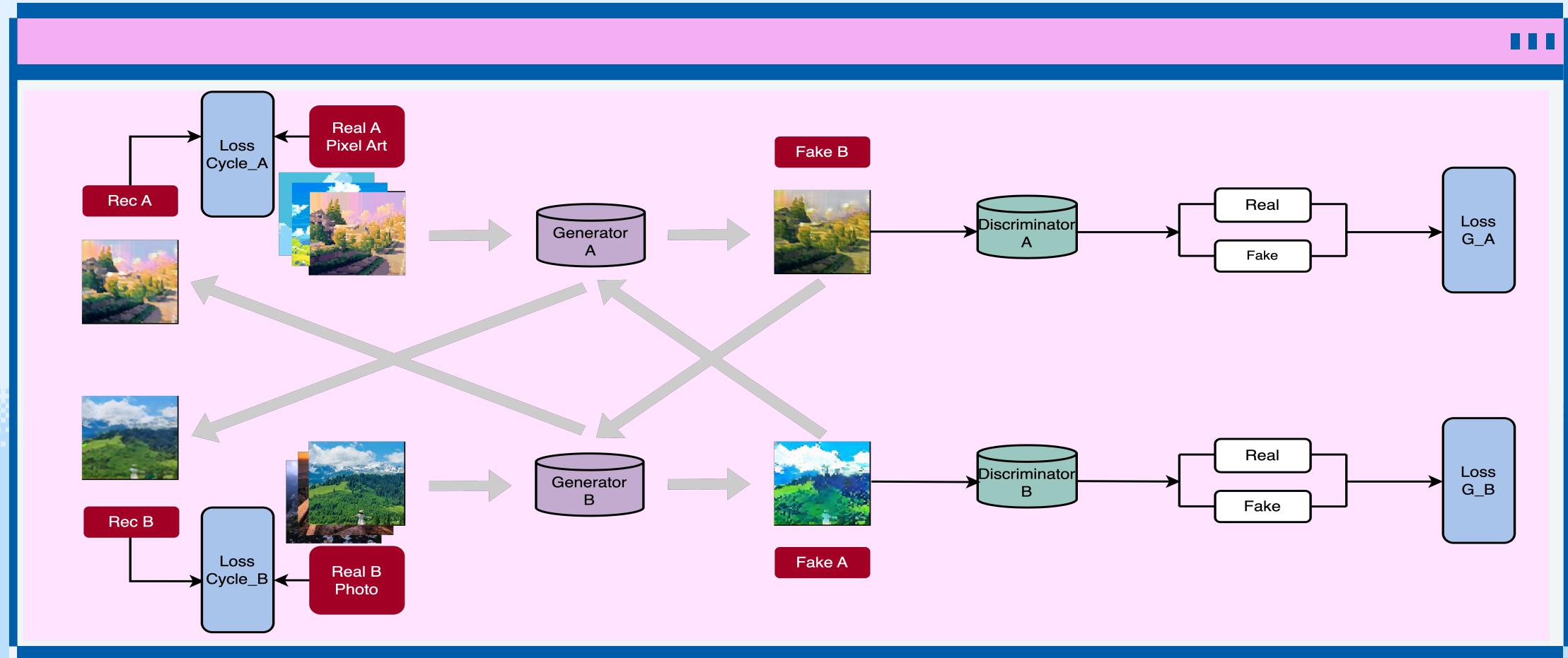




Result



Network Architecture



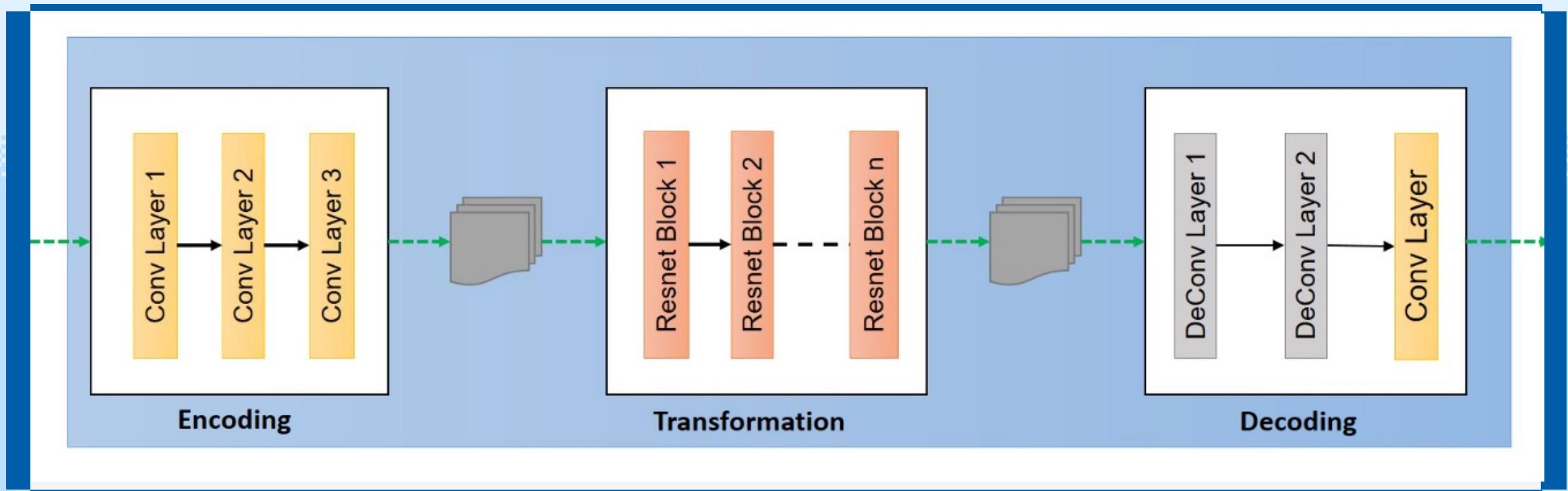
$\square \text{ Loss}_G = \text{Loss}_{G_A} + \text{Loss}_{G_B} + \text{Loss}_{\text{cycle_A}} + \text{Loss}_{\text{cycle_B}}$

Network Architecture



Building the Generator Resnet

Each CycleGAN generator has three sections: an encoder, a transformer, and a decoder.

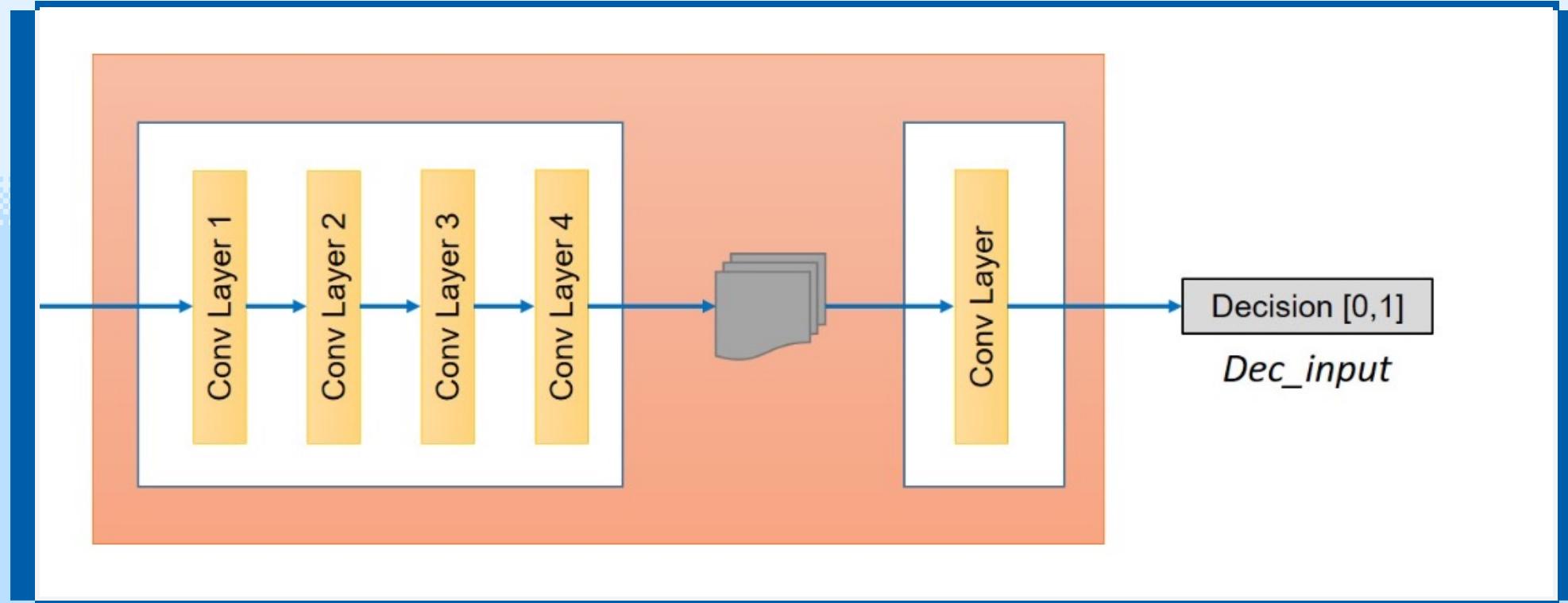


Network Architecture



Building the Discriminator

The discriminators are PatchGANs, fully convolutional neural networks that look at a “patch” of the input image, and output the probability of the patch being “real”.



Dataset+



Pixel



Photo



- Source: Pictures online, dataset made by ourselves.
- Numbers: 900
- Size: 256*256
- The theme and style of the paintings are similar.
- Many subtle differences in the details.

- Source: Photos online, dataset made by ourselves.
- Numbers: 2500
- Size: 256*256
- The theme and style of the photo are landscape.

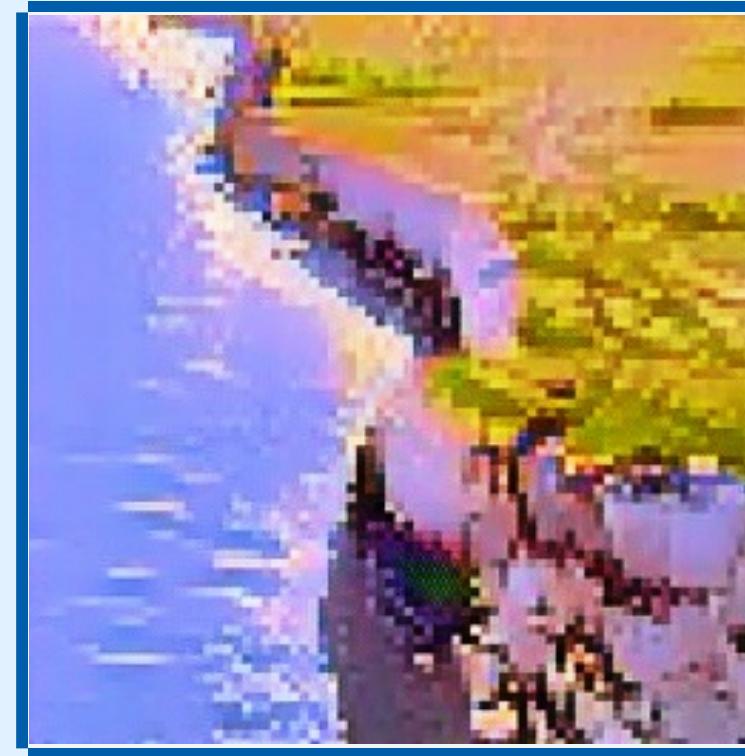
Result 1



Photo



Baseline

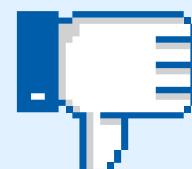


CycleGAN

- Captures Pixel Art aesthetics



- Noticeable color shifts
- Subject details are obscured



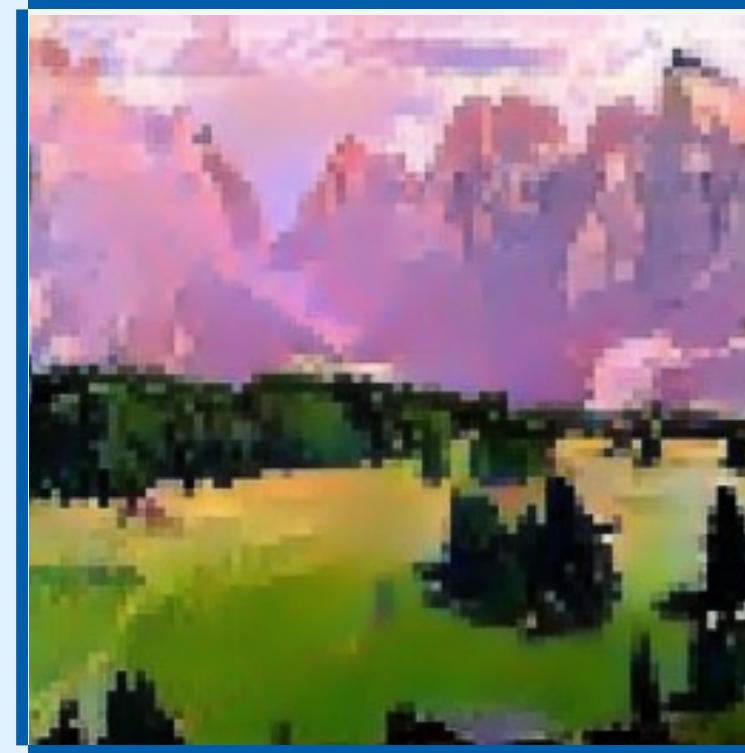
Result 1



Photo

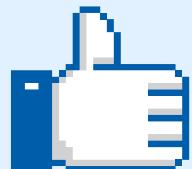


Baseline

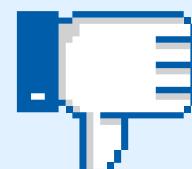


CycleGAN

- Captures Pixel Art aesthetics



- Noticeable color shifts
- Subject details are obscured



Add Attention



Why?

- We add the channel attention layer to generally address the issue of color shift in the baseline.

How

- Inserted after the decode module of Resnet.
- Focus on the most informative features by re-weighting the channels of the input data



Result + 2



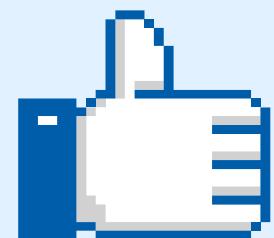
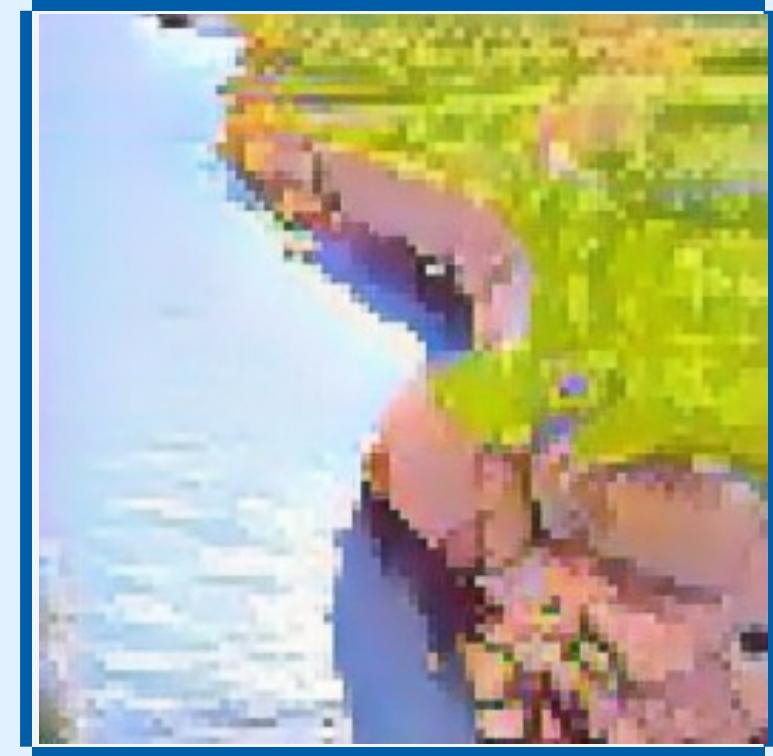
Photo



Baseline



Attention



CycleGAN + Attention

- ❑ Achieves a color palette that resonates with quintessential Pixel Art aesthetics.
- ❑ Subject details are slightly obscured.

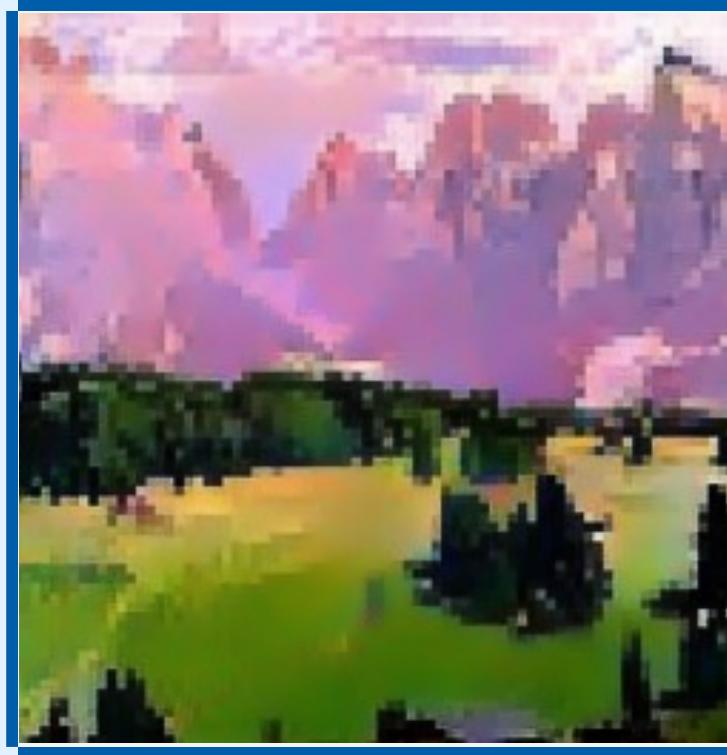
Result + 2



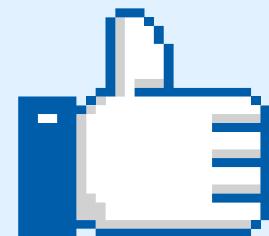
Photo



Baseline



Attention



CycleGAN + Attention

- ❑ Achieves a color palette that resonates with quintessential Pixel Art aesthetics.
- ❑ Subject details are slightly obscured.

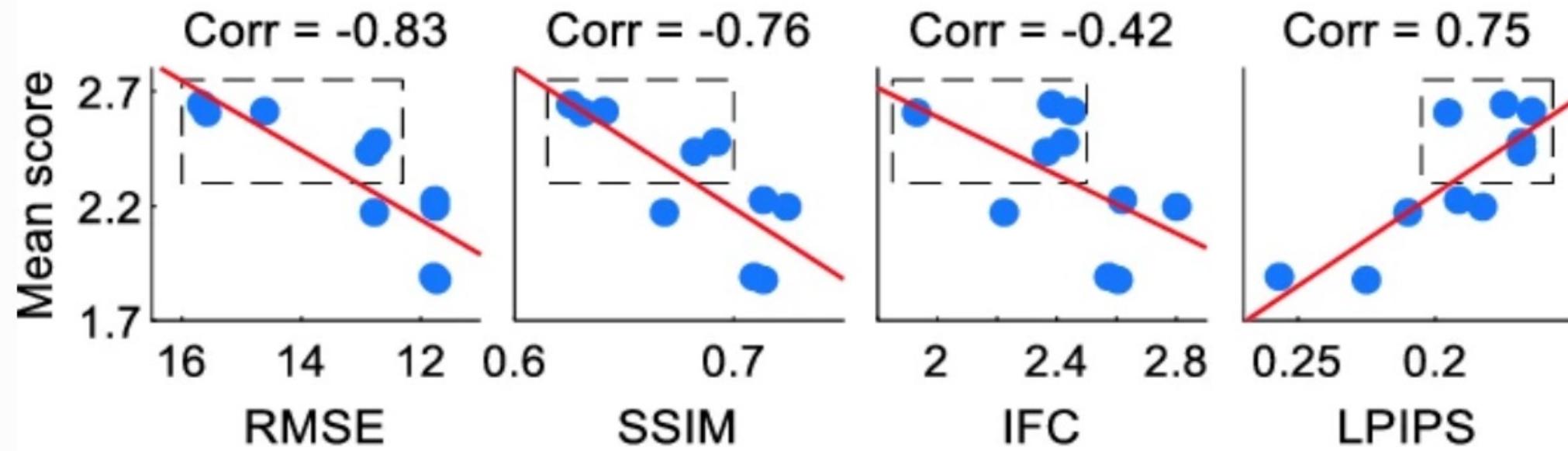


Enhancement with LPIPS



LPIPS (Learned Perceptual Image Patch Similarity)

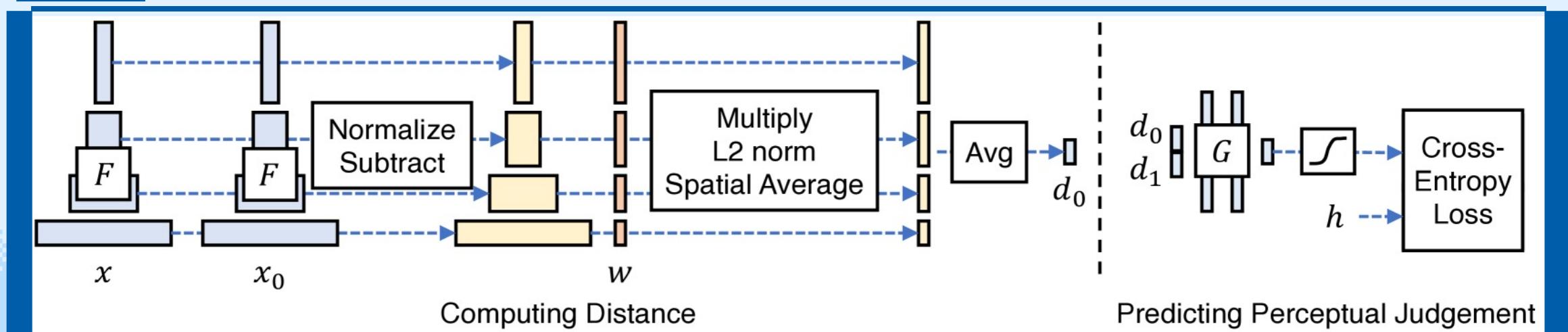
Show a strong positive correlation with human perception in image quality assessment.



Enhancement with LPIPS



Deep Networks As A Perceptual Metric



$$d(x, x_0) = \sum_l \frac{1}{H_l W_l} \sum_{h,w} \|w_l \odot (\hat{y}_{hw}^l - \hat{y}_{0hw}^l)\|_2^2$$

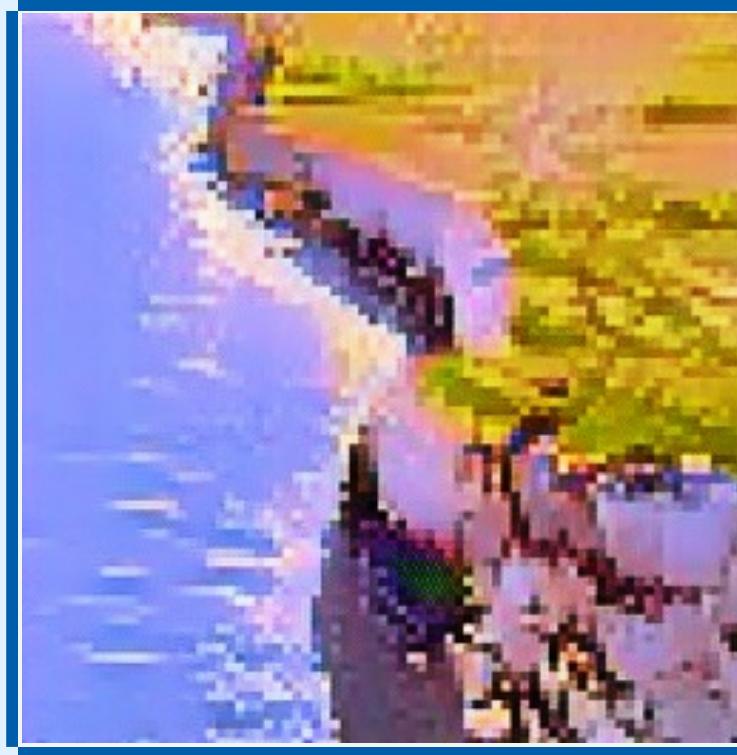
Result + 3



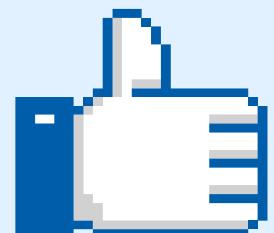
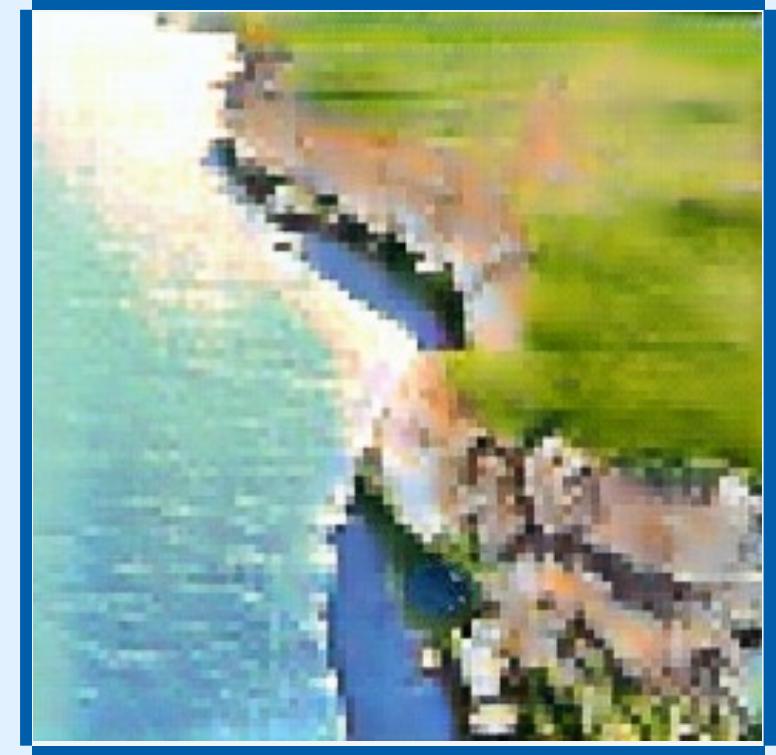
Photo



Baseline



Lpips



CycleGAN + LPIPS

- Slightly reduced color shift from CycleGAN
- Improved color matching
- Though less effective than other improvements

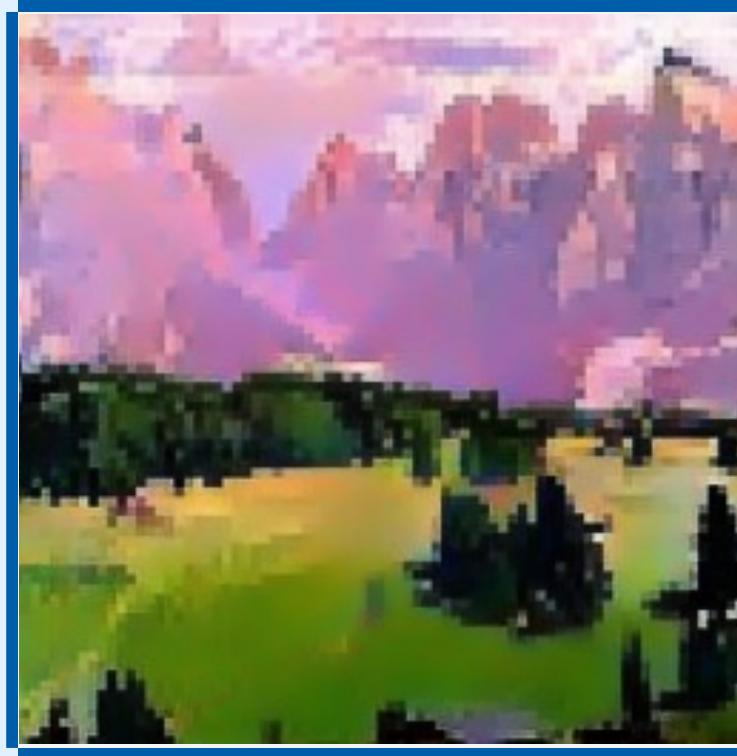
Result + 3



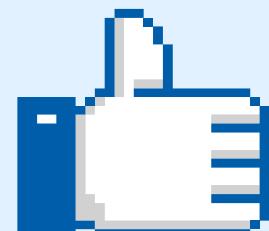
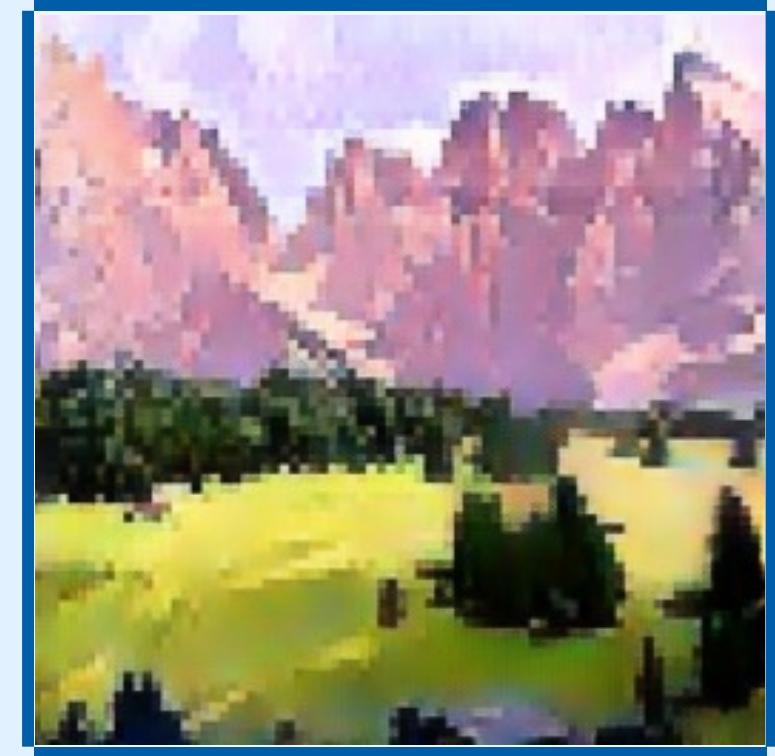
Photo



Baseline



Lpips



CycleGAN + LPIPS

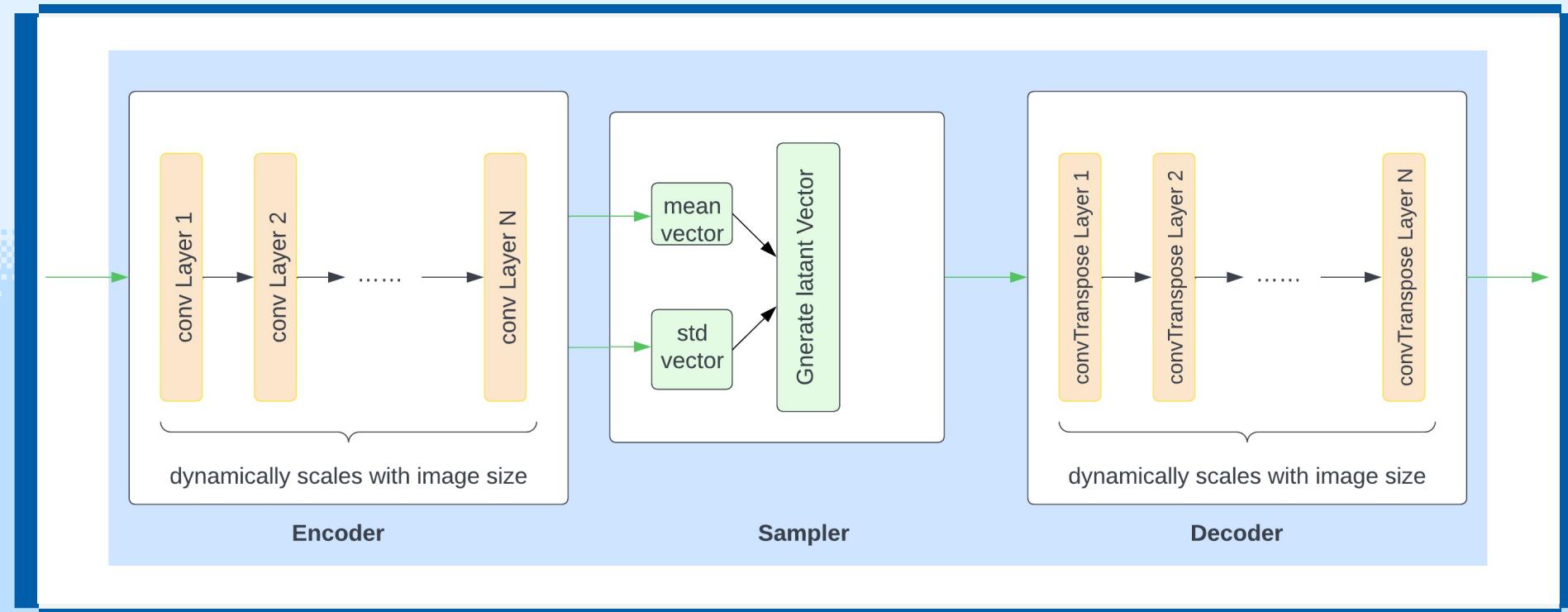
- Slightly reduced color shift from CycleGAN
- Improved color matching
- Though less effective than other improvements



Enhancement with VAE



Replacing the Generator with VAE



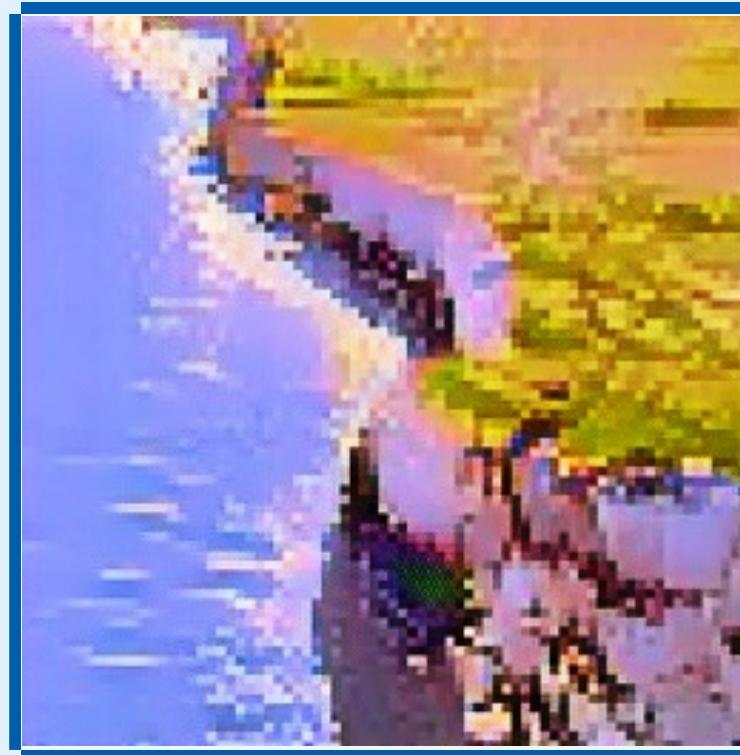
Result + 4



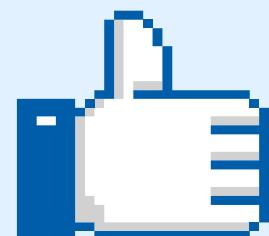
Photo



Baseline



VAE



CycleGAN + VAE

- Most true-to-source colors with Pixel Art texture maintained.
- The subject is the most discernible.
- Running time is faster.

Result + 4



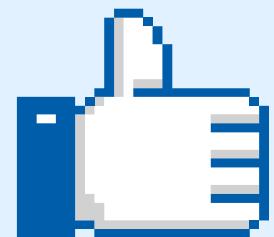
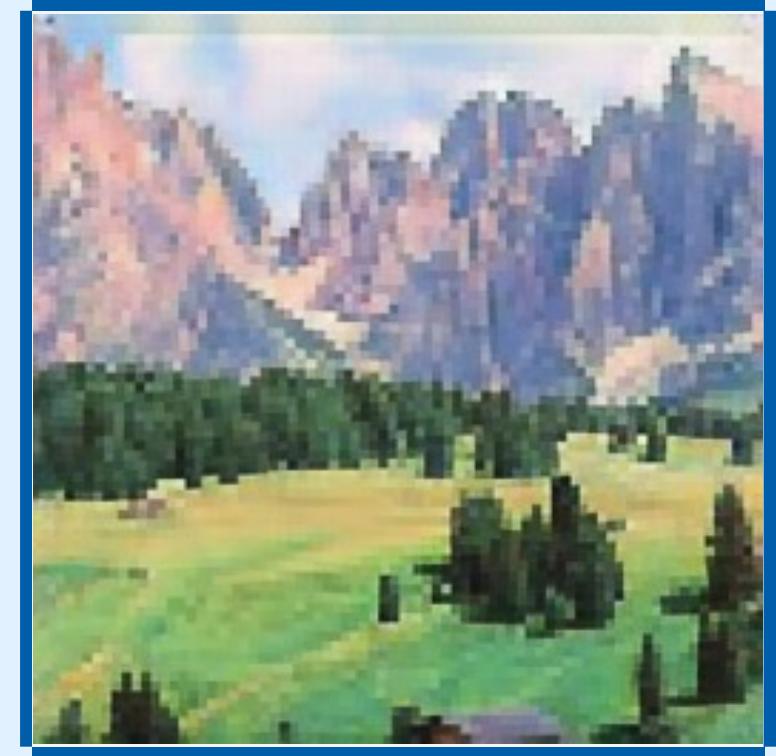
Photo



Baseline



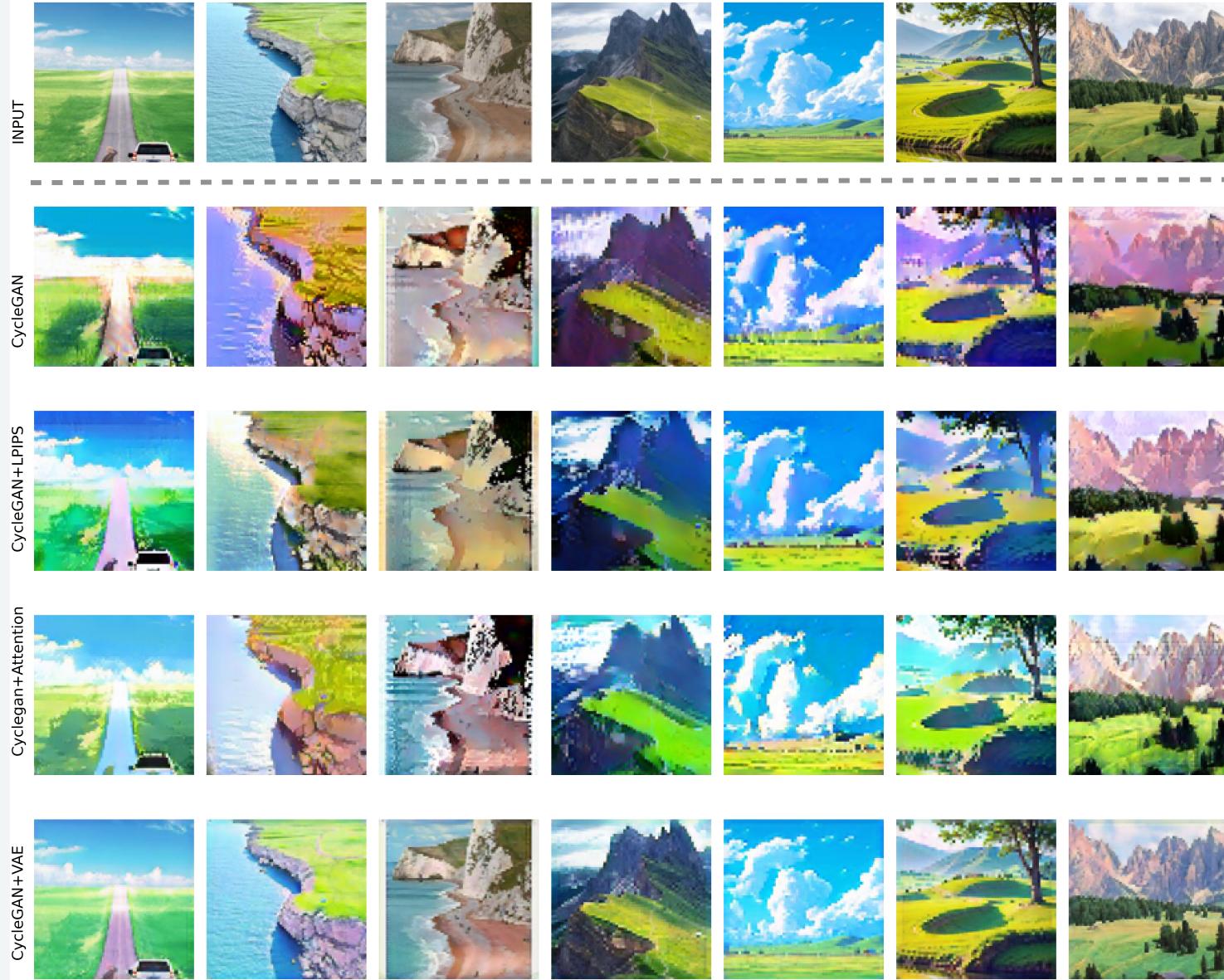
VAE



CycleGAN + VAE

- Most true-to-source colors with Pixel Art texture maintained.
- The subject is the most discernible.
- Running time is faster.

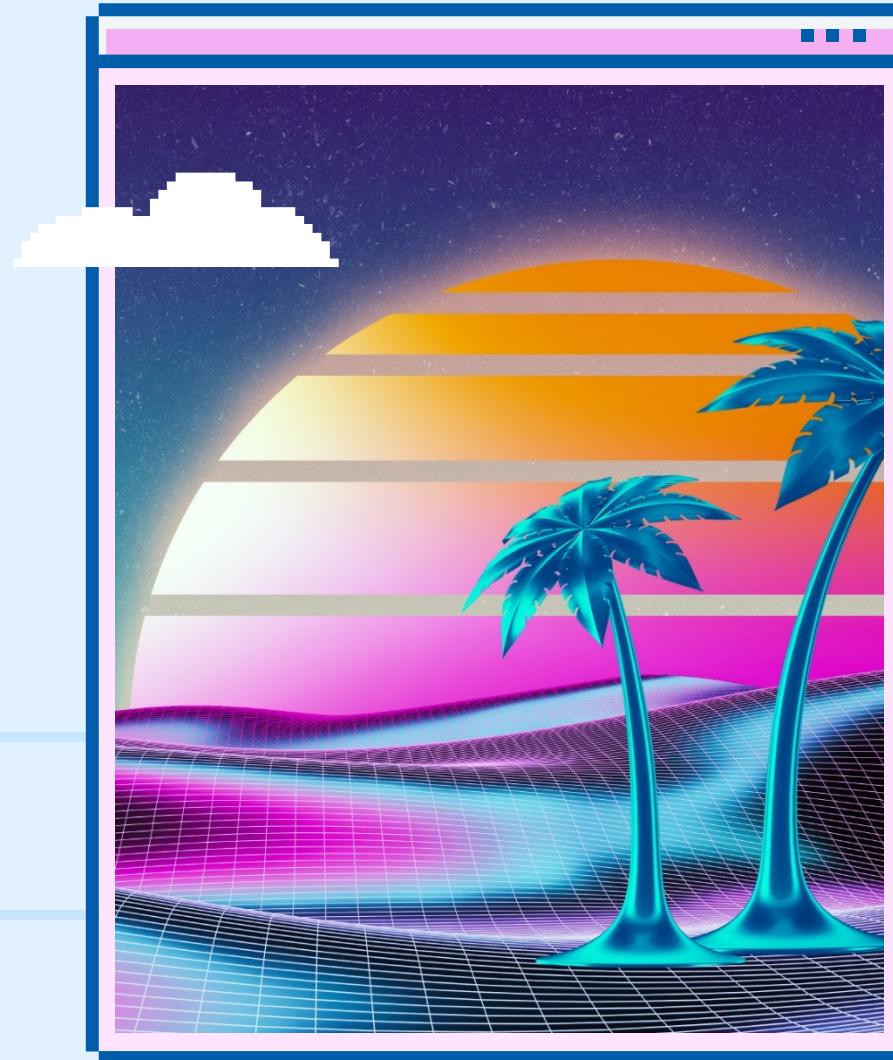
Comparison





Further
Plan

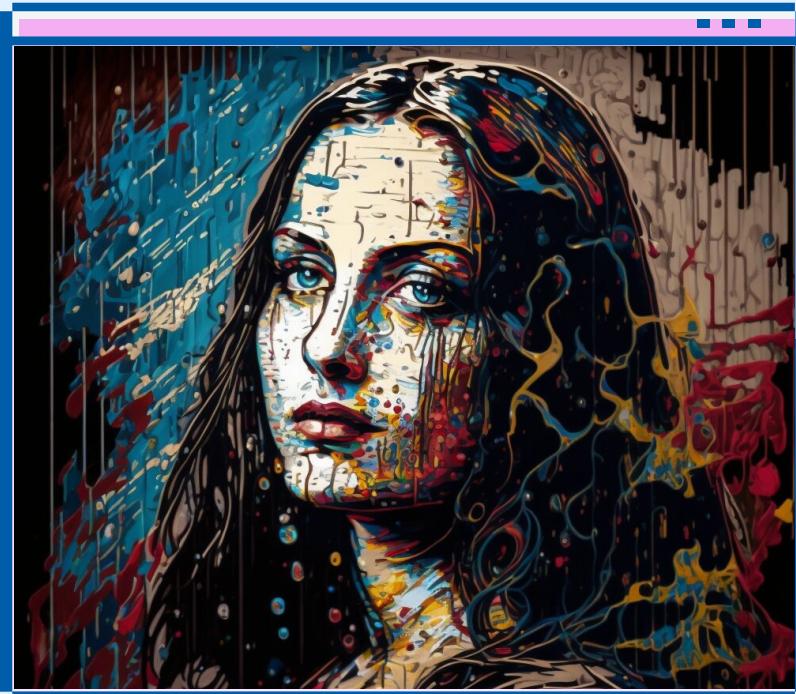




WHAT
WILL
WE
DO_?

- ▶ Dataset Expansion
- ▶ User Interface
- ▶ Use more advanced model

Diffusion Model



High-Quality Image Generation



Interactive Refinement Process



Higher Computational Demand



Highlight
Reel



