



Chinese Painting Style Transfer Using Deep Generative Models

Kris Ma, Yanyang (Emma) Kong

Microsoft

krisma@stanford.edu, yanyangk@stanford.edu

Stanford

CS 236 – Fall 2019

Introduction: Chinese Painting Style Transfer

What is Chinese painting “Guo-hua” (国画)?



"Gong-bi"(工笔) Lotus

- meticulous
- detailed
- precise



"Shui-mo"(水墨) Mountains

- water and ink
- freehand
- sketch

Chinese painting style transfer example



Going-bi style transfer



Transfer a real lotus photo to a “Gong-bi” style Chinese painting using “Gong-bi” cycle-GAN



Shui-mo style transfer



Transfer a mountain landscape photo to a “Shui-mo” style Chinese painting using naïve combination model (“Shui-mo” CycleGAN + CNN neural transfer)

Problem Setup

- Transform a realistic photo like portrait, nature photo, landscape to a Chinese painting in "Gong-bi" or "Shui-mo" style using deep neural network models.
- Use “Going-bi” style for human portraits, nature objects, animals
- Use “Shui-mo” style for landscapes

Implemented Methods

CNN neural style transfer: Use Gaty’s CNN neural transfer model

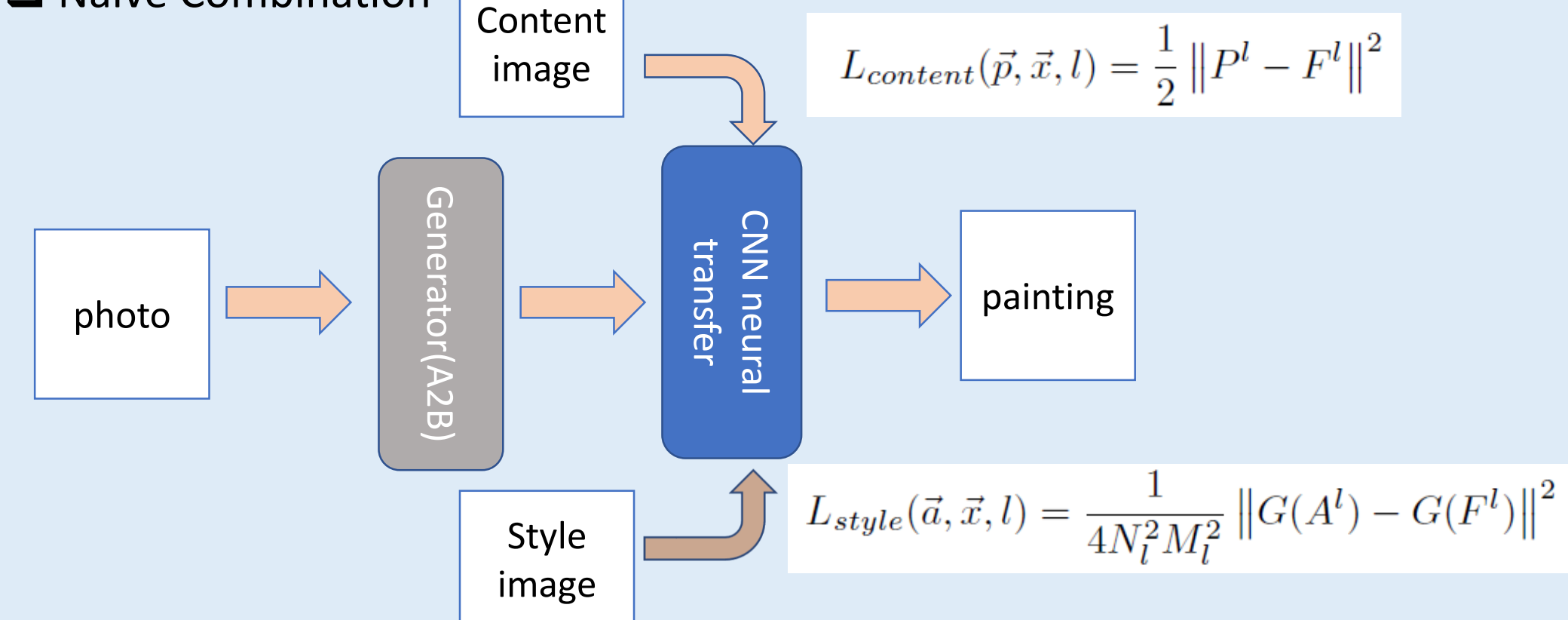
- choose one Chinese painting as style image for each photo (form a <photo, style painting> pair as input)

cycle-GAN: Used directly to transform a photo to a painting

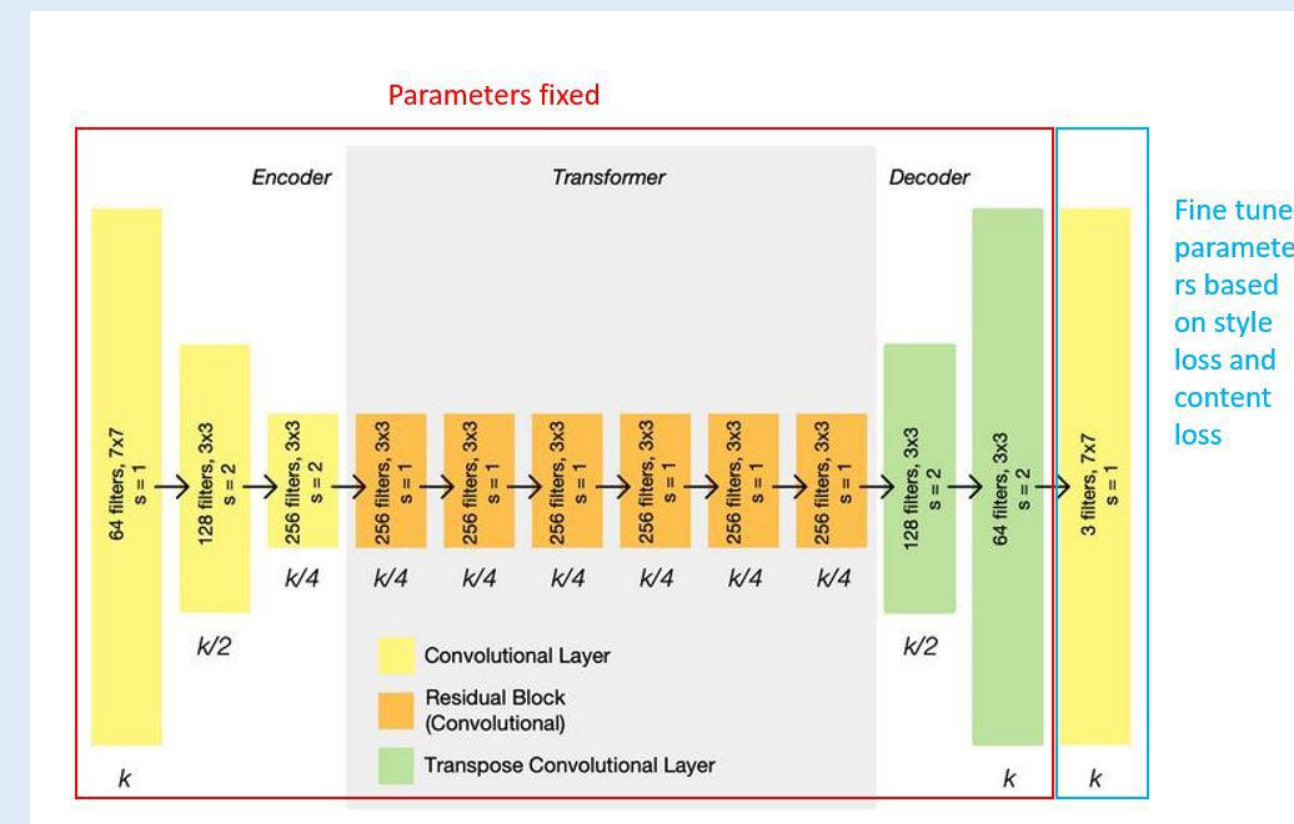
- Train cycle-GAN for **human portraits, nature objects** ⇄ “Gong-bi” paintings
- Train cycle-GAN for **landscapes** ⇄ “Shui-mo” paintings

Combined cycle-GAN with CNN neural style transfer: Our own methods

- Naïve Combination



- Use pretrained cycle-GAN front CNN layers for CNN neural style transfer
- Fine tune cycle-GAN Generator(A2B) by adding style loss + content loss



Acknowledgements

- Thanks Yuan Chen, Guanyang Wang, Ying Chen for providing Chinese painting dataset (<https://github.com/ychen93/Chinese-Painting-Dataset>)
- Thanks for cycle-GAN Pytorch repository (<https://junyanz.github.io/CycleGAN/>)

Experiments and Results

CNN neural style transfer

using layer ‘conv4_2’ for content representation and layers ‘conv1_1’, ‘conv2_1’, ‘conv3_1’, ‘conv4_1’ and ‘conv5_1’ as style representations from pretrained vgg-19)

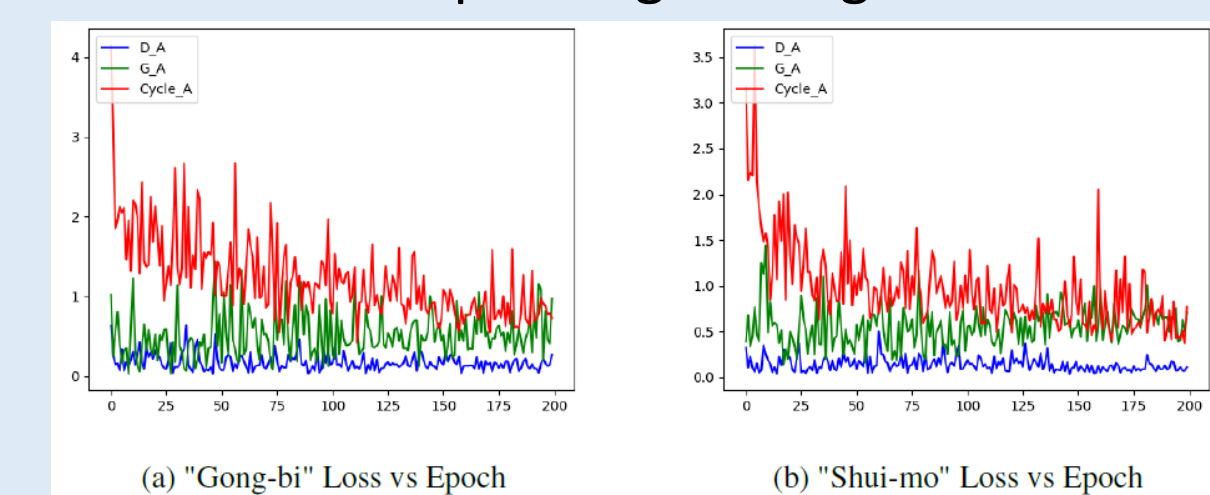
cycle-GAN (trained on single Nvidia GTX 2080 Ti GPU for 200 epochs)

- “Going-bi” cycle-GAN:

- 4 categories photos: human portraits, birds, lotuses, peonies, in total 477 photos
- 470 "Gong-bi" paintings for target domain

- “Shui-mo” cycle-GAN:

- 1031 landscape photos
- 1542 "Shui-mo" paintings in target domain.



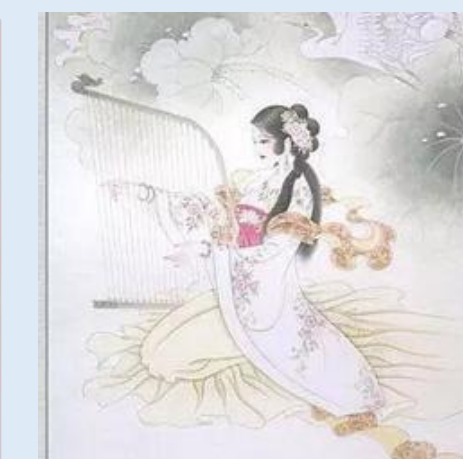
Combined cycle-GAN with CNN neural style transfer

- Naïve Combination:** use trained generator from cycle-GAN task, reuse pretrained vgg-19 as CNN neural transfer model
- Use pretrained cycle-GAN:** we use ‘conv1’, ‘conv2’, ‘conv3’ from cycle-GAN generator for style representation and ‘relu3’ for content representation
- Fine tune cycle-GAN Generator:** add style loss and content loss in the last convolutional layer and finetune its parameters

Model Performance on Human Portrait



Human portrait



“Gong-bi” style



CNN neural transfer



Cycle-GAN



Naïve combination



Cycle-GAN neural transfer



Cycle-GAN finetune



Stanford
University