

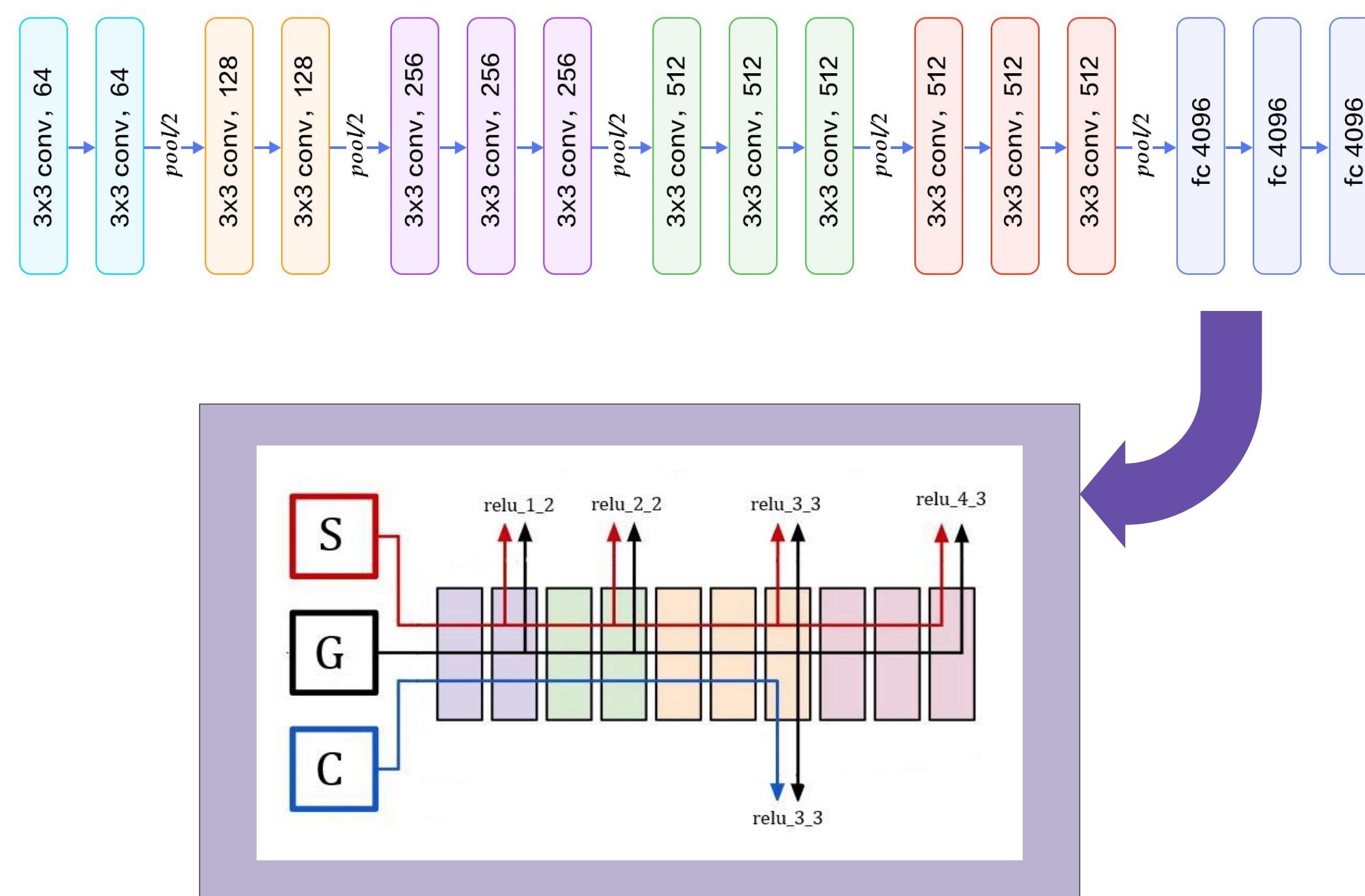


Introduction

- ❑ Leverage a pre-trained convolutional neural network feature layers to derive the style representation of an image and transfer that style to the content of another image.
- ❑ Design and develop a style transfer tool with content image and style image as inputs

Methods

- ❑ The idea comes from the paper *A Neural Algorithm of Artistic Style* by Gatys et al. Our CNN leverages the VGG19 architecture pretrained on the ImageNet image classification dataset.



- ❑ Replace the max pooling layers with average pooling layers to produce better results and improve gradient flow
- ❑ Change any arbitrarily-generated image using gradient descent until the feature responses of generated image match those of the original image

$$\text{Content Loss} \quad \mathcal{L}_{content}(\vec{p}, \vec{x}, l) = \frac{1}{2} \sum_{i,j} (F_{ij}^l - P_{ij}^l)^2$$

$$\text{Style Loss} \quad G_{ij}^l = \sum_k F_{ik}^l F_{jk}^l$$

$$E_l = \frac{1}{4N_l^2 M_l^2} \sum_{i,j} (G_{ij}^l - A_{ij}^l)^2$$

$$\mathcal{L}_{style}(\vec{a}, \vec{x}) = \sum_{l=0}^L w_l E_l$$

$$\text{Total Loss} \quad \mathcal{L}_{total}(\vec{p}, \vec{a}, \vec{x}) = \alpha \mathcal{L}_{content}(\vec{p}, \vec{x}) + \beta \mathcal{L}_{style}(\vec{a}, \vec{x})$$

where α and β are weights for content loss and style loss

ArtNet: Artistic Style Transfer Network

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Improvements

1. Multiple-Style images

Compute multi-style loss using:

$$\mathcal{L}_{multi_style}(\vec{a}, \vec{x}_1, \vec{x}_2, \dots, \vec{x}_n) = \sum_{s=1}^n u_s \sum_{l=0}^L w_l E_l$$

2. Color Preservation

Content image \rightarrow IQ channels
Output image \rightarrow Luminance channels

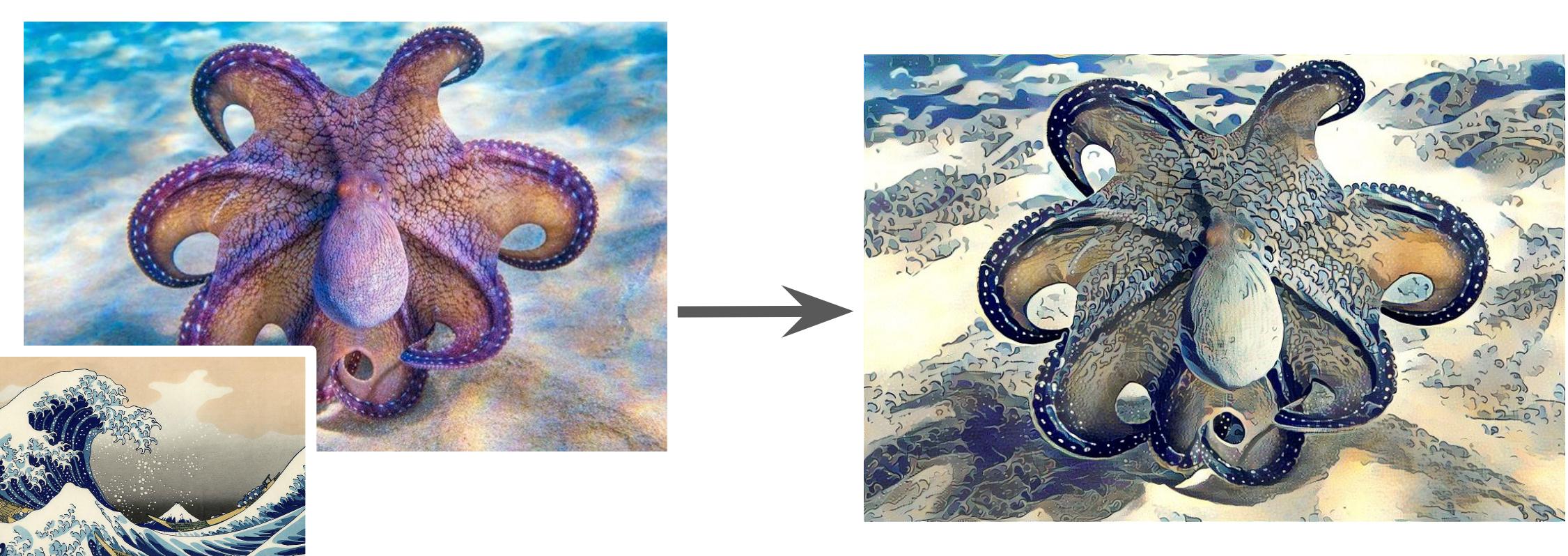
Original color in output image

Datasets = Content Images + Style Images



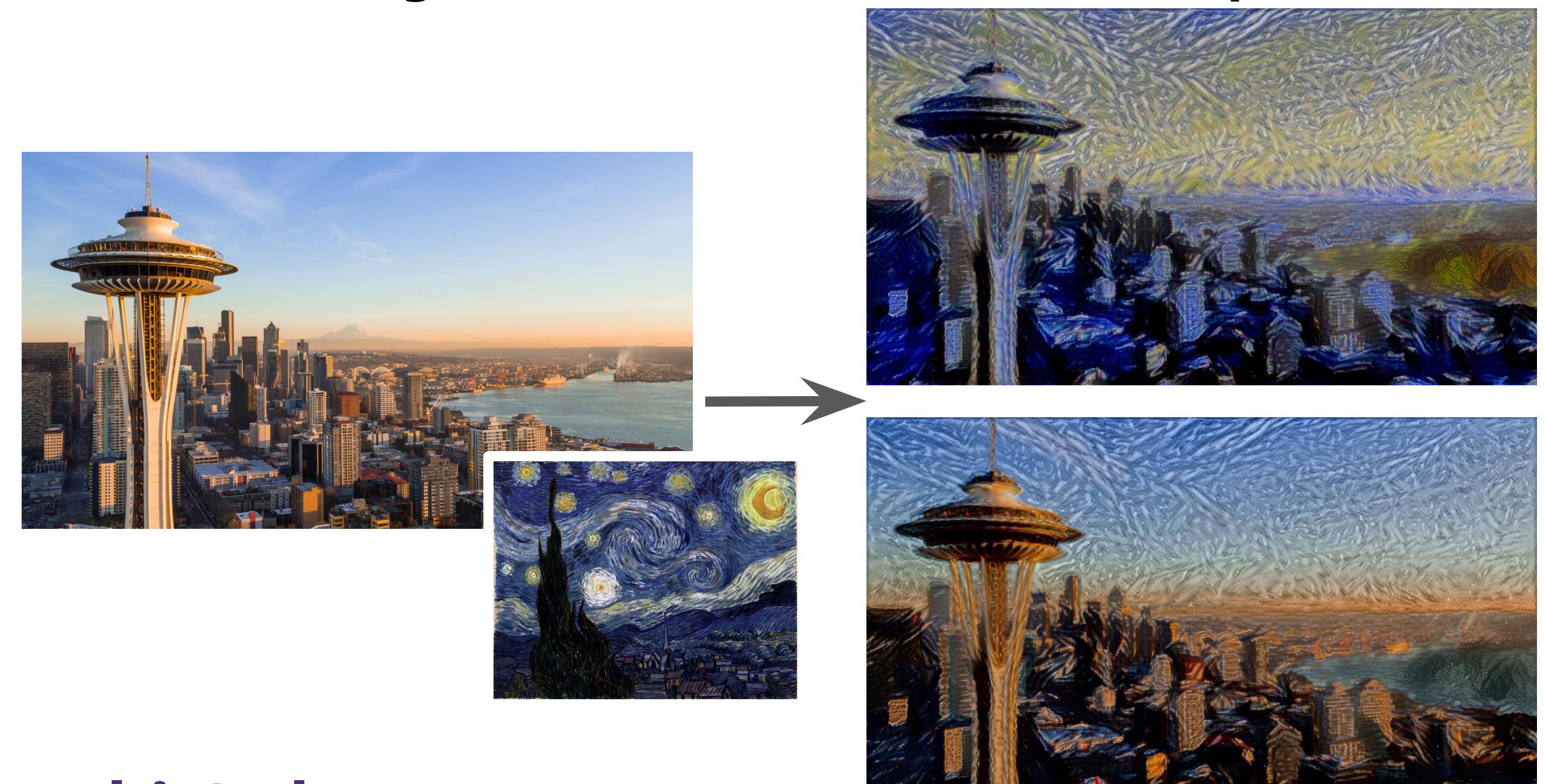
Single-Style

Hokusai + Octopus \rightarrow without color preservation



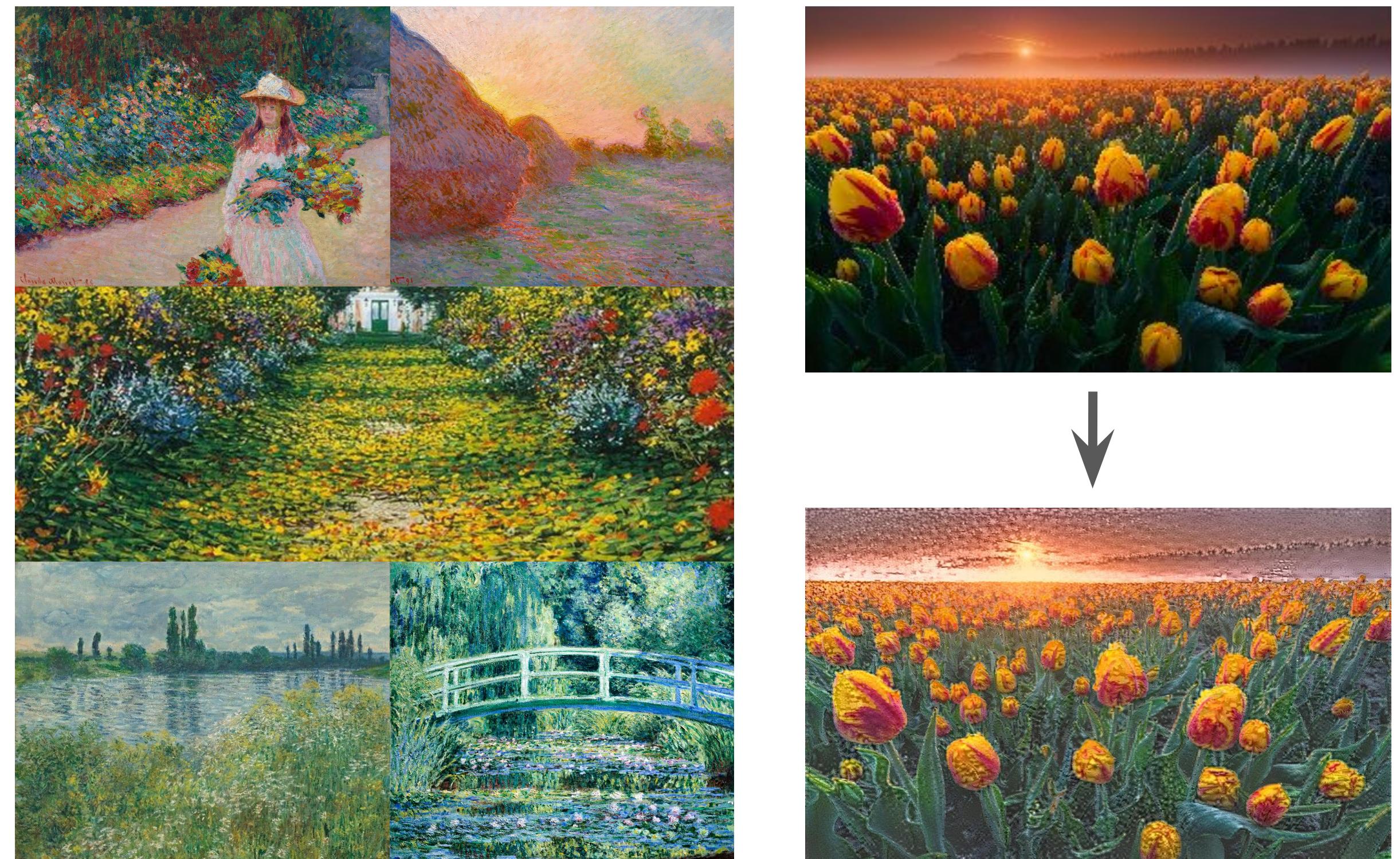
Single-Style

Vincent van Gogh + Seattle \rightarrow with/without color preservation



Multi-Style

5 Monet Paintings + Tulips \rightarrow Monet's Tulips



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