



Image Style Transfer

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What is Image Style Transfer?



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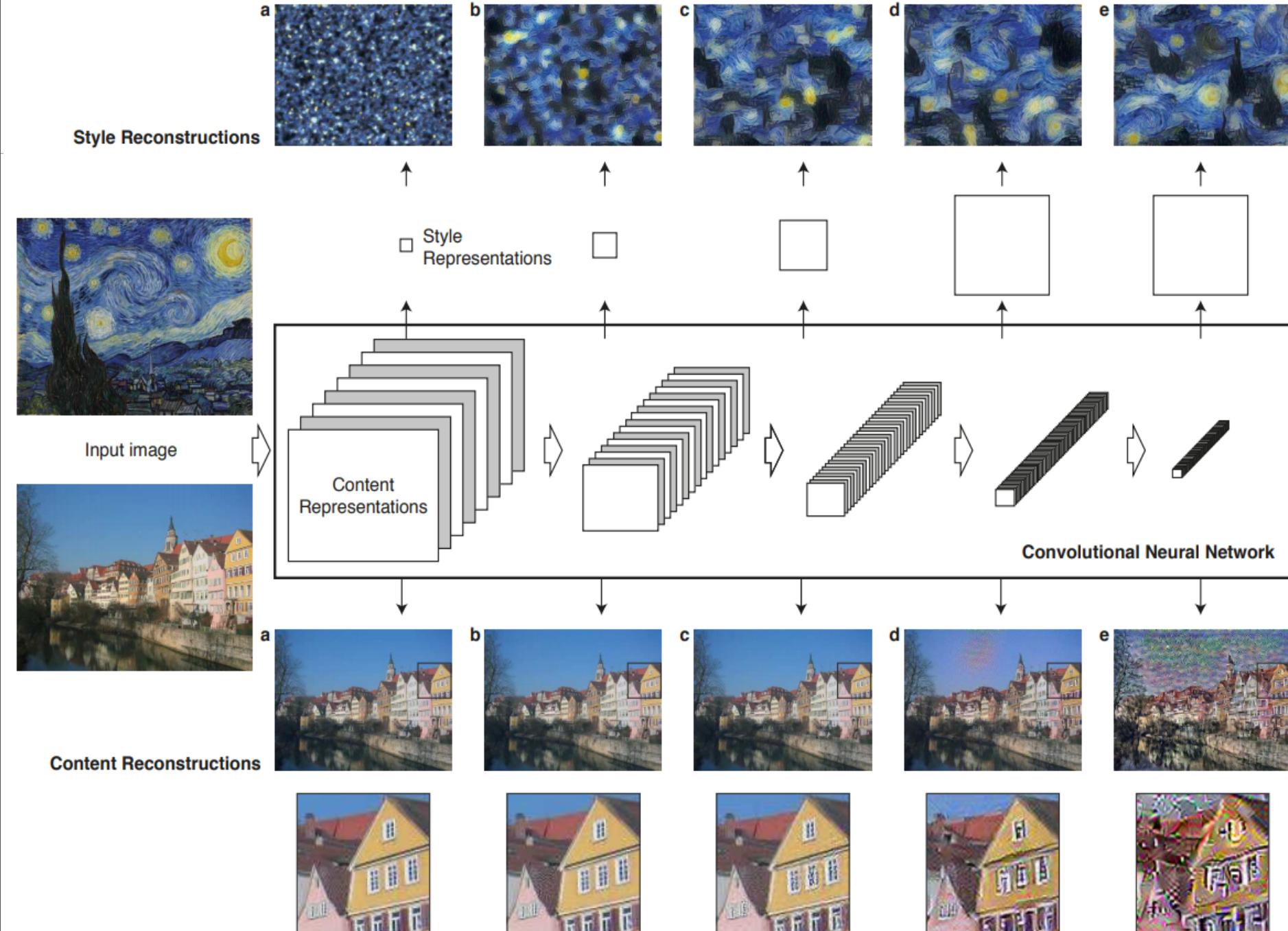
Content

Style

Pastiche

Transfer the style from one image to the content of another image

How do we implement it



How do we implement it

Content Reconstructions and Style Reconstructions done by VGG 16 network

A given input image is represented as a set of filtered images at each processing stage in Convolutional Neural Network

A Neural Algorithm of Artistic Style

Extract content and style by loss functions

Content Loss Function:

squared-error loss between the
two feature representations

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

To preserve the contours of the content image, we need to minimize the difference
between the features that are activated for the content image and for the mixed image

How do we implement it?

Gram-matrix:

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

It measures the features activated simultaneously in a given layer, as an activation pattern.

Style Loss Function:

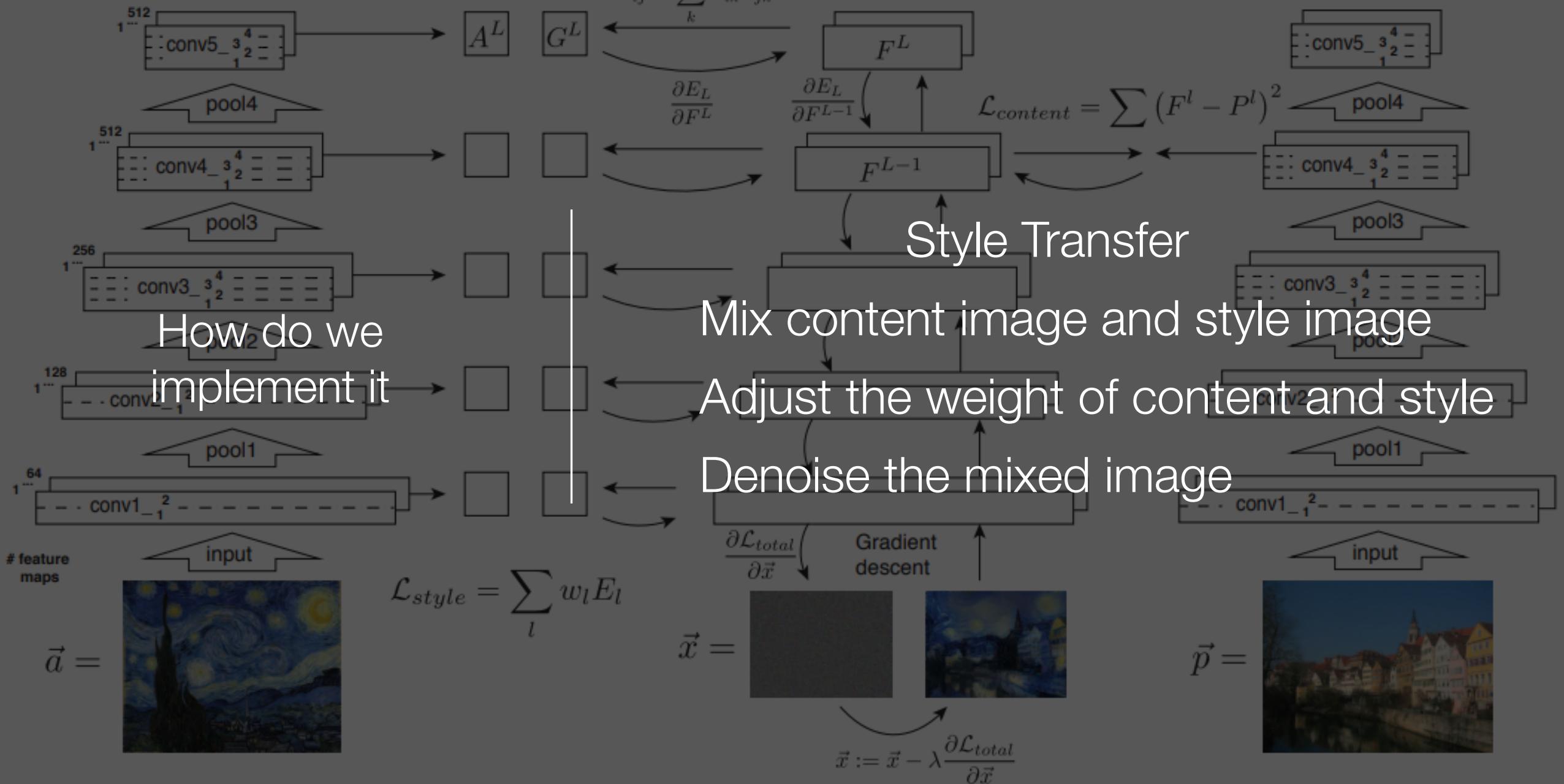
$$\mathcal{L}_{\text{style}}(\vec{a}, \vec{x}) = \sum_{l=0}^L w_l E_l,$$

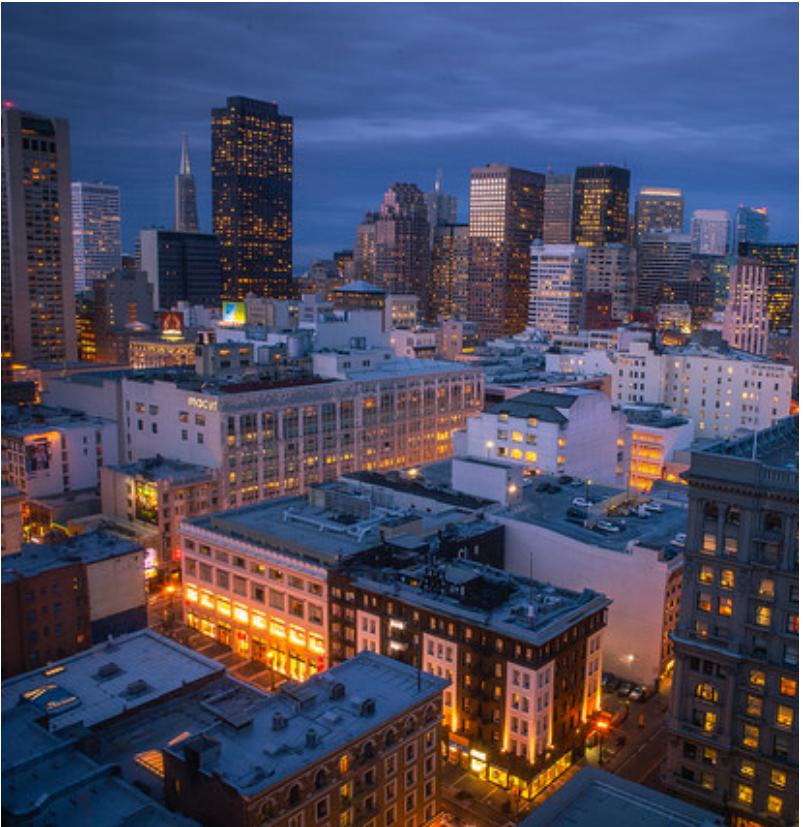
Minimizing the difference of activation pattern of style image and mixed image preserves the color and texture of the style image.

How do we implement it?

$$E_L = \sum (G^L - A^L)^2$$

$$\mathcal{L}_{total} = \alpha \mathcal{L}_{content} + \beta \mathcal{L}_{style}$$

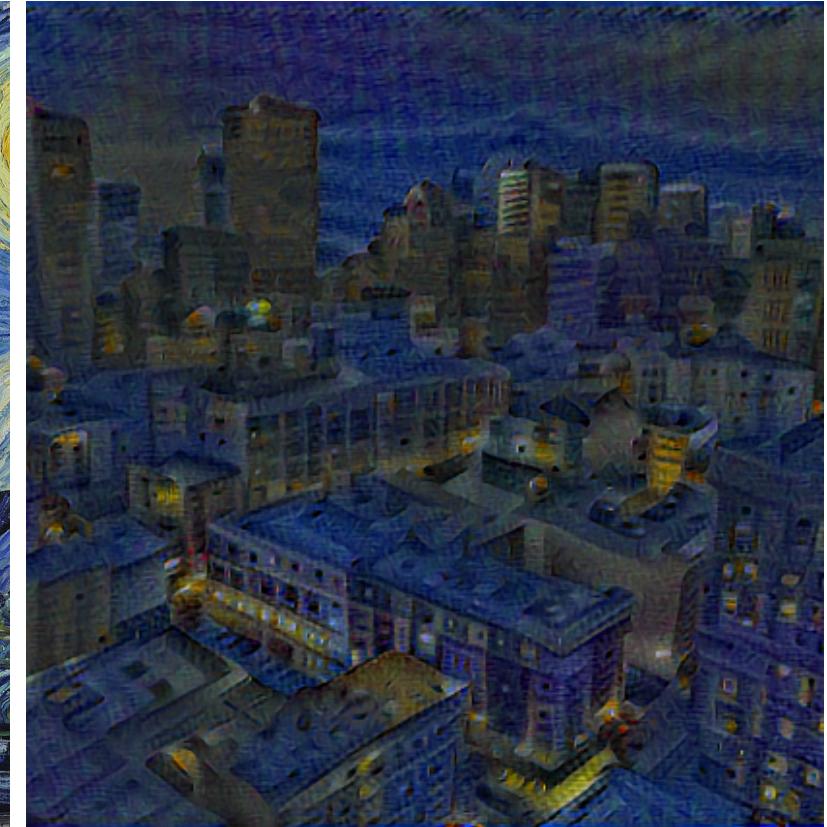




Results



Style



Result

Image



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Results



Results

Portion Selection



We selected several part that we want to implement the style transfer first

Portion Selection



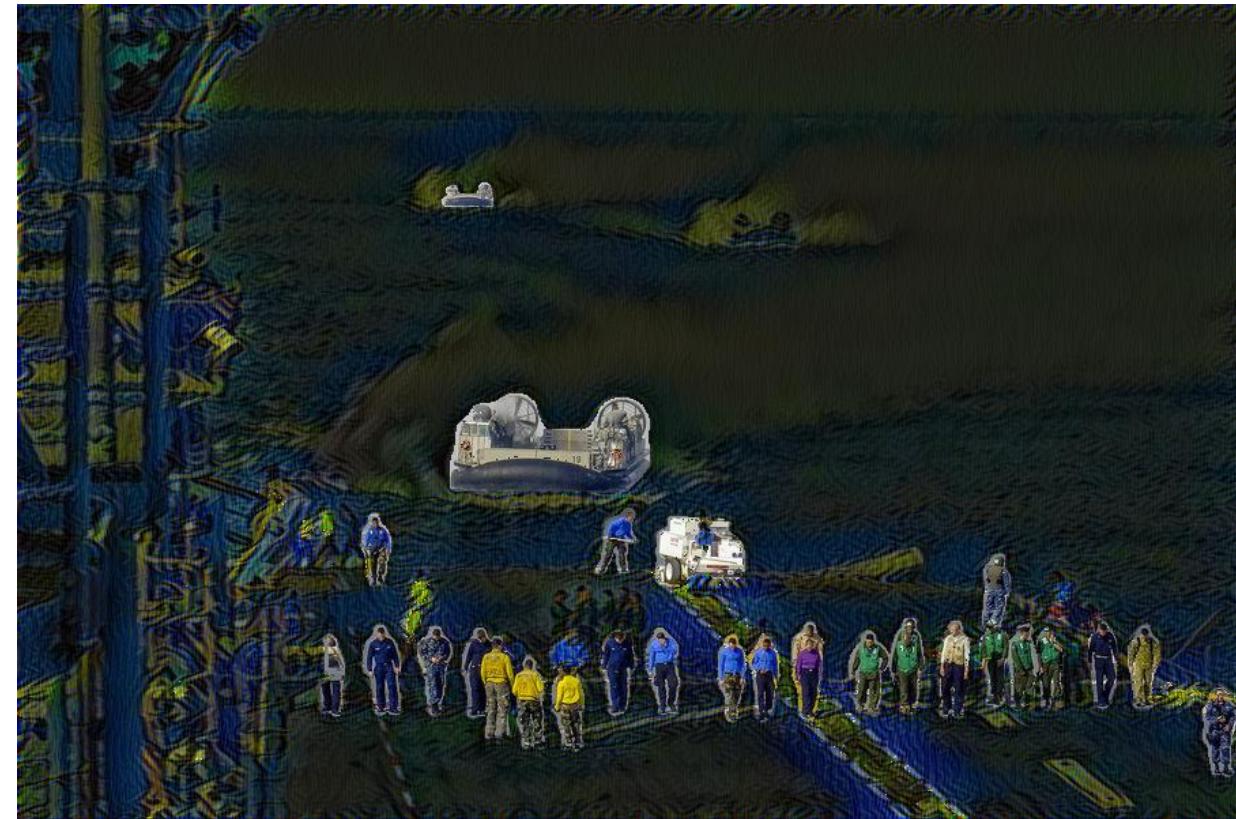
We selected several part that we want to implement the style transfer first

Style Image





Results



Results

Shortcomings

Relatively Slow Process: It took at least several minutes to generate a satisfying result

Different content images and style images require different weights to generate good results

Results are not as great as online examples





References:

- Gatys, L. A., Ecker, A. S., & Bethge, M. (2016). Image Style Transfer Using Convolutional Neural Networks. 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR). doi:10.1109/cvpr.2016.265
- Artistic Style Transfer with Convolutional Neural Network. (2018). Retrieved from <https://medium.com/data-science-group-iitr/artistic-style-transfer-with-convolutional-neural-network-7ce2476039fd>
- <https://github.com/Hvass-Labs/TensorFlow-Tutorials>
- <https://github.com/fzliu/style-transfer>