Neural Style Transfer for Logos

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What is the Goal?

Using the hierarchical structure of CNNs to extract the concepts of content from one image and style from another image which are then merged together into a third image.

What is Content and Style?

Mathematical representation:
Content/Style loss:

$\vec{p}$:content image

$\vec{a}$:style image

$\vec{x}$:generated image

$F_{ij}^l \in \mathcal{R}^{N_l \times M_l}$

N_l: # of filters, M_l: activation map

$G_{ij}^L = F_{ij}^l (F_{ij}^l)^T$, the Gram matrix

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

$$\mathcal{L}_{style}(\vec{a}, \vec{x}) = \sum_{l=0}^{L} w_l \frac{1}{4N_l^2 M_l^2} \sum_{i,j} (G_{ij}^l - A_{ij}^l)^2$$

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

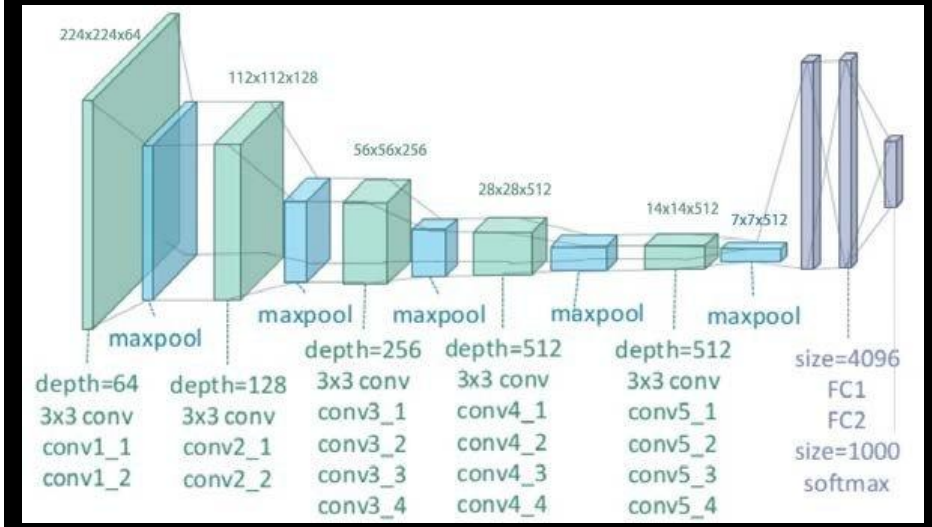
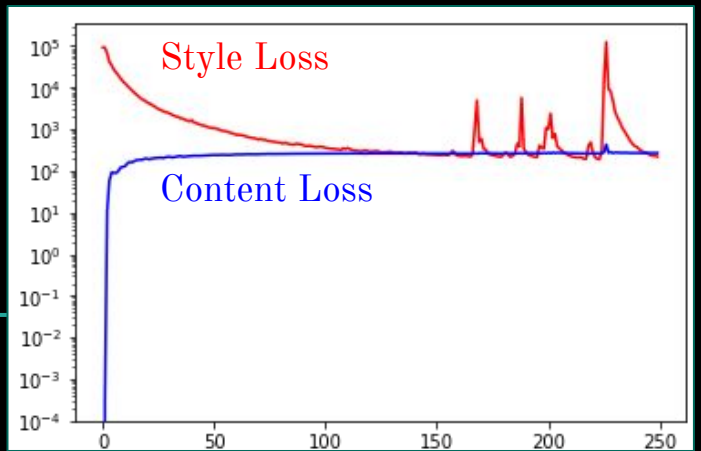
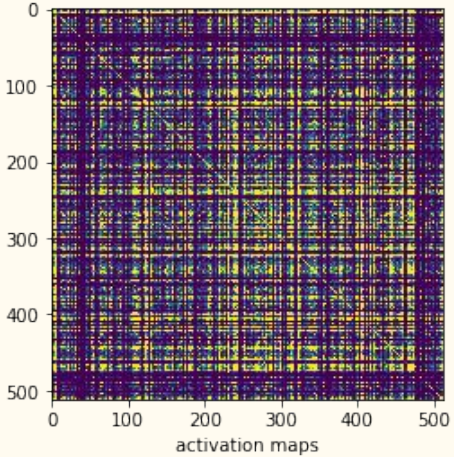


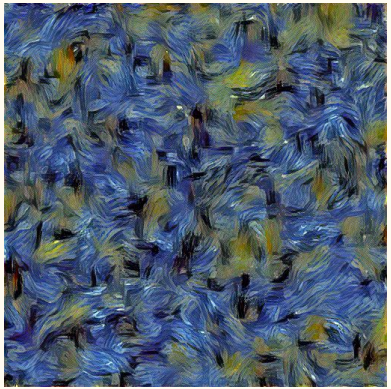
Fig1. VGG19 Architecture



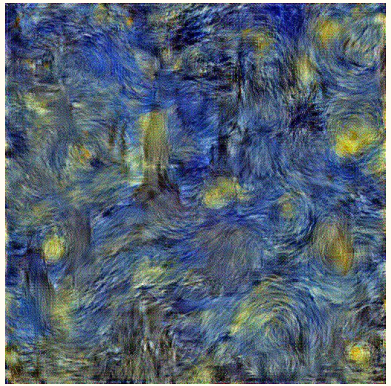
What does a machine see as “Style”?

The style of The Starry Night can be represented as a Gram matrix of the activation maps of the CNN layers. Gradient descent is then used to backpropagate the error and generate these images.
The method can be transferred to other networks as well with proper normalizations and adjustments.

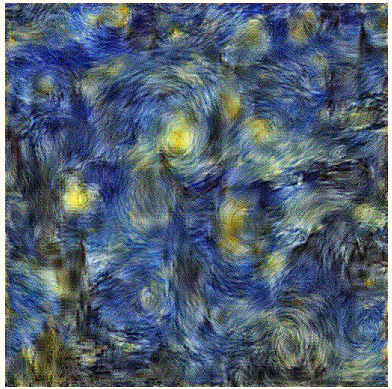




VGG19



Inception



AlexNet

Logo Results

We applied this algorithm to a variety of logos with varying results.

Conclusion

The terms “style” and “content” still are very subjective.

This technique can be effective at differentiating between textures and color palettes from content, but in many contexts color and texture is not what we mean when we as humans say “style”. In such cases this technique is not effective.

The Future might not be so far off!

Deep Learning is coming for your jobs Graphic Design majors! (or it will be an amazing tool to use)