Neural Style Transformations

Example of Machine Learning for Art

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Evening Talk

(contains art not intended for the eyes of prudish minds)

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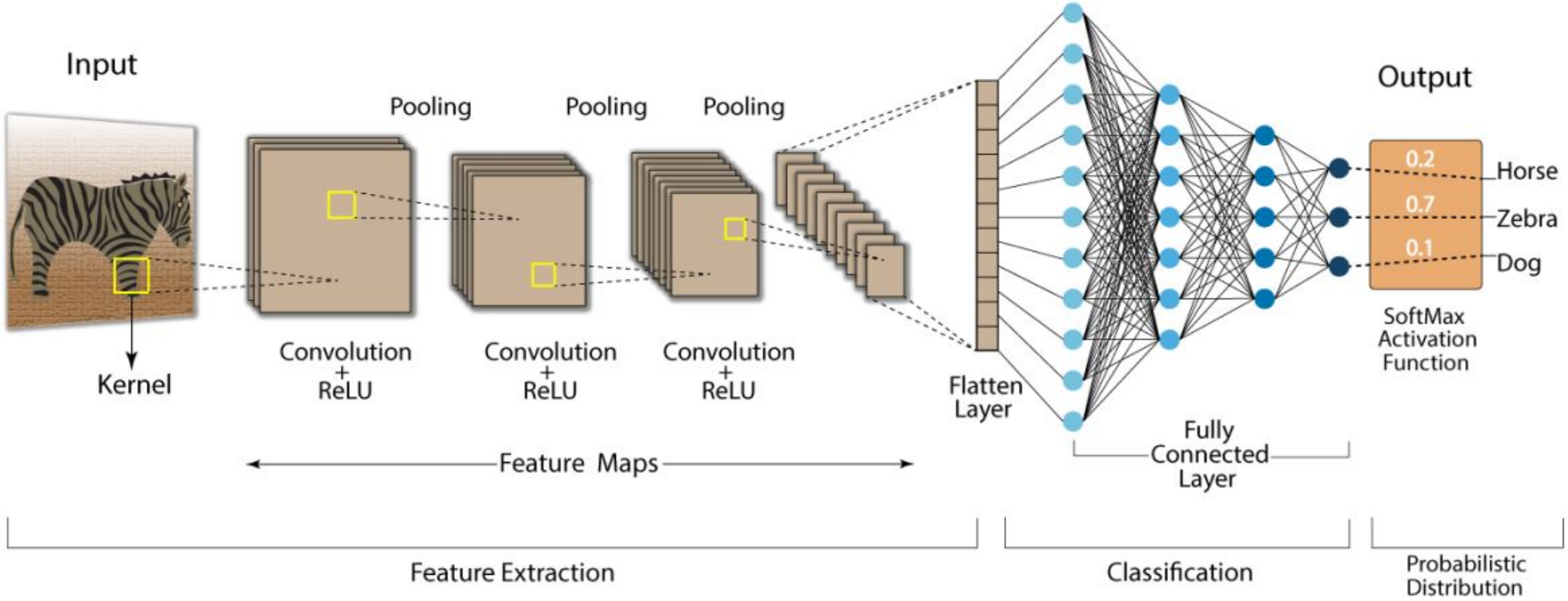
First let us see what ChatGPT is saying, if it is online …

Please write a Python code snippet which explains what backpropagation is !

What are neural style transformations in machine learning ?


Convolution Neural Network (CNN)
Input
Pooling
Pooling
Pooling
Output
0.2
Horse
0.7
Zebra
0.1
Dog
Kernel
Convolution + ReLU
Convolution + ReLU
Convolution + ReLU
Flatten Layer
SoftMax Activation Function
Feature Maps
Fully Connected Layer
Feature Extraction
Classification
Probabilistic Distribution

Formulation

The process of NST assumes an input image p and an example style image a.

The image p is fed through the CNN, and network activations are sampled at a late convolution layer of the VGG-19 architecture. Let $C(p)$ be the resulting output sample, called the 'content' of the input p.

The style image a is then fed through the same CNN, and network activations are sampled at the early to middle layers of the CNN. These activations are encoded into a Gramian matrix representation, call it $S(a)$ to denote the 'style' of a.

The goal of NST is to synthesize an output image x that exhibits the content of p applied with the style of a, i.e. $C(x) = C(p)$ and $S(x) = S(a)$.

An iterative optimization (usually gradient descent) then gradually updates x to minimize the loss function error:

$$\mathcal{L}(x) = |C(x) - C(p)| + k|S(x) - S(a)|,$$

where $|.|$ is the L2 distance. The constant k controls the level of the stylization effect.

Play with it ...

You can use this notebook:

https://github.com/sigvehaug/MLwPython/blob/master/NST_Tutorial.ipynb

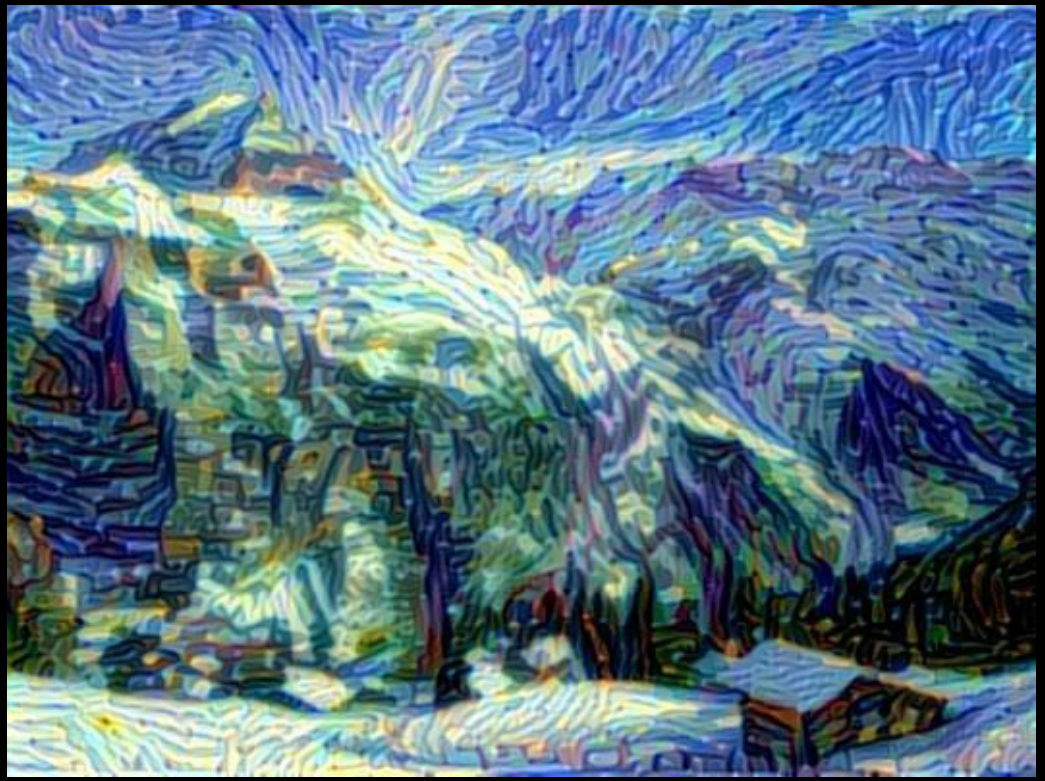
Other examples follow.

AI for Art: https://aiartists.org/ai-generated-art-tools

Photo of Muerren from a participant

Van Gogh Style

Muerren drawn by CNN in Van Gogh style



Self portrait in golden gown, 1997-98, 187 x 144cm, collection Astrup Fearnley Museet for Moderne Kunst, Oslo.

Odd Nerdrum (1944-), Norwegian Painter.

L'Origine du monde ("The Origin of the World")

Oil on canvas by Gustave Courbet, 1866.

Musee d`Orsay