May 31st 2019

# MRP – Week#1 Report

## I spent this week understanding the background fundamentals of Neural Style Transfer and how it can be implemented in Python.

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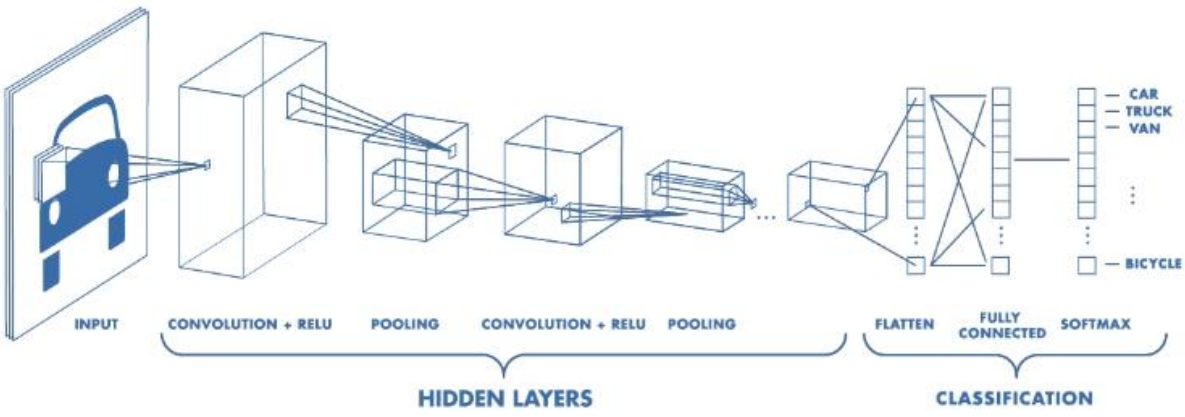
Convolutional Neural Networks (CNNs)

- Great for working with images
- Computers perceive images as 2D arrays of numbers (a.k.a pixels)
- **Regular neural networks:** transform an input by putting it through a series of hidden layers. Every layer is made up of a **set of neurons**, where each layer is fully connected to all neurons in the layer before. Finally, there is a last fully-connected layer — the output layer — that represent the predictions
- **CNNs**: the layers are organised in 3 dimensions: width, height and depth. Further, the neurons in one layer do not connect to all the neurons in the next layer but only to a small region of it. Lastly, the final output will be reduced to a single vector of probability scores, organized along the depth dimension
- **2 Main components**
    - Feature Extraction/Hidden layers – Convolution and Pooling operations to extract features
    - Classification – probability assigned to what the image possibly contains




- **Convolution Layer:** apply a filter as a sliding window over the image
- **Activation Layer:** nonlinear activation functions like ReLu and tanh for machine learning
- **Pooling:** down-sampling of features

Neural Style Transfer

- The CNN extracts information at each layer as a feature map.
- Deeper layers provide more content information
- To extract the style of an image (i.e. the stroke and colors), we calculate the correlation between the outputs of higher level layers. This calculation captures texture information in the image.

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Python Implementation

- Tensors allow us to store discriminative feature in an array
- Python offers a TensorFlow flow package, ideal for implementing CNNs
- Flow refers to the operations we perform on our arrays such as non-linear transformations
- When you're working with TensorFlow, constants, variables and placeholders come handy to define the input data, class labels, weights and biases.
- We can use an existing VGG-16 network, pre-trained on over 14 million images. (Saves us the pain!)
- The downloads are available on : https://www.cs.toronto.edu/~frossard/post/vgg16/