Project Proposal

Project Title	:	**Neural Style Transfer**
Course Name	:	**Capstone II**
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Date of Submission	:	**January 24, 2020.**

Problem statement

Computational art is a creative field that indicates a futuristic use of A.I. Despite the common belief that machines are unable to create art, current developments and examples in computational art present a new form of art. A.I. is creating 'art' in multiple facets including visual, and musical art and have the added advantage of being able to receive constant feedback from the user.

Creation of artistic images manually where – the merging of multiple images, videos or using the style of one image into another in order to create new art in traditional ways can be a challenge. Artists, social media sites (Facebook, Twitter, Instagram, etc.) utilize and expand on this technology. The current struggle that they face is that it is time-consuming and expensive. Although it is possible for the user to add a new style to the photo, to transform it, with programs such as Photoshop, it requires technical knowledge and skill. It is very difficult to instantly produce such a generated photo and make it ready for sharing - the opportunity exists to create a less expensive, less time consuming, transformational product for both consumers and businesses.

Rationale Statement

Emerging technology (Artificial Intelligence) brought an effective solution of the problem to merge a styles into the images and videos in order to give an artistic look the content images . Neural style transfer is an optimization technique which can able to do this at a lower cost, better quality and in less time. Professional sports teams around the world can market themselves by asking the user to use their photograph and blend it together with the sports team's art. Unlike fitting the image inside the frames provided by sports team on social media platform, Neural Style Transfer will blend the image in such a way that the main features of the image are preserved and style is applied in the rest of the image. The image will look like it is from the creator rather than the user. This will attract die-hard fans of the sports teams to use the software, as well as a sports team as they will be able to use this technique in artistic reproduction in the fields of advertising and promotion

content image + style image = generated image

Ancient city of Persepolis   The Starry Night (Van Gogh)   Persepolis in Van Gogh style

Process

This process includes 5 general steps the perform this functionality which includes visualization of available data, preprocessing the data, set up the loss functions, create a model and finally optimize the loss function.

Apart from this, there is an effective approach to take a pre-trained model (VGG16, VGG19) and process the images and get the artistic images automatically. It is the pre-trained image classification network, which is necessary to define the representation of content and style from out input base image.

The pre-trained models are using the is based on convolution neural networks that are already trained on more than a million images from the ImageNet database and the depth of this network is 19 layers. As a result, this is able to detect high-level features in an image. Following this, we would calculate the similarity between images to the base and style image on the specific layer of CNN in the network. Eventually, we calculate the loss of the generated image in respective of base and style image.

Key Metrics

The architecture will have two key Metrics-

1. Content Loss
2. Style Loss

Content Loss

The content loss is a function that describes the distance of content from our input image x and our content image, p

$$L_{content}^l(p, x) = \sum_{i,j}(F_{ij}^l(x) - P_{ij}^l(p))^2$$

Style Loss

The style loss is the mean squared distance between the feature correlation map of the style image and the input image. The contribution of each layer to the total style loss is described by

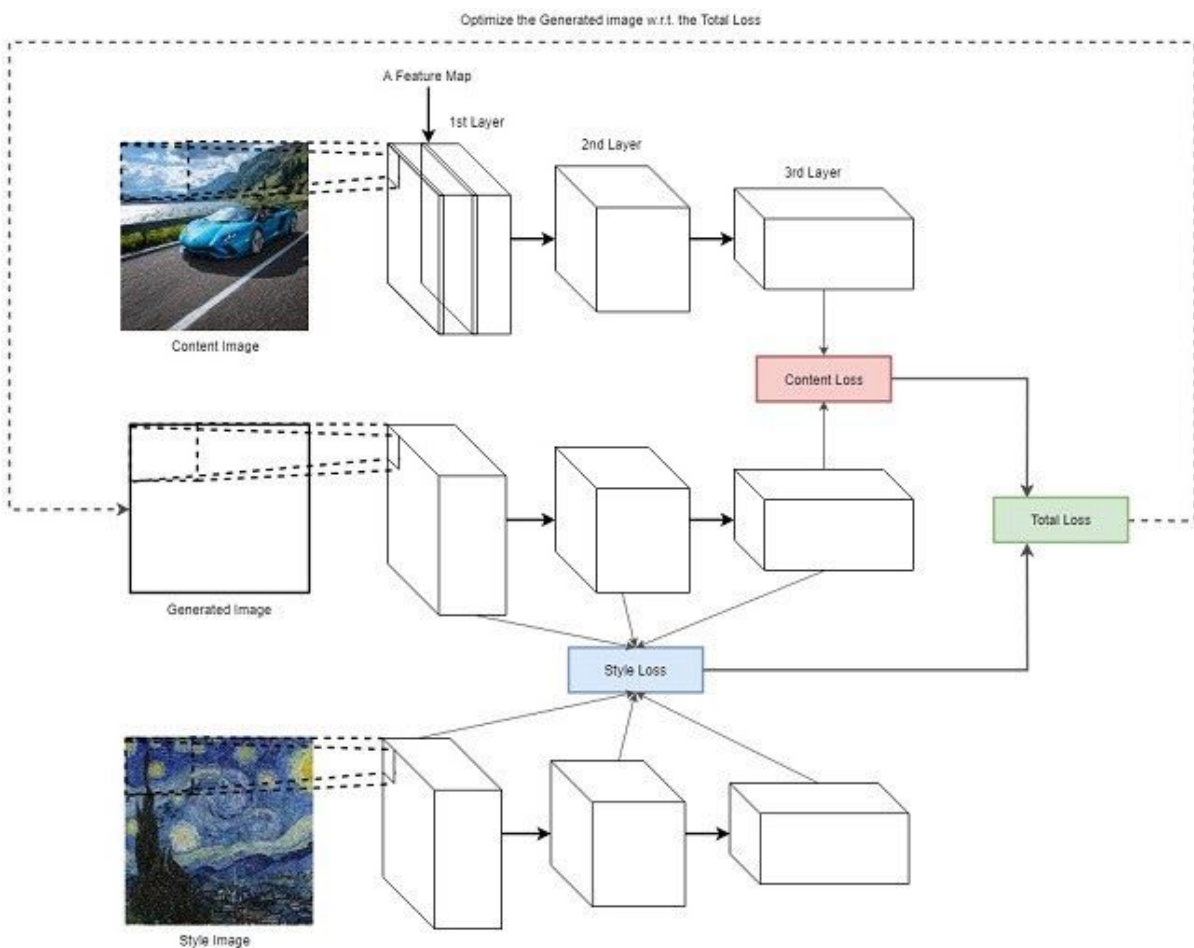$$E_l = \frac{1}{4N_l^2 M_l^2} \sum_{i,j}(G_{ij}^l - A_{ij}^l)^2$$

The goal is to minimize the sum of **Style Loss** and **Content Loss.** Gradient Descent algorithm as an optimization technique will be used to minimize the loss.

Architecture

Layers of Convolution Neural network
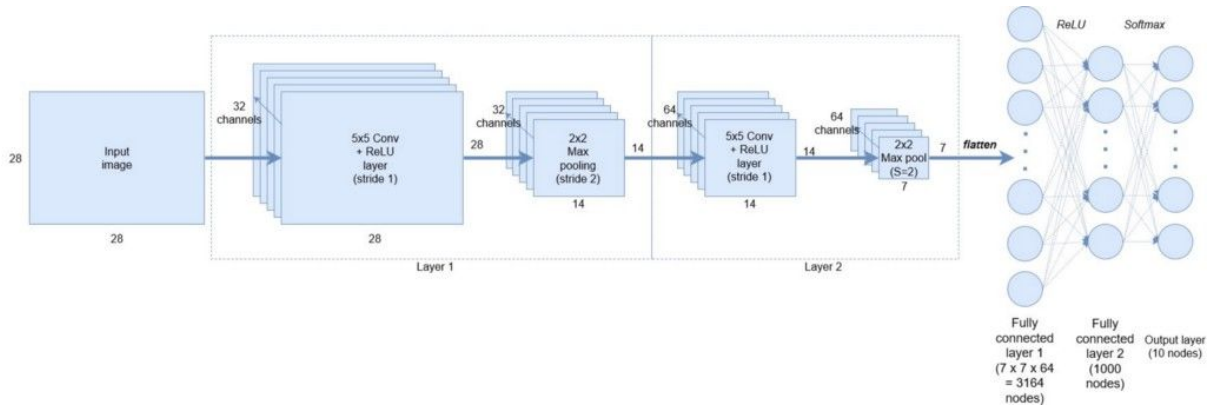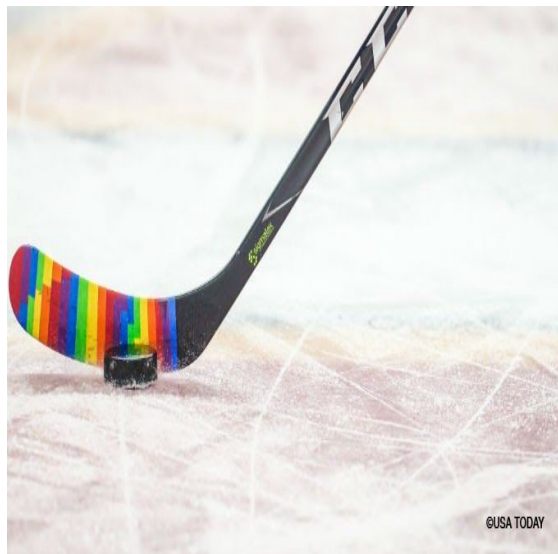

Architecture

End Result

1. In the end application, the user will upload the image , which will be content image -

2. The user will choose one of the styles -

3. The output will be as -

References

https://medium.com/tensorflow/neural-style-transfer-creating-art-with-deep-learning-using-tf-keras-and-eager-execution-7d541ac31398
https://hackernoon.com/how-do-neural-style-transfers-work-7bedaee0559a