Neural Style Transfer

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Machine Learning

Abstract

The aim of this report is to show the uses of deep learning field. For example, the “Neural Style Transfer” used to create new art mixing a style of any painter with any picture.

Objective

Develop a code capable to transform a content image with a style image and get a style_content_image using neural style transfer.

Introduction

This technique known as neural style transfer is an optimization process used to take three images, a content image, a style reference image such as an artwork by a famous painter), and any image you want to style.

For example the image1:

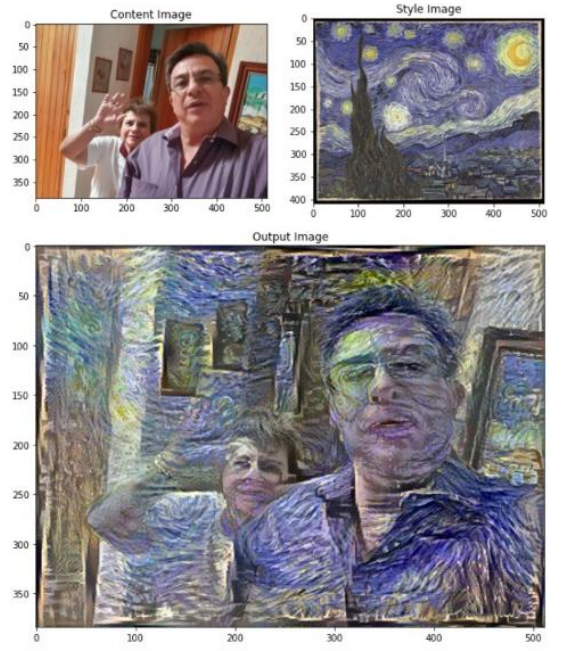


Image1.- Style transfer example

This is possible by the uses of the VGG19 network, with Keras that makes available its uses for an input image encoded for each layer of the CNN. Layers with N filters or Kernels will generate N features maps as outputs finding special characteristics of the input image such as lines, curves, dots, objects, figure, etc.

In the algorithm those features outputs will be flattened out in a one-dimensional vector M, where M is the height times the width of the output of each filter when applied to the input image.

The main idea of the neural style transfer is to define two distance functions. One function used to obtain the difference between the content image and the input image, and the other function used with the same purpose, but in terms of their style. This main idea help us to get the loss function to obtain the variance and try to reduce by optimization process with different gradient values to minimize the content distance and the style distance.

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

Image2. Total loss.

In the image2. where, α denotes content weight, and β denotes style weight. We can get an idea of the main propose in maintain balance between the content and the style paint getting the target image as is shown in image3 process.

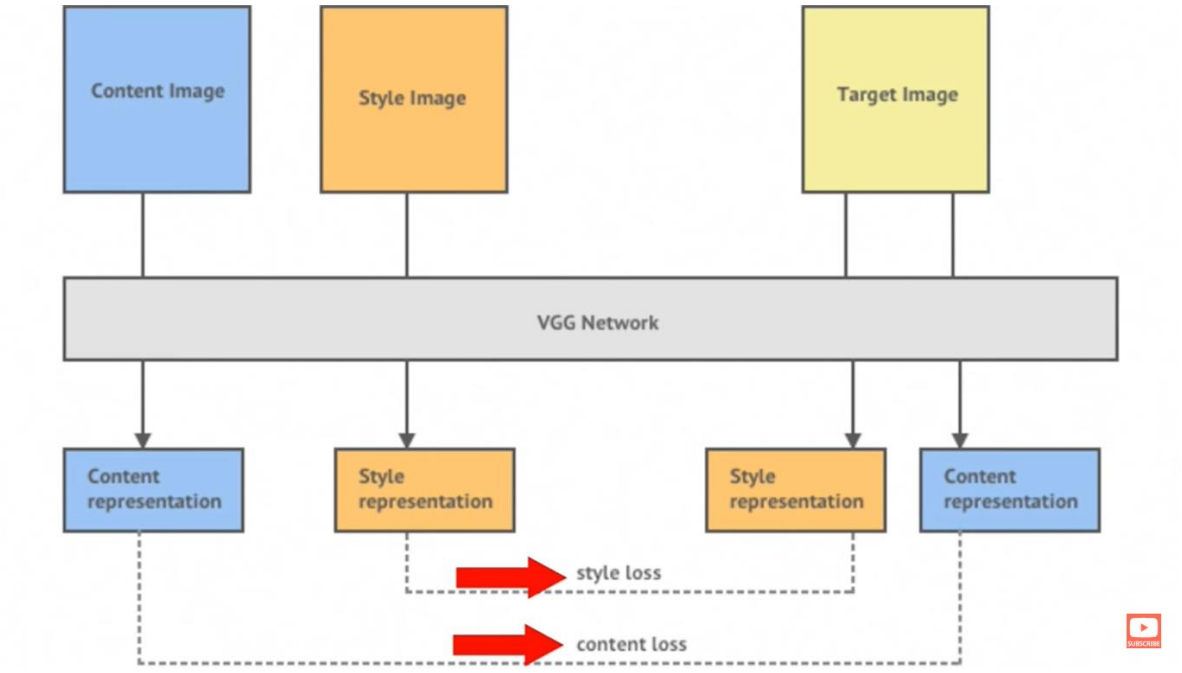


Image3. Representation of target image process.

Steps

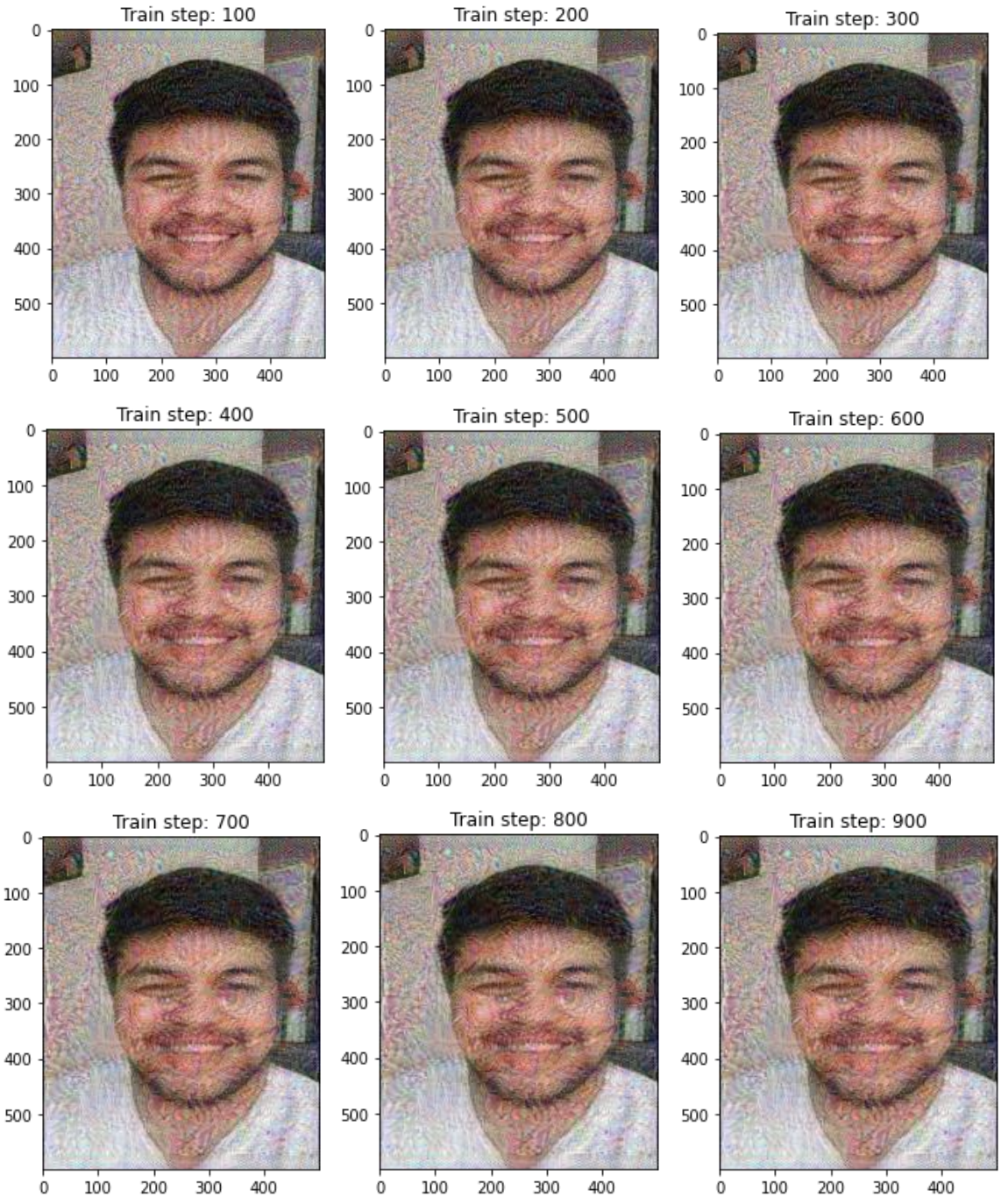
1. Visualize data
2. Basic Preprocessing/preparing our data
3. Set up loss functions
4. Create model
5. Optimize for loss function

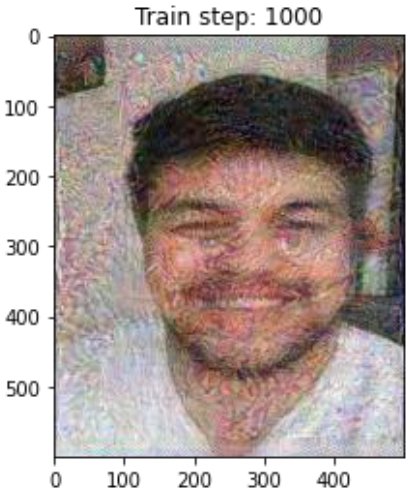
Data implemented

Style_image

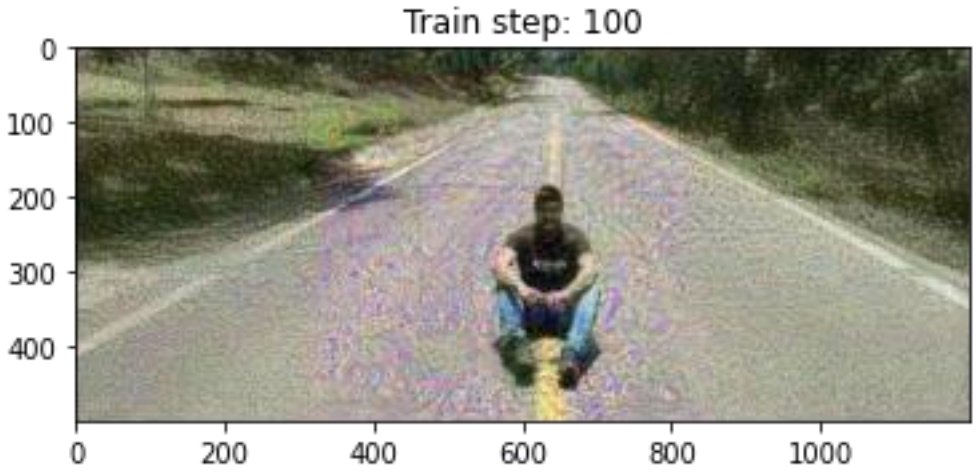
Content_image

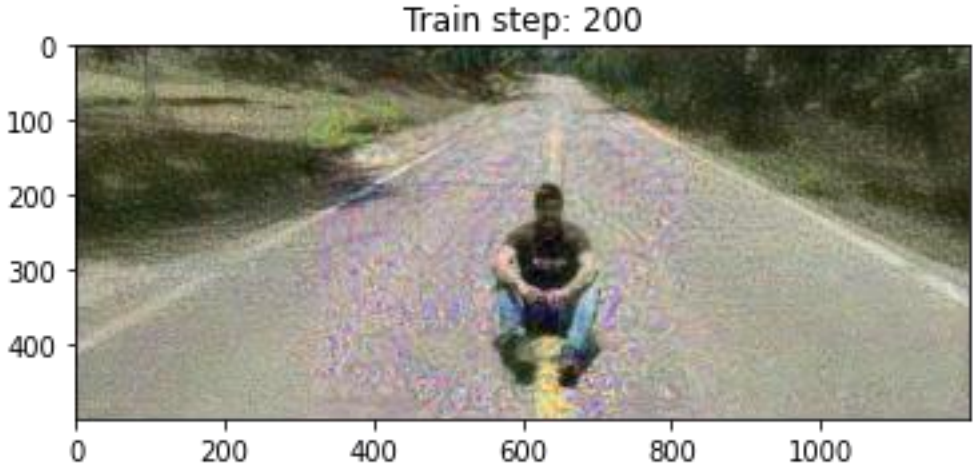
Results


Train step: 100
Train step: 200
Train step: 300
Train step: 400
Train step: 500
Train step: 600
Train step: 700
Train step: 800
Train step: 900



Another Tryals


Train step: 100
0
100
200
300
400
0
200
400
600
800
1000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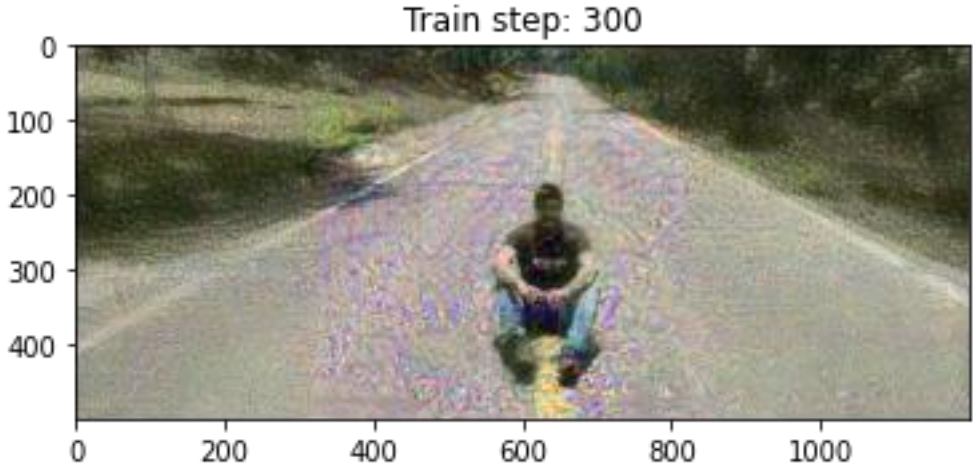
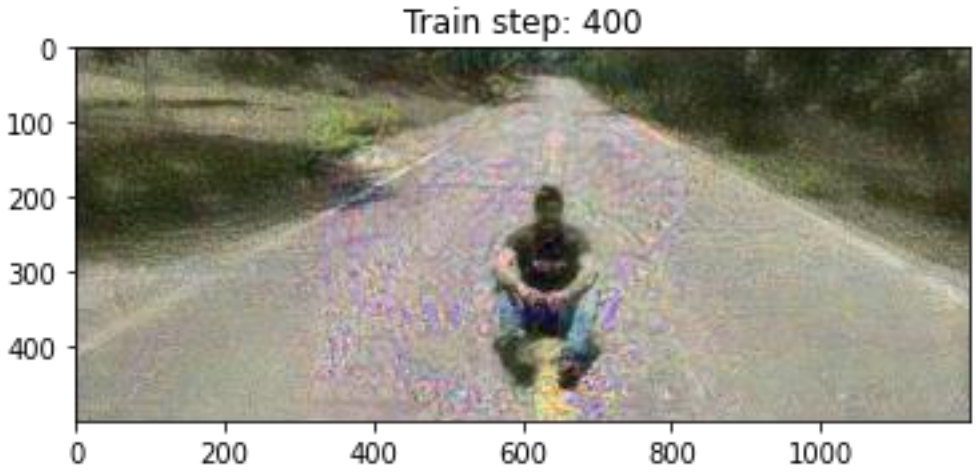
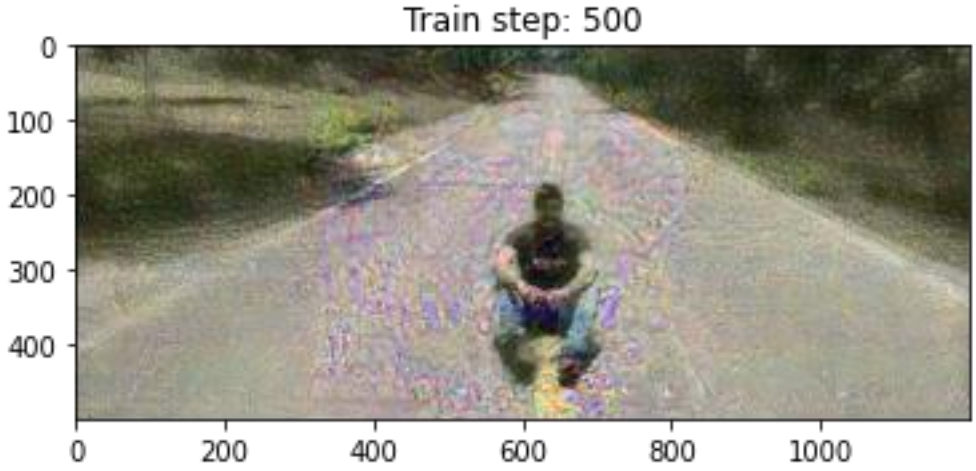
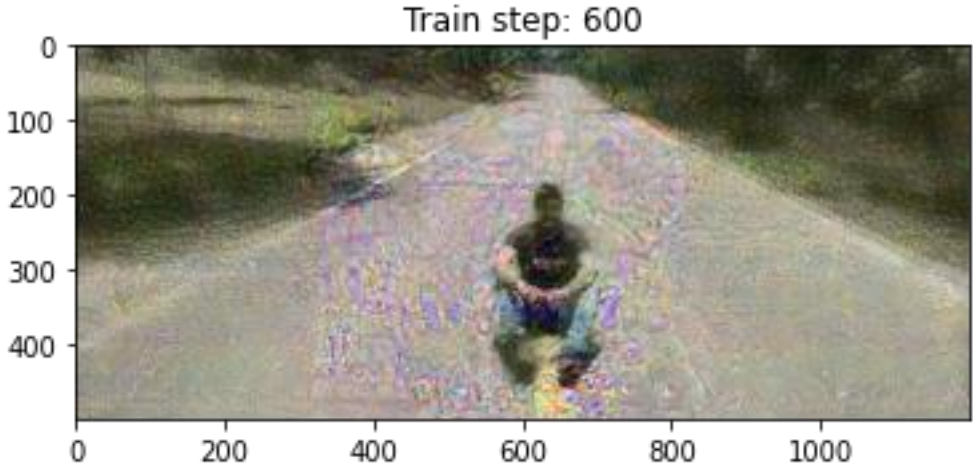
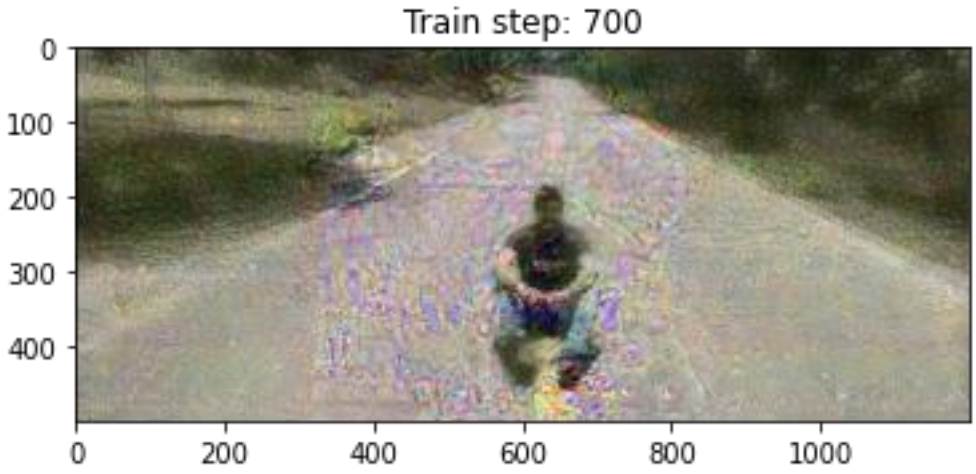
0
100
200
300
400
0
200
400
600
800
1000

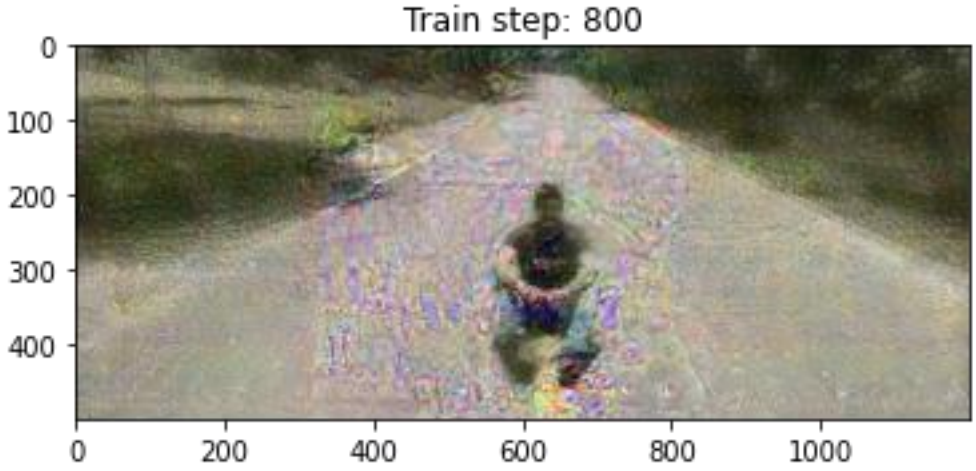

Train step: 300
0
100
200
300
400
0
200
400
600
800
1000

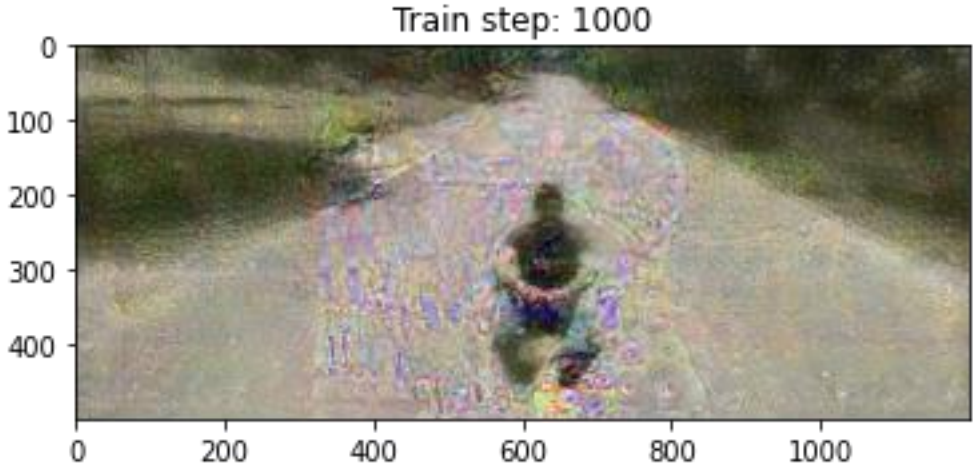

Train step: 400
0
100
200
300
400
0
200
400
600
800
1000


Train step: 500
0
100
200
300
400
0
200
400
600
800
1000


Train step: 600
0
100
200
300
400
0
200
400
600
800
1000







Conclusions

As shown above we can conclude that the model needs more iterations two get better results in the target image. May be this code need a better implement in the

optimization loses or may be more instances generated, unfortunately my computer was too slow to continue making trials. However, we can conclude that the model VGG-19 is a deep learning tool so helpful to get in love with IA techniques such as classification or creating art. In this case I used as creating art leaves me the curiosity of making new codes for classification data.

References:

This report takes reference from paper Implementing “Neural Style Transfer Using TensorFlow 2.0”. This paper uses the VGG-19CNN architecture for extracting both the content and style features from the images implements.

Advanced Applied Deep Learning. (n.d.). Retrieved May 21, 2020, from https://books.google.com.mx/books?id=hJyyDwAAQBAJ

Implementing Neural Style Transfer Using TensorFlow 2.0 ... (n.d.). Retrieved May 21, 2020, from https://www.datacamp.com/community/tutorials/implementing-neural-style-transfer-using-tensorflow

TensorFlow Implementation of "A Neural Algorithm of Artistic Style". (n.d.). Retrieved May 23, 2020, from http://www.chioka.in/tensorflow-implementation-neural-algorithm-of-artistic-style