Project Title: Style Transfer Trilogy

Group Members: Yuejiao Qiu, Ruoting Shen, Wenxuan Tang, Sirui Wang, Yuening Wang

Project Goal & Objective Summary

We are inspired by the filter effects in diverse mobile applications that we can transform an image into another image which keeps the same content, such as objects and shapes while changing the styles. However, sometimes, the filters are not satisfying enough, it suffers from shading, brightness, contrast, etc.

In this project, we aim to design a more flexible way to convert the image style completely. By providing another image, such as diverse artists' masterpieces or various photographers' work with distinct styles, we adopt these styles as the "filter effects" to transform the content image. The building block is to transform the style to the utmost extent while preserving the object in the original image as much as we could. Besides, we intended to try out different algorithms and network architectures to maximize the performance of style transformation as well as the runtime.

Proposed Data Source and Methods

Based on the topic we defined, our datasets fall into two categories: style and content. As for style images, the primary source is based on artistic paintings, among which the famous ones are Water Lilies by Claude Monet, Starry Night by Vincent Van Gogh, etc. The stylistic paintings of the several famous artists can be found on Kaggle. In terms of content images, for a smaller dataset, Kaggle also provides a dataset consisting of 3,747 photographs on which we can train the model. Since we also want to perform a real-time style transfer, it is important to have a sufficiently large dataset. Thus, for a larger dataset, we find LabelMe, which is created by the MIT Computer Science and Artificial Intelligence Laboratory, with 187,420 images. With data prepared, we intend to preprocess them by resizing them into the same size, converting them into numerical features, and other necessary transformations.

The main algorithm we will implement in the project is Convolutional Neural Network (CNN). Based on the previous research, neural style transfer (NST) has two main fields: image-optimization-based (IOB) online neural methods and model-optimization-based (MOB) offline neural methods. Basic style transfer realizes a style render of one fixed style to one fixed content using IOB-NST algorithms proposed by Gatys et. al(2016), which utilizes a pre-trained VGG19 as the loss network. For the MOB-NST model, we will basically follow Johnson et. al (2016) and Ulyanov et. al (2017) to use a feed-forward network optimized over a sufficiently large number of content images for each style. And Shen et. al (2018) proposed a novel method to generate specified network parameters in the meta networks, which archives real-time transfer of any style and content. But due to the limit of space and resources, it might be challenging for us to implement.

In the experiments, we will attempt different models and choose the one with the best performance. Different algorithms and loss functions will be included to evaluate the results. After comparison, we will evaluate the selected model based on transformation accuracy at last.

Expected Outcomes

The purpose of this project is to develop an algorithm that extracts different artistic styles and then applies these styles as filters to the target image. Based on retaining the original content of the target image, the style can be used to the greatest extent. Our target is to make the total loss as small as possible.