Neural Style Transfer

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1. Problem Description & Goal

Style transfer is a sub-problem of Image Transformation tasks. It is an unsupervised task to apply style of one picture onto another picture. Neural style transfer was originally developed with traditional CNN architectures and was applied on painting and arts style transfer. Our goal is to build an adaptive style transfer network on different kinds of data sets such as cities, natural landscapes and portraits, etc. To reach this goal we need to analyze model architectures for each specific type of data set to achieve best results, as well as how to make the system choose different model for different input images.

2. Previous Work

In recent years there has been multiple research work focusing on image transformation, and there are two most prevalent approaches. One approach is to use CNN based supervised learning and per-pixel loss function to perform super-resolution tasks and colorization tasks.[1] The other approach is to focus on the high-level image feature representations extracted from trained CNN.[2][3] The former strategy achieves a higher speed while the latter strategy takes perceptual difference into account to achieve a better performance. Recently, researchers attempt to apply GAN model[4][5] on neural transfer so it can be applied on realistic photos, which is deemed to be a more difficult style transfer task. The performance of GAN is sound on realistic photos according to the literature. Neural style transfer also has several research branches such as video style transfer and high-resolution picture style transfer.

3. Method

Our work can be splitted into two main parts. Firstly, we would train different transfer networks, using different architectures and parameters to achieve best results for different image data sets accordingly. Secondly, we would train a classifier to assign input images to a model that can potentially make the best style transfer. The alternative technologies for style transfer network in the first step are CNN and GAN. We will explore different model settings, such as ResNet or VGG for CNN-based models, and cycleGAN for GAN-based models, for different data inputs. To classify image categories in the second step should be a classic problem on image classification which there are numerous research projects we can refer to such as the classification challenge on CIFAR data set.

Our expected deliverable should be a style transfer system that performs adaptive style transfer based on the nature of the input image.

4. Dataset

We plan to find different data sets that belong to different categories in order to train different models. These categories may include pictures of cities, natural landscapes and portraits, etc.

5. Evaluation Criterion

Neural Style transfer is more artistic than image classification which can be measured by prediction accuracy. We evaluate our model based on the visual effect. Based on previous research, several parameters could be tuned in order to achieve the best style transfer result, such as loss network depth and transformation-loss weight ratio.

References

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