# Style Transfer Using Deep Neural Networks

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## Introduction

Style Transfer has been a hot topic in recent years. However, one of challenges that remains is the object size difference between style and content images. In this project, we combined Unet based Siamese network with pretrained VGG model to produce style transfer images, aiming to achieve real-time brush-size control. Our implementation is fully based on Tensorflow.

## Data Processing

The dataset that we are using contains two portions: the style images from the BAM Dataset, and we picked the content images from the ImageNet 2012 dataset.

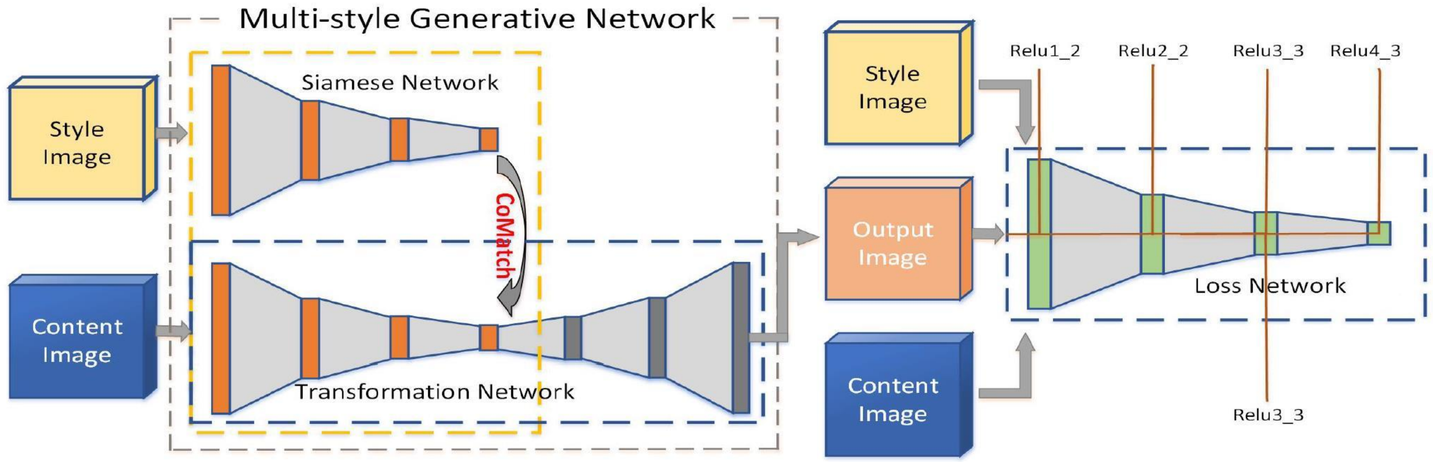
In order to make the training process easier, we decided to normalize and center our data input, that is, center all the pixel values so that their mean is nearly zero; then, normalize all the pixel values so that

$$\frac{\text{image} - 0.5}{\text{image}.\max()} = \text{image}$$

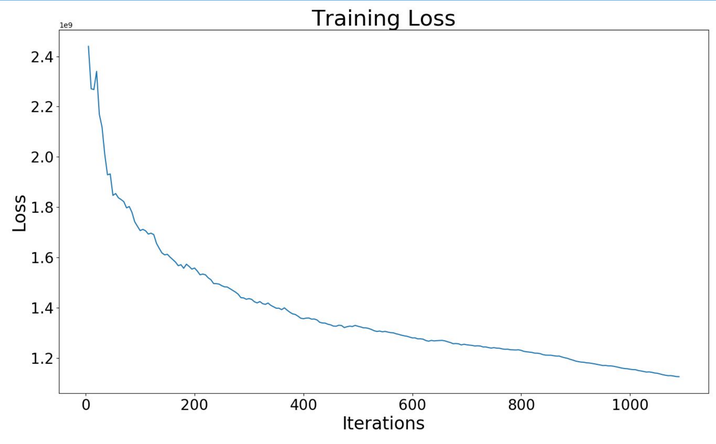
the pixel values ranges from -0.5 to +0.5. After centering and normalizing, the neural network will in theory be more robust to different kinds of images.

## Architecture

We use Unet to embed a style image with a content image. Specifically, we apply Unet based Siamese Network to combine in embedding space the style image and the content image. We then use a pretrained VGG model to evaluate to evaluate both style loss and content loss. Finally, we backpropagate gradients of both losses to update the model parameters.




## Experiments




## Results

Expected result: Auto match the scale of content image and style image. Avoid dense style pattern from being applied to low variant parts in the content image due to high resolution.

## Conclusion and Future Work

One way to modify the structure is to replace the VGG with ResNet. Since ResNet has a deeper structure than VGG, using the intermediate output of deeper layers to calculate the loss can help generate more detailed styled images.

## References

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