Generative Adversarial Networks for Image-to-Image Transformations on Landscapes

Phat Phan
p6phan@eng.ucsd.edu

Christian Koguchi
ckoguchi@eng.ucsd.edu

Lucas Tindall
ltindall@eng.ucsd.edu

1 Objectives

Our project will focus on using Generative Adversarial Networks (GANs) for multiple image transformation tasks. Our first objective is to use GANs for image colorization. Next, we will implement artistic style transfer. Lastly, we will perform season transfer. For each of these tasks, we will focus on natural images of landscapes and cityscapes. We will source our artistic styles from collections of paintings including the works of Vincent Van Gogh and Claude Monet.

The scope of our project will focuse on three tasks with varying difficulties:

- For image colorization, we will attempt to colorize black and white photos of landscapes using a GAN as a generative model. For any colorized image in our dataset, we nearly need to map RGB pixel space to grayscale as input, so preprocessing the data is relatively easy.

- For artistic style transfer, we wish to implement a GAN that will stylize a landscape photograph in the style of a famous painting. While this task may be difficult, there are promising results on several papers that demonstrate the ability of GANs to stylize a photograph inspired by the works of famous artists such as Vincent Van Gogh and Claude Monet.
- For season change, we wish to change the season of one of the test landscape images into a target season (e.g. winter, summer, spring, autumn).

2 Challenges

GANs are difficult to train. An imbalance in performance between the Generator network and the Discriminator network could lead to poor performance and instability since an overpowering Discriminator/Generator network will cause the network to be unable to learn.

It is difficult to quantitatively test the performance of GANs using an evaluation metric without being subjective or relying on heuristics specific to the data. It is hard to compare performance across different domains and datasets in a systematic way.

3 Dataset

We will be using multiple datasets with many types of landscapes and cityscapes. These will be taken from various sources. We also plan to use the datasets from CycleGAN referenced below.

Their datasets include training data for season transfer and artistic style transfer. We also located an outdoor scene web cam stream from Brown which will be useful in season transfer. All datasets are included in the references below.

4 References

Precomputed Real-Time Texture Synthesis with Markovian Generative Adversarial Networks:
https://arxiv.org/pdf/1604.04382.pdf

Unsupervised Cross-Domain Image Generation:
https://arxiv.org/pdf/1611.02200.pdf

Image-to-Image Translation with Conditional Adversarial Networks:
https://arxiv.org/pdf/1611.07004.pdf

GAN Hacks:
https://github.com/soumith/ganhacks

Towards Principled Methods For Training Generative Adversarial Networks:
https://openreview.net/pdf?id=Hk4_qw5xe

Improved Techniques for Training GANs:
https://arxiv.org/pdf/1606.03498.pdf

GAN: A Beginner's Guide to Generative Adversarial Networks:
https://deeplearning4j.org/generative-adversarial-network

GANS-Awesome-Applications:
https://github.com/nashory/gans-awesome-applications

Artistic Style and Seasons Datasets (CycleGAN) (**Dataset**):
https://people.eecs.berkeley.edu/∼taesung_park/CycleGAN/datasets/

Natural Images (CSAIL) (**Dataset**):
http://places.csail.mit.edu/browser.html

Outdoor Scenes (**Dataset**):
http://transattr.cs.brown.edu/

Landscapes and Cityscapes (**Dataset**):
http://mmlab.science.unitn.it/RAISE/