Project Proposal

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Generative Adversarial Networks for Automatic Image Colorization

1 Introduction

There exists a large amount of photographs and videos, mainly antique, that lack color. Providing color to these images provides a modern view to each scene. For a human, the task of colorizing these black and white photos leaves open room for imagination. While some objects commonly hold the same color (e.g grass is *usually* green), many are left up for interpretation. For example, given a black and white photo of someone wearing a dark colored shirt, it would be very difficult or near impossible to tell whether that shirt was blue or green. The loss of information and the fact that there is not one correct answer, automatic colorization is an ill-posed problem.

2 Approach

Recent advances in deep learning and big data provide us with a good starting point for tackling this problem. We propose to leverage two specific areas to solve this problem. The first is deep Convolutional Neural Networks (CNNs). Literature has shown[1] that these can be used to provide a *plausible* colorization of a black and white photo. The second is Generative Adversarial Networks (GANs)[4]. Recently, GANs have shown very promising results for generating data. Energy-Based GANs[2] have been shown to offer greater stability during training, as well as generate higher resolution images. We believe the combination of these two methods should improve on automatic colorization.

3 Objectives

Given the nature of current research in deep learning, there are many variations in which we can try. We have four main tasks that we will be exploring that will ultimately converge.

(1) Implement the state of the art[1] for image colorization. This will provide us not only with a baseline, but given the impressive results, it would make sense to use this architecture as the architecture for the generator in our GANs.

(2) Implement Deep Convolutional Generative Adversarial Networks (DCGANs)[3].

(3) Implement Energy-Based Generative Adversarial Networks (EBGANs).[2]

(4) Explore methods to pretrain the model used in 1 and fine tune it as a generator in 2 and 3.

(5) Time permitting, develop our own GAN architecture for comparison.

Both (2) and (3) will be implemented as they are in their respective papers for generating images. After we are certain the results are valid (i.e the implementation is correct), we will alter them for the main problem at hand. After each piece has been implemented, it is straight-forward to replace the generator in 2 and 3 with the architecture from 1. While much of the work will overlap as the project progresses, our current plan for task delegation is as follows.

Jahidul: 1, 4, 5
Cameron: 2, 3, 5

4 References

[1] Zhang, Richard, Phillip Isola, and Alexei A. Efros. "Colorful image colorization." European Conference on Computer Vision. Springer International Publishing, 2016.

[2] J. Zhao, M. Mathieu, and Y. LeCun. Energy-based Generative Adversarial Network. ArXiv e-prints, September 2016.

[3] Radford, Alec, Luke Metz, and Soumith Chintala. "Unsupervised representation learning with deep convolutional generative adversarial networks." arXiv preprint arXiv:1511.06434 (2015).

[4] Goodfellow, Ian, et al. "Generative adversarial nets." Advances in neural information processing systems. 2014.