

Cartoon Auto-painter

CS 698O: Visual Recognition

Project Proposal

Anil Kumar Gupta- 14097 Kritagya Dabi - 14326

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1 Introduction

Humans have the ability to comprehend hand-drawn sketches and extrapolate these to have realistic and colorful visual imagery of these sketches. This ability is obtained through experience, by actually seeing the color images. Similar to the human ability a machine learning model can be trained to perform the same task given sufficient data to do the learning. Hence a machine learning model (more precisely a neural network) can be constructed to paint a gray-scale image or hand-drawn sketch of a cartoon to pleasing colorful object.

Recently, realistic image generation from gray-scale images using deep neural networks has become a hot topic in machine learning and visual recognition. Colorful realistic images can be generated at pixel or patch level by training from a large dataset.

The aim of the project is to build a conditional GAN based neural network for image to image translation of hand-drawn cartoons to color full images.

- **GAN:** GAN or the Generative Adversarial Network is a neural network architecture that learns a generator model (which behaves as the adversary) trying desperately to fool the discriminator and a discriminator working hard to correctly discriminate or classify the image.

2 Related Work

- **Conditional GANs :** Unlike GANs, conditional GANs (cGANs) learns the mapping from the random noise vector z and <https://www.sharelatex.com/project/59d2399d1cd75037fde0795fd> input $x : G : x, z \rightarrow y$ [1]. Several works has been done for studying different cGAN where the generator is conditioned on inputs to generate output images. The discriminator is needed to distinguish between output and ground truth [2]. In this project, both discriminator and generator will be conditioned on the input image to get better performance.
- **Pix2Pix Translation [3] :** Work has been done to investigate conditional adversarial networks as a general-purpose solution to image-to-image translation problems. These networks not only learn the mapping from input image to output image but also learn a loss function

to train this mapping. This makes it possible to apply the same generic approach to problems that traditionally would require very different loss formulations. Also a 'U-net' architecture has been proposed for the general image to image transfer, which this project will be using.

- **Auto-painter [4]** : The auto-painter model generates compatible colors for a sketch. This new model is not only capable of painting hand-draw sketch with proper colors, but also allowing users to indicate preferred colors. Experimental results on two sketch datasets show that the auto-painter performs better than existing image-to-image methods. Our project will be an improvisation of Auto-painter model.

3 Novel Analysis

The first part of the project includes implementing the model auto-painter that has been discussed in the paper. The second half of the paper is analysis of the test results on images with missing features in sketches. It also includes comparison of results when the model is trained with and without examples with missing features.

4 Tentative Milestones

- **29th October** - Implementing the model of Auto-painter as in the paper and training the model in different conditions to improve the accuracy.
- **12th November** - Complete training and testing of the model on cartoon character. Test the model with images of cartoons with some features missing and analyze the difference of output in the case when the model was trained without those examples vs when the model was trained with these missing features.

References

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- [3] Tinghui Zhou Alexei A. Efros Phillip Isola, Jun-Yan Zhu. Image-to-image translation with conditional adversarial networks. *Berkeley AI Research (BAIR) Laboratory*, 21 Nov 2016.
- [4] Zhenbo Luo Yifan Liu, Zengchang Qin and Hua Wang. Auto-painter: Cartoon image generation from sketch by using conditional generative adversarial networks. *Intelligent Computing and Machine Learning Lab, School of ASEE Beihang University, Beijing 100191, China*, 7 May 2017.