

Colorization of Grayscale Images

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What problem are we trying to solve?

This project explores the problem of colorizing a grayscale image to make it more aesthetically appealing and perceptually meaningful. Since there are many possible ways to assign colors to an image, this is clearly an under-constrained problem and hence requires prior knowledge about the image content. Traditional methods require user interaction in the form of providing color scribbles, similar images or performing segmentation. Over the course of this project, we intend to explore various fully automated data-driven approaches via a thorough related work study, and then implement our own system using Convolutional Neural Networks (CNNs), or a similar approach. The goal of this implementation is not necessarily to recover the ground truth, but rather to produce a plausible colorization that is visually meaningful and appealing.

Why this problem?

Image colorization has a wide range of applications. We list a few here that we find interesting.

- Automatic colorization of historical photography and movie archives.
- Enhance information from grayscale images by a CCTV/crime prevention camera.
- Generation of computer assisted art.
 - Generate colours for computer art.
 - Color style transfer, that is, color an image using the context of another.
 - It would be an interesting experiment to learn colorization based on different photographic styles or different painting styles, and compare the colorization styles learnt.
- Potential pretext for representation learning - can be used for classification, detection and segmentation.

Our Proposed Approach

At the end of the project, we intend to have a working system for colorization, a good grasp of the systems/choices/trade-offs, and an understanding of the effect of various choices we make in representation and learning. We intend to do one or more of the following

- Explore various ways to represent/model this problem.
 - E.g. classification vs regression
 - CNNs vs other representations
- Pick a model, along with experiments, potential improvements if any.

- Quantitative experiments to improve our model
 - E.g. Various error functions
- Qualitative experiments
 - Comparing results of learning different coloring styles/tones.
- Consider exposing this on the project website, perhaps as a way to get qualitative feedback, or A/B testing

Time Table

Date	Goal
Proposal	15 Feb
Previous work study and analysis	02/15 - 02/28
Summarize past work, identify scope for our project, lay down basic design. (Re-implement a specific paper, or find some change / experiment that we want to do)	By 03/10
Setup, explore environments and tools for implementation, change design if necessary based on choices. (Packages, cloud offerings, etc)	By 03/18
Spring break	03/18 - 03/27
Start our design's implementation	27 March
Mid Term Report	29 March
Iterate, improve on implementations, perform various experiments, try different techniques, compare and contrast, understand the problem domain better	April
Think about exposing this as a service via our website.	
Presentations	24 April - 01 May
Document results and findings, finishing touches.	
Website	08 May

Project Proposal (Due: Feb 15) (5%)

This will be a short report (usually one or two pages will be enough). You will explain what problem you are trying to solve, why you want to solve it, and what are the possible steps to the solution. Please include a time table.

Links

<http://pages.cs.wisc.edu/~mohitg/courses/CS766/Projects.html>

http://richzhang.github.io/colorization/resources/colorful_eccv2016.pdf

<https://github.com/phillipi/pix2pix>

Uses Torch, needs NVIDIA GPU + CUDA CuDNN

<http://ieeexplore.ieee.org/abstract/document/1246997/?reload=true>

<http://dl.acm.org/citation.cfm?id=2925974>

http://www.cv-foundation.org/openaccess/content_iccv_2015/html/Cheng_Deep_Colorization_ICCV_2015_paper.html

http://link.springer.com/chapter/10.1007/978-3-319-46493-0_35

<http://dl.acm.org/citation.cfm?id=1101223>

<https://arxiv.org/abs/1604.07904>

http://link.springer.com/chapter/10.1007/978-981-10-2260-9_27