Transforming a Photograph into a Coloring Page

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ABSTRACT

Photographs are a key element in preserving memories, but photographs often sit around and collect dust. To make these memories more interactive, and given the recent popularity of coloring books among adults as well as children, we propose an application that will turn photographs into coloring pages and provide a finished sample.

1. INTRODUCTION

Coloring book has always been the activity of choice for children, helping them refine their motor skills and learn their colors. Recently, the hobby gained popularity among adults looking for a way to demonstrate their skills or to achieve relaxation. In this project, we will analyze what constitutes a good coloring page, whether a coloring page has elements distinct from other lineart, and how a photograph should be manipulated in order to achieve the distinct style. The application's final output will be a coloring page generated from the input photograph and a version of the page with the colors filled out so that the user can have a reference to the original picture.

2. Approach

The project needs to work on edges and colors of the original image. We will have to apply a filter like a Gaussian blur to the image and simplify the colors and eliminate unnecessary edges. The blur may be applied multiple times with different kernel sizes in order to determine which edges and colors are the 'strongest'. Then we will use an edge detection algorithm to make outlines on the input. Once the black-and-white image of the outlines are generated, we will use the filtered version of the input to create another output where the areas within the outlines are colored in, where the colors are extracted from the filtered versions of the input.

2.1 Data Sources

When dealing with image generation in a particular style, it is important to have some ground truth to compare results against. We plan to use the Berkely Segmentation Dataset [1] as our ground truth data for edge detection. This dataset consists of images and 5-10 manual segmentations for each image. The segmentations in this dataset will be our ground truth, and we will use the corresponding images of the dataset as the input to our application. We will split this dataset into a training dataset and testing dataset.

3. Evaluation Plan

The output of the application can be evaluated with our own eyes. Some criteria to look out for in a successful output would include reasonable selection of significant edges and colors–for example, edges should separate the foreground from the background while not losing details we might want to keep, like facial features.
For the class project, success would mean producing doable coloring pages. Upon completion of the project, we will have acquired

a good understanding of image manipulation, edge detection, and color filtration.

Additionally, we will be able to compare our output with the ground truth data set in [1].

4. Project Plan

By milestone 1 on March 23, we will have experimented with photograph edge detection and have a good idea of how we can isolate important edges from the photograph for use in the coloring page.

By milestone 2 on April 7, we will have implemented the black and white coloring page generation and will be starting implementation for the extraction of most prominent colors in each region of the image, where a region is outlined by the edges of the coloring page image.

By the paper draft due date on April 21, we will submit a paper draft detailing our application and presenting the coloring page results produced by our application.

By the final deliverable due date on May 2, we will have a fully implemented coloring page generator and a final paper presenting the results of our application.

5. Related Work

Since our application relies on the detection of significant edges in an image as well as color aggregation, we will likely find significant assistance from sources that have dealt with these sorts of things.

We have located an academic paper regarding detecting natural boundaries in images [2] that we think will be especially useful in our efforts to isolate boundary edges in the photographs. Additionally, we discovered a source code repository [3] with some existing edge detection algorithms.

We were unable to locate any literature pertaining to determining the most characteristic color in a particular image region, but we argue that it is simple enough to apply a filter to the image to simplify the colors visit each pixel in a particular region and analyze the color data along the way. We feel confident that we will be able to implement this functionality on our own, with some assistance from [4].

6. REFERENCES

[1] D. Martin, C. Fowlkes, D. Tal, and J. Malik, "A Database of Human Segmented Natural Images and Its Application to Evaluating Segmentation Algorithms and Measuring Ecological Statistics," Proc. Int'l Conf. Computer Vision, 2001.

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[3] Afshar, Mohammad. edge-detection. (2016). Github repository, https://github.com/mafshar/edge-detection.

[4] Leo Ercolanelli, "How We Tackled Color Identification." algoliaBlog (blog), July 2016, https://blog.algolia.com/how-we-handled-color-identification/.