

Assignment 5

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Abstract

In this assignment, we are tasked with using kmeans to alter images with 2, 4, and 8 kmeans values respectively.

Introduction

By using kmeans, we can reduce the overall number of distinct pixels in images to smaller, more manageable numbers. We will use this to reduce the amount of distinct colors in 8 images in order to showcase how much of an image we can determine with very few distinct colors. We will also provide a side by side comparison to show the difference between 2, 4, and 8 individual colors for our images and the unaltered image.

1 Initial Setup

I initially worked on code to read and plot each image to ensure I was able to access them properly. I used the code given to us by our professor and once I verified I was able to access each of the images, I set to work on the assignment.

2 Decision Points

2.1 Decision 1

My first decision came from needing to resize the images. I needed to decide on what size to resize the images to in order to reduce calculation times.

I initially tried 64x64 but found that the image was too pixelated at that resolution. I then tried 128x128 and 256x256 respectively and found the 256x256 provided a good balance between resolution and calculation time.

I next wanted to resize the images proportionately so I took some time to think about a way I could accomplish this. I settled on keeping the width constant at 256 pixels since all the images were wider than they were tall. I then found the proportion of the original image by dividing the width by the height. This gave me values roughly between 1.4 and 1.9 for each image. I then created a simple algorithm to set the width at 256 pixels and the height at 256 divided by the proportion I found for each individual image. For the first image this came out to be 170x256. I was satisfied with the results so I kept this approach.

2.2 Decision 2

My next decision was how to decide on the initial values for μ . I thought about trying to come up with something clever that would distribute the initial values equally around the image but I ultimately decided against it and settled on randomly selecting points from the image. During my testing this seemed to work fine so I decided to leave it as is.

2.3 Decision 3

My final decision was whether or not to resize the images back to normal either before or after performing all the alterations on them. I found difficulty in trying to resize the image back to its original size and then performing the alterations on it. The image would either be completely black or a single color across all pixels. When I resized the images back to their original sizes after performing the alterations, there was very little difference in appearance between either. Because of this, I decided to just leave the images at their new sizes after altering them. It will take more time for me to try and come up with a work around for this but I have run out of time so I have to leave it as is for now.

3 Results

My results can be found on the next page.

k=2

k=4

k=8

unaltered



The images came out to be fairly similar to the images provided by our professor but not exact. I believe this is due to my resizing of the images and being unable to resize them back to their original sizes with the right alterations. My images appear less vibrant as k increases while the images provided by our professor seem to show more vibrant colors. I will most likely continue to work on this in the future to increase both the accuracy of my calculations and also to improve the performance. Currently, it takes a lengthy amount of time to perform the calculations on these images and I want to try to find a way to optimize my algorithm to perform better. Overall I am happy with the results and look forward to what I can do in the future.

4 What I learned

I learned to perform a simple kmeans algorithm on several images to reduce the number of distinct pixels and to find the cluster centers of those colors. I learned additional ways to reduce code length in python and ways to manipulate images for processing. I also continue to gain more appreciation for the optimized algorithms others have been able to devise and will continue to work on improving my own abilities in optimizing my code.