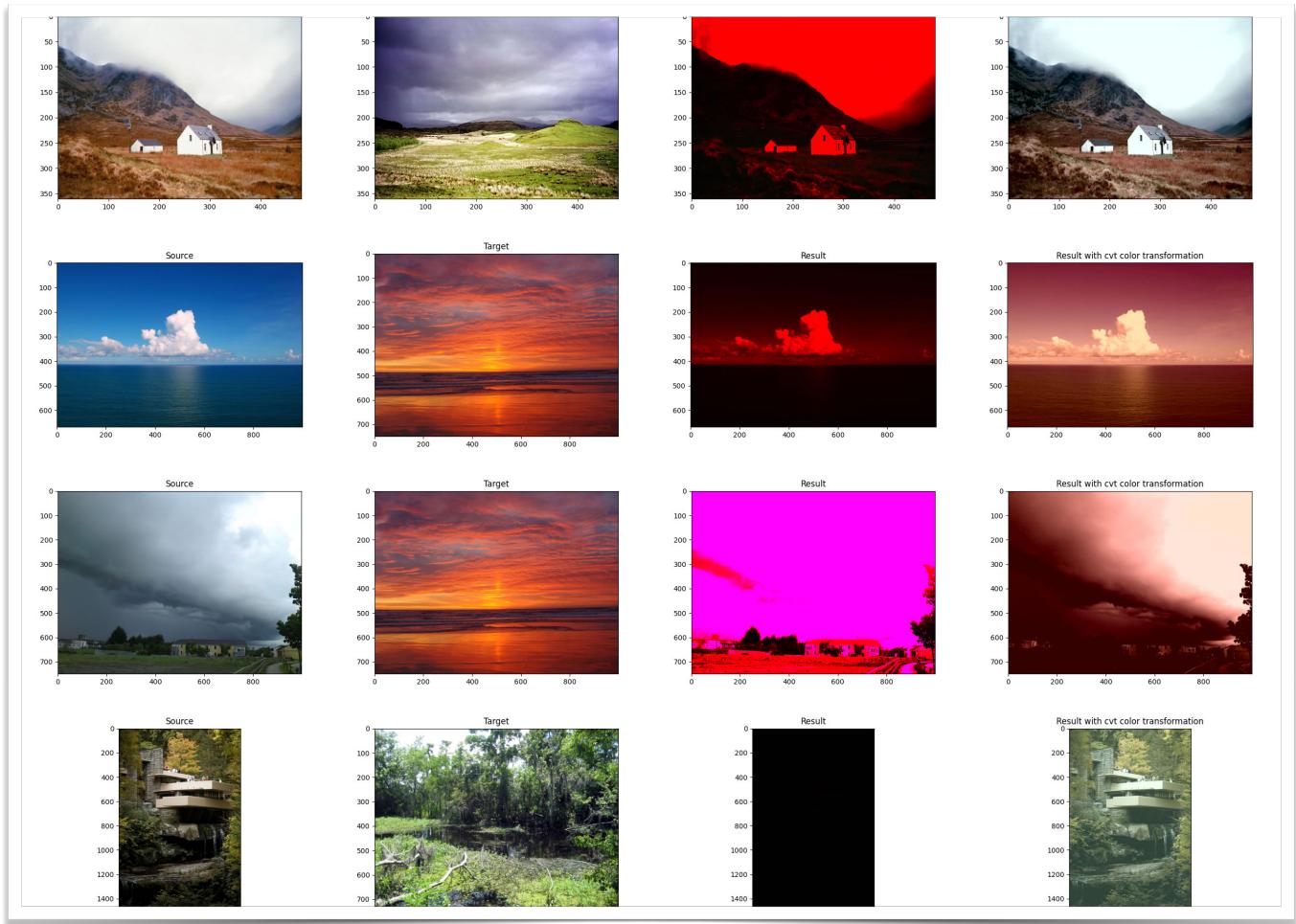


BBM 415 Assignment-1

Quantize, Floyd Steinberg and Color Transfer

Emre Hancı - November 08, 2021



Introduction

First of all, in this project we were need to implement two part, in the first part we need to show quantized image without dithering result and Floyd Steinberg result from original image. In the second part we need to show the color transfer result of given source and target image, when the color_transfer function takes source and target image, it need to do take the color pallet in the target image and manipulate the source image with it.

Part-1

How is the given method achieves to prevent quantization error?

When quantization value calculating, we use the formula "round(old pixel/q) * q" and this formula calculates the new pixel which is rounded the old pixel value the new pixel according the range which is calculating by q. As an example, If we use the image with q parameter which is 4 and old pixel is 166 the findQuantizedValue calculates the new pixel as 182.25 and the quant error is the difference of old and new pixel. The difference between old and new pixel gives us the rounded value according given q parameter which is 4

What is the behavior of the algorithm for different q parameters?

Q parameter provides the pixel values to round in the given elements range as an example if we gives q as 4, the q values equals to 60.75 according to "image.max() / q" formula the reason that I use image.max() instead of 255 is taking the max value of image because this gives most useful result. And when we gives q as 4 the new values should will be one of the array which is [0, 60, 121, 182, 243] and if the pixel value is 166 its rounded to 121, if the value is 75 it is rounded 60. As a result, different q parameters provides to restriction in the calculating range.

[0 60 121 182 243]

New Pixel Limitations for Q = 4

[0 30 60 91 121 151 182 212 243]

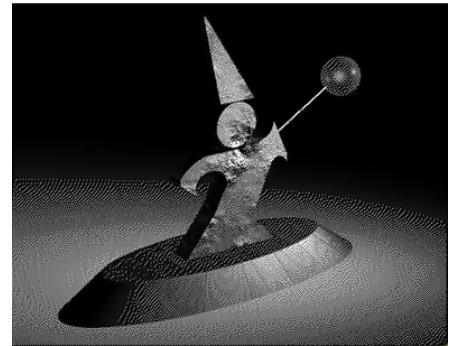
New Pixel Limitations for Q = 8

Comparing the quantized image and dithered image for different q parameters.

The results are shows us, if the value of q incremented, images has number of q types color, and if we increment the value of q Floyd Steinberg algorithm shows most useful images.



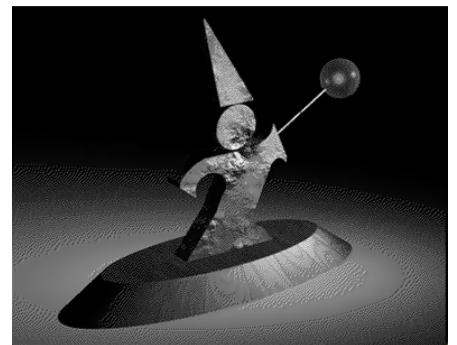
Q = 1 - Quantized



Q = 1 - Floyd Steinberg



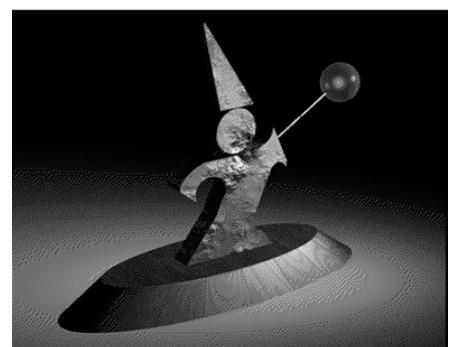
Q = 2 - Quantized



Q = 2 - Floyd Steinberg



Q = 4 - Quantized



Q = 4 - Floyd Steinberg



Q = 8 - Quantized



Q = 8 - Floyd Steinberg



Q = 16 - Quantized



Q = 16 - Floyd Steinberg

What are the disadvantages of Floyd-Steinberg dithering algorithm?

Floyd Steinberg algorithm produce an image within some dots, when the grey region nearly has uniform. If we gives the q parameter more smaller the size of dots getting large and it has more worst result ever. Other disadvantage of algorithm is observed when image has most sharp color transitions, in this case algorithm produce some errors which are could be more destructive.

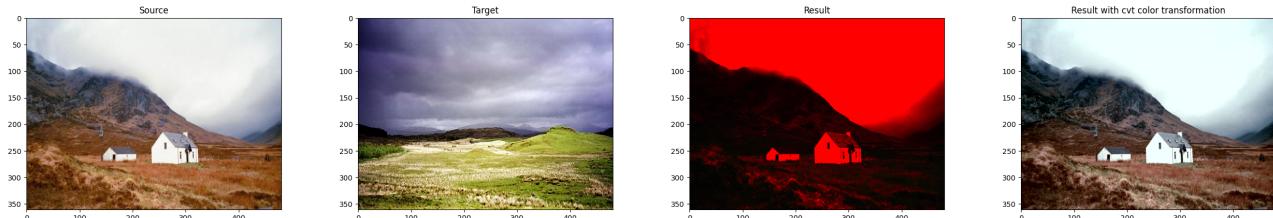
Part-2

Why does the algorithm change color space from RGB to Lab?

In the RGB space pixel values usually has large weight, if the one of the channel has large value, and we need to change other channel values with in an order, and that process the reason of getting color transformation harder. Therefore the space into the lab space which is developed by Ruderman. Lab space allow us to apply different operations in

different color channels with some confidence that undesirable cross channel artifacts won't occur. Because of that reasons we are change our color space to lab space

Show the results of your implementation for several images

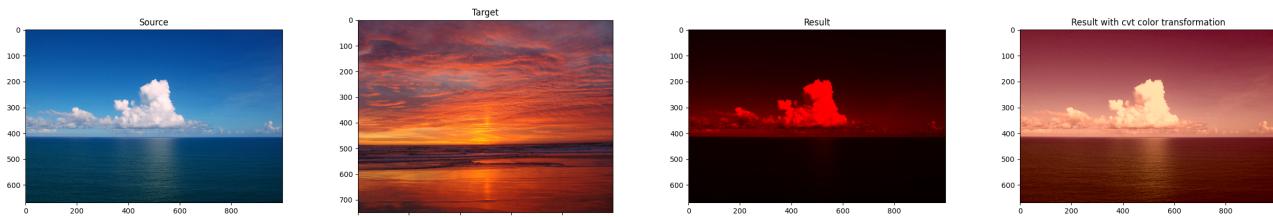


Source

Target

Algorithm

OpenCV

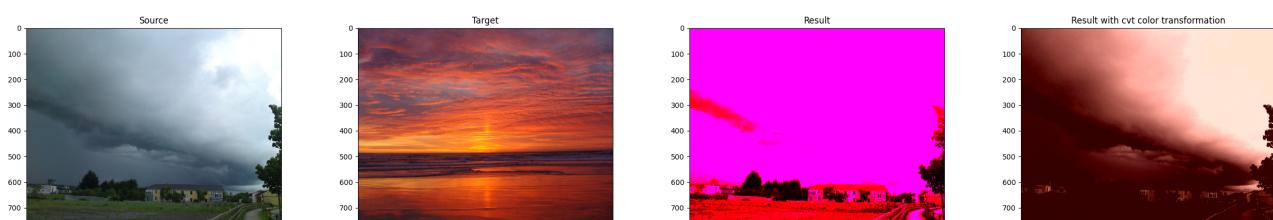


Source

Target

Algorithm

OpenCV

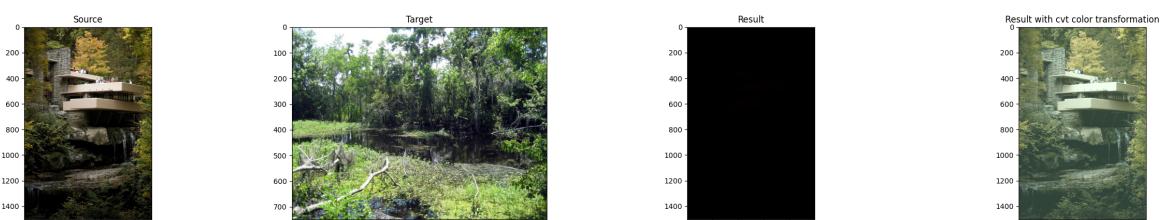


Source

Target

Algorithm

OpenCV



Source

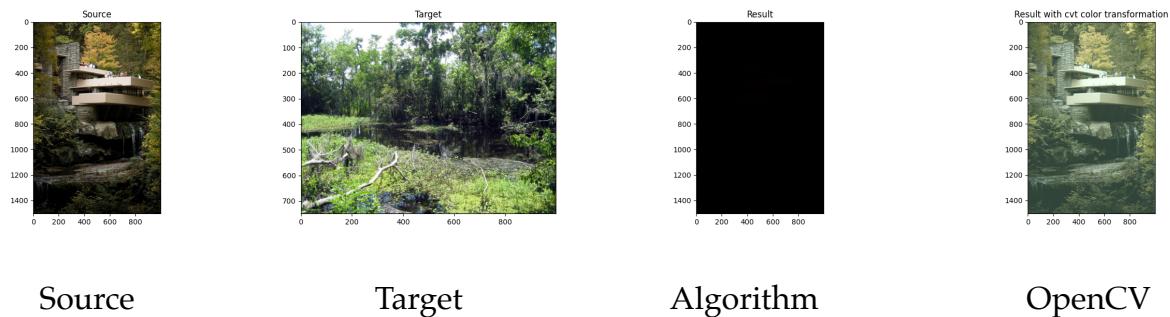
Target

Algorithm

OpenCV

What are the disadvantages of the given color transfer algorithm?

Although I thought that I applied the given algorithm correctly I couldn't get the expected result image, therefore I think there is a mistake and when I compare the Image result which are change the RGB space to LAB space with opencv function, the mistake should be in the space changes in the algorithm. If need to speak about disadvantages although the mistakes the results are can be seen in the opency, the target pictures color pallet shouldn't has near color pallet of source image for better color transfer results.



As the seen in the example, algorithm produce all black image as failure, but in open cv implemantation I couldnt produce any failure image