

Computational Photography

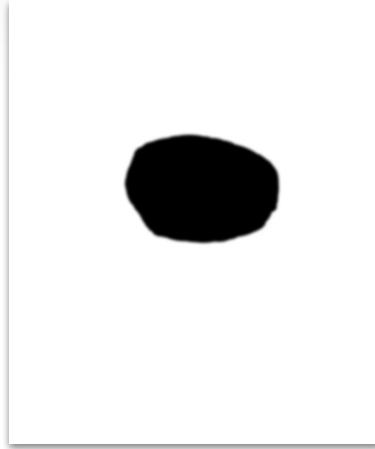
Assignment #4: Blending

Kazakov Maksim
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Input Images



Black



Mask

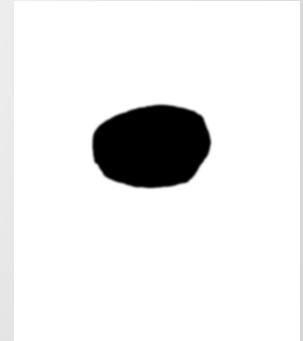
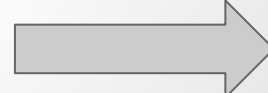
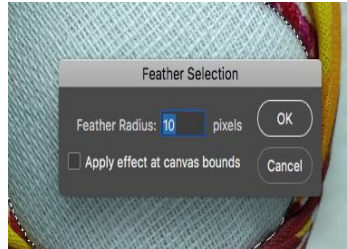


White

I took images of the dolls from my trips to Japan (black) and Russia (white). Russian doll is faceless. Let's see if I can fix it with blending.

Mask

- Since I was trying to replace face of the russian doll with japanese one, I had to create a mask of Russian doll's face. To make the process easier I used Photoshop since it has all the necessary tools to do that. Here's how I made it:
 - Align two images together, to match face of one doll with face of another;
 - Use Elliptical Marquee tool to select face of the Russian doll;
 - Use feather tool to smooth the borders of the selection;
 - Create new layer with white background and fill the selection from previous step with black using Paint bucket tool;
 - Crop and resize all layers and save dolls' layers as black and white images and layer with black mask on white background as mask image.



Mask

Final Blended Image



“Japanese doll in Russian outfit”

Blend Discussion

1. How did you determine precisely where to make the blend?

Doll's face has very distinctive border thanks to cloth it wears around the head. Since I wanted to keep cloth and only replace face I decided to make that face border into blend mask.

2. How might you automate the location of the blending point?

It might be difficult to automate mask creation since depending on the task we can create different masks (e.g. if we want to swap the whole head). On the other hand if the goal is always to swap faces then various algorithms (including ones from OpenCV) can be used to detect faces and detected region can be used as a mask.

3. Do you think that blending or using a cut (as discussed in Lecture 4-04) is a better approach for your input images? Why?

I believe that blending in my case is better since both dolls are made of different materials. So to make it seem more natural, images have to be blended and mixed along the border of the mask. This way one material gradually transforms into another making it a much more smooth transition. It also helped to reduce any imperfections in the mask itself.

reduce_layer() & expand_layer()

- **What is the significance of using $a = 0.4$ for the generating kernel?**

Depending on parameter a kernel function takes on different forms. E.g with $a=0.5$ kernel has more triangular form, while $a=0.4$ is closer to Gaussian function. Since for this project we want to use Gaussian kernel thanks to its property of applying effect of low-pass filter after convolving it with the image, by default a is chosen to be 0.4 .

- **Why does the output of `expand_layer` have to be multiplied by 4?**

During the scaling up procedure we're adding twice as many rows and columns as original image and convolving it with Gaussian kernel which blurs the new image. After these steps all values (brightness) of the original image pixels are spread out across the new image that is now 4 times bigger than original one. Thus it looks darker. To compensate for that we have to multiply all values by 4 to bring them closer to original brightness.

Successes and Improvements

1. Did your blended image come out as you expected? Explain.

Even though I was happy with the results it didn't end up as I planned from the beginning. Instead of "put face of the one doll on another" I got the effect of "dress one doll in clothes of another". Which might be very similar but not exactly what I expected. This is due to the fact that dolls not only made of different materials but also have different postures.

2. What were you most happy about with the final result? Be specific.

I was very surprised how well edges of one image blended with another. At the edge of blending materials even seems to transform from one to another. And even shadows from the clothes of one image appear on head of the doll from another image.

3. What improvements would you make to improve your final blended image (from template slide 5)? Even if you have great results, what part of the process could be improved?

I would try and experiment with different positions of the dolls, trying to achieve more natural look, maybe even closer to what I had in mind in the beginning (doll look straight and not to the side).

Resources

A multiresolution spline with application to image mosaics”:

http://persci.mit.edu/pub_pdfs/spline83.pdf

OpenCV basic image operations:

https://docs.opencv.org/3.1.0/d3/df2/tutorial_py_basic_ops.html

SciPy signal processing documentation:

<https://docs.scipy.org/doc/scipy/reference/signal.html>