

Digital Image Processing - CS 663

Assignment 3 - Question 3

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1 Overview

In this question, we had to perform spatially varying blurring to mimic the background blur effect. For this task, we had to first properly identify the foreground and the background, as the foreground was supposed to be kept perfectly intact.

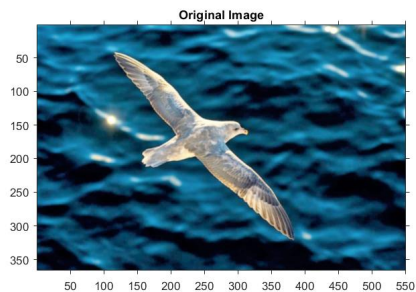
We had two approaches in mind. The first one was to identify edges using Canny Edge Detection, and then fill in the recognised object to generate a mask. But the problem here was that the edges were discontinuous, and hence had to be filled in. Concave/convex filling of the edges causes distortions and hence this approach was scrapped, as edge preservation is important and it may not be the case that we always have strong edges, hence this wasn't a reliable method.

The second approach, which was chosen finally, was to identify segments using the mean shift segmentation algorithm implemented in the previous question. The image was first blurred and then downsampled by a factor of 2. The algorithm was then allowed to run for quite some iterations, so that minimum number of segments were obtained. Then, the largest such segment(excluding the background) was selected using the breadth first search algorithm. Thus a proper mask for the foreground was obtained.

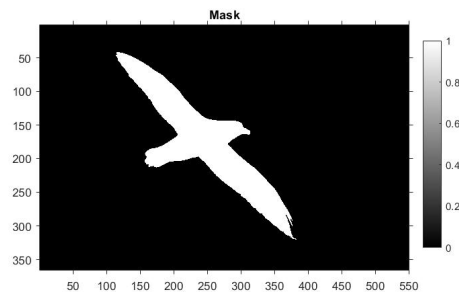
Next up, blurring was performed using a spatially varying kernel as per the specifications suggested in the Question. The required images have been included in this report.

2 Bird.jpg

The mean shift segmentation parameters were tuned properly to obtain the foreground, and finally the optimal values of bandwidths, 30 for the color feature and 20 for the spatial feature



(a) Original Image



(b) Mask Image



(a) Original image with 0 Foreground



(b) Original image with 0 Background

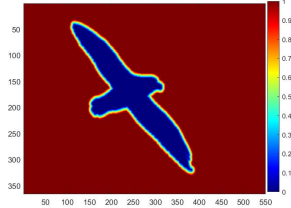


Figure 3

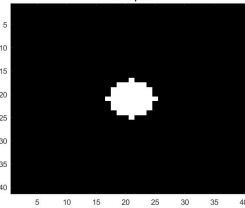


Figure 4: 0.2α

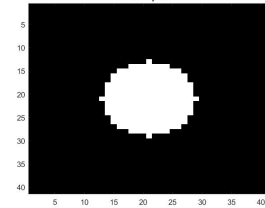


Figure 5: 0.4α

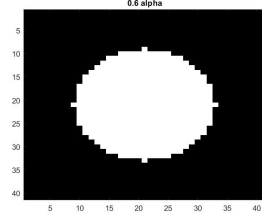


Figure 6: 0.6α

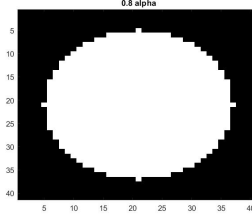


Figure 7: 0.8α

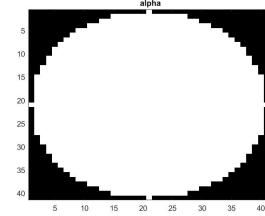
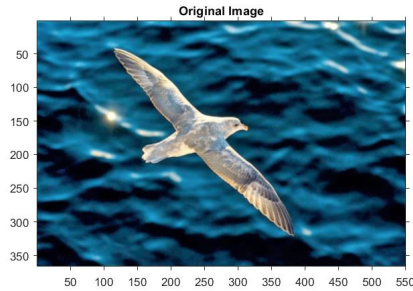
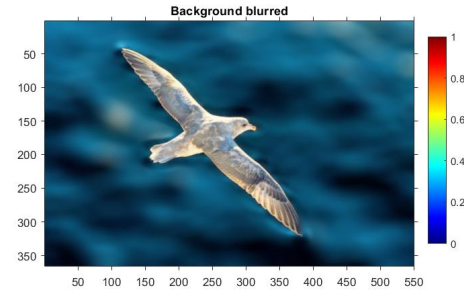


Figure 8: α

Figure 3 is the jet colormap image demonstrating the variation of r with respect to the distance of the foreground in the Mask. The rest of the images show the blurring kernels computed at distances 0.2α , 0.4α , 0.6α , 0.8α & α . $\alpha = 20$ in this case, as the image has been undersampled by 2 here. Note: The images seem elliptical but are actually circular due to the weird aspect ratio.



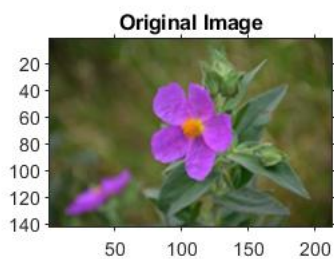
(a) Original Image



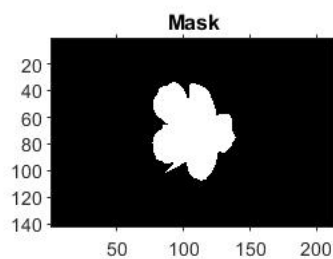
(b) Blurred Image

3 Flower.jpg

The mean shift segmentation parameters were tuned properly to obtain the foreground, and finally the optimal values of bandwidths, 20 for the color feature and 15 for the spatial feature



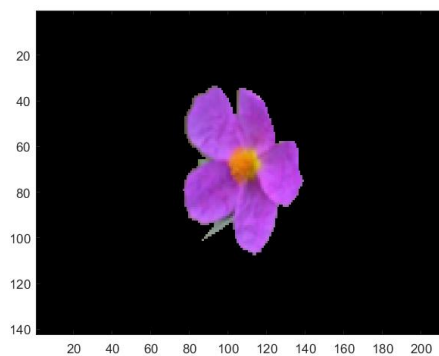
(a) Original Image



(b) Mask Image



(a) Original image with 0 Foreground



(b) Original image with 0 Background

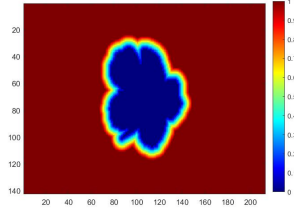


Figure 12

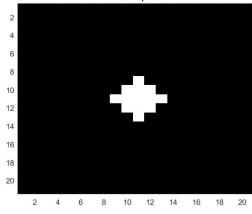


Figure 13: 0.2α

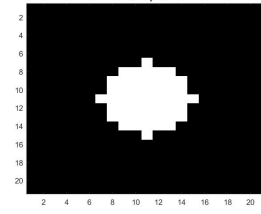


Figure 14: 0.4α

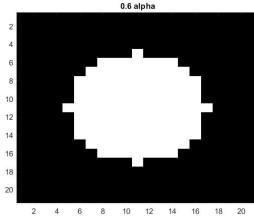


Figure 15: 0.6α

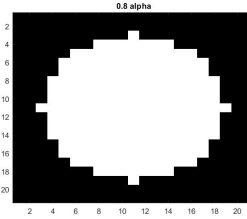


Figure 16: 0.8α

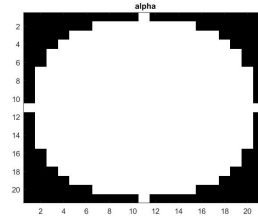
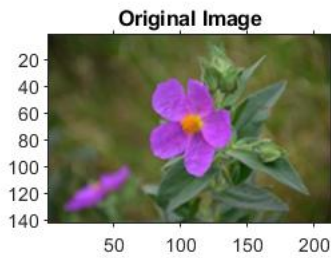
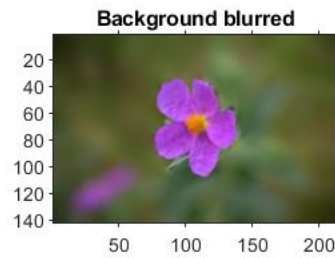


Figure 17: α

Figure 12 is the jet colormap image demonstrating the variation of r with respect to the distance of the foreground in the Mask. The rest of the images show the blurring kernels computed at distances 0.2α , 0.4α , 0.6α , 0.8α & α . α is 10 in this case, as the image has been undersampled by 2 here. Note: The images seem elliptical but are actually circular due to the weird aspect ratio.



(a) Original Image



(b) Blurred Image