

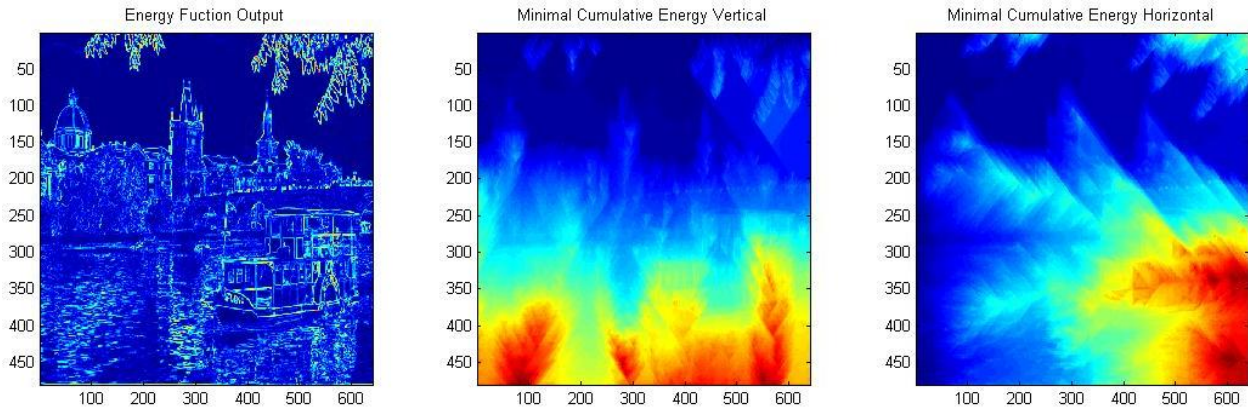
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**CS376 Problem Set 1: Seam carving**  
**Answers to Part 2:**

1) As shown in Figure 1, the results of seam carving kept most of the images intact with a few minor exceptions. In the prague image we see that the least expensive/energetic seams involved a portion of the sky and blue rooftop, resulting in some unwanted carving in the roof. However all the high energy water ripples and the boat are intact. In the mall image, the least expensive seams were those that ran along the trees. This resulted in thinning of the tree trunk.



**Figure 1.**

2) Displayed in figure 2 we have the output of the energy function(left) and the cumulative minimum energy maps for the vertical (center) and horizontal(right) directions for the prague image.



**Figure 2.**

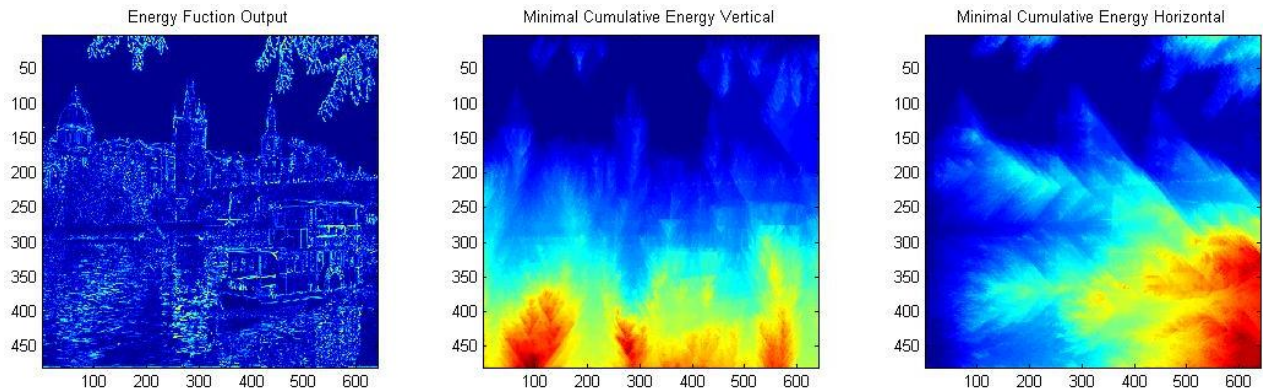
**3)** Figure 3 displays the prague image with the optimal vertical and horizontal seams plotted over them. We can see that the optimal seam directly relates to the least expensive (bluest) areas in cumulative minimum energy map shown above in figure 2.



**Figure 3.**

**4)** By replacing the Prewitt filter in the energy function with a Laplacian of Gaussian (LoG) we obtain the results in figure 4(a) and (b). The LoG filter provides more smoothing than the Prewitt filter. Thus, we can see less of the high (red) values in the minimum cumulative energy maps, figure 4(a). This has caused the first optimal seams to change positions as shown in figure 4(b)



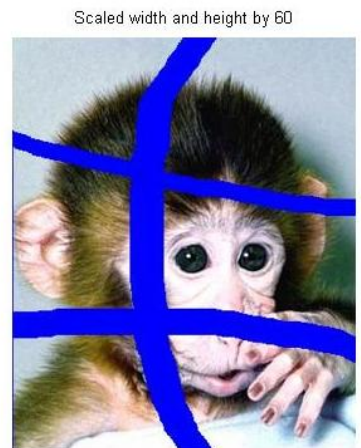
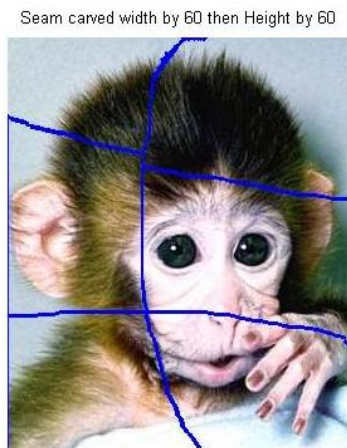
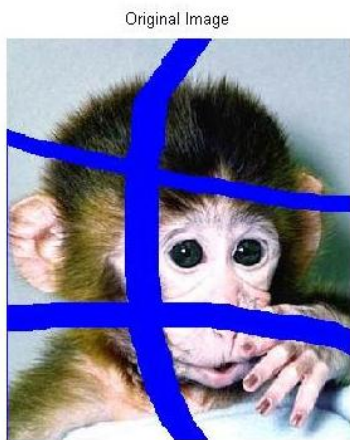


**Figure 4(a).**



**Figure 4(b).**

5) Shown below in figure 5 are three examples of seam carving. The first column contains the original images, the second column contains the seam carved result and the final column contains the result of blindly scaling the images. The first image was originally 139x284. The seam carved result is 139x209. Most of the carving took place in the smooth water and sky areas. The second image was carved from 194x259 to 194x159. The smoothness of the road caused it to be thinned. Note that the high energy tree and flowers were left unchanged. This is not the case in the third column. The tree is clearly warped. The last image was originally 389x333, but after processing is 329x273. As you can see we have very low energy blue paths for the algorithm to carve through. This results in what appears to be a sliding together of the separated sections over a blue surface.



**Figure 5.**