https://drive.google.com/open?id=1RoN-hkCdjH-WySXMLXh1LBd0HxTCr010 (delete before submit)

Joseph Torres
Linda Li
Professor Lee
ECS 174
05/1/2019

Problem Set 1

Part I.

1. The associative property of convolution, i.e. f (n) * (g(n) * h(n)) = (f(n) * g(n)) * h(n), is what makes separability of a convolution function possible. In this sense, separability means being able to split a convolution function into two simpler functions that can be applied to an image in turn to achieve the same filtering effect with reduced computational complexity. For example:

   Let f = [2;4;2], g = [2,4,2], h = [1,2,3;4,5,6;7,8,9]. Then (f(n) * g(n)) * h(n) implies convolution f and g first: f * g = [4, 8, 4; 8, 16, 8; 4, 8, 4] and requires taking 9 products. Then (f*g)*h = 320 and requires another 9 products, totaling 18. Whereas f(n) * (g(n)*h(n)) implies first taking g(n)*h(n) = [16; 40; 64], requiring taking 9 products. f(n)*(g(n)*h(n)) = 320 as before but adds just three products for a total of 12.

2. This is the input image: [1 0 1 1 0 0 0 1]. The result of dilation with a structuring element [1 1 1] is **[1 1 1 1 1 0 1 1]** .

3. One limitation to exclusively using additive Gaussian noise for image noise simulation is that not all image noise follows a Gaussian normal distribution. Random instances of white pixels (impulse noise) or white and black (salt and pepper noise) cannot be represented by Gaussian noise.

4. An approach to improper assembly detection might be to use edge detection, contour comparison to reveal nontrivial differences from specification. The steps used in such a process could be applied to each frame of video the camera captures, or just at some interval, or even just at the end product. The These steps might be:

   A. Use a smoothing technique to remove any noise in the image.
   B. Apply a filter to maximize contrast (derivative of Gaussian)

C. Find gradient magnitude/orientation

D. Utilize hysteresis thresholding to preserve intediate edges.

E. Having completed the above on frames of a proper assembly, compare them with each set of frames of candidate assemblies. This can be achieved using chamfer matching to decide on acceptable chamfer distance in a way that is tolerates variations.

Part II.

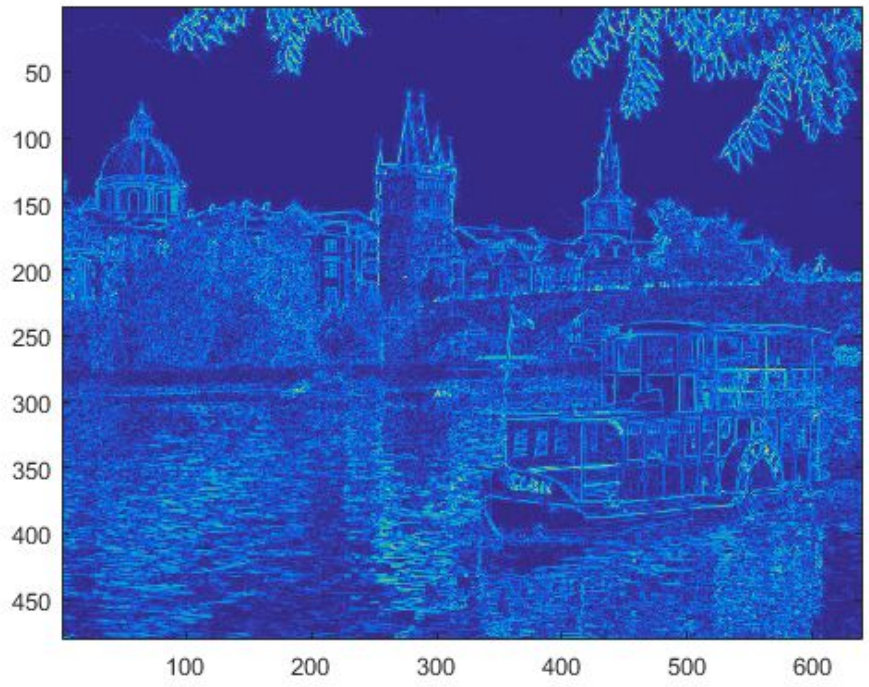
1. outputReduceWidthPrague:

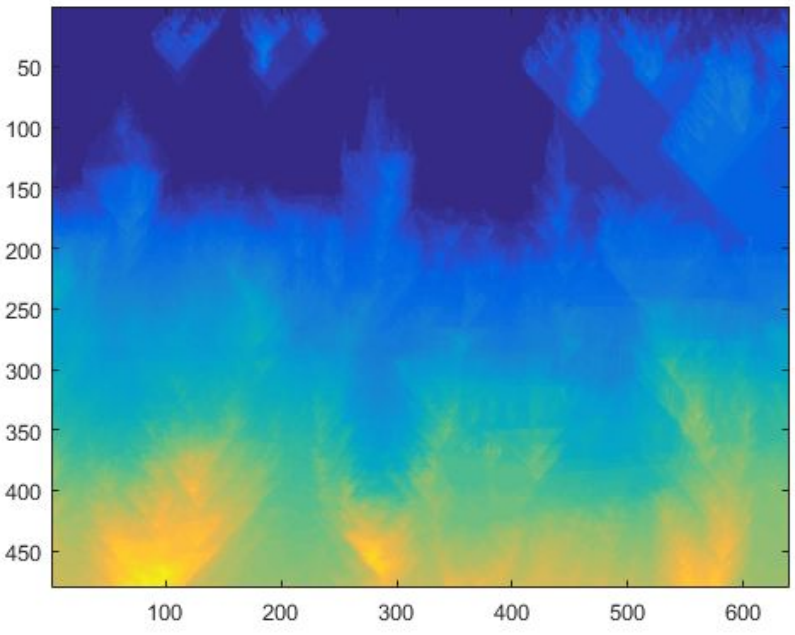
outputReduceWidthMall:

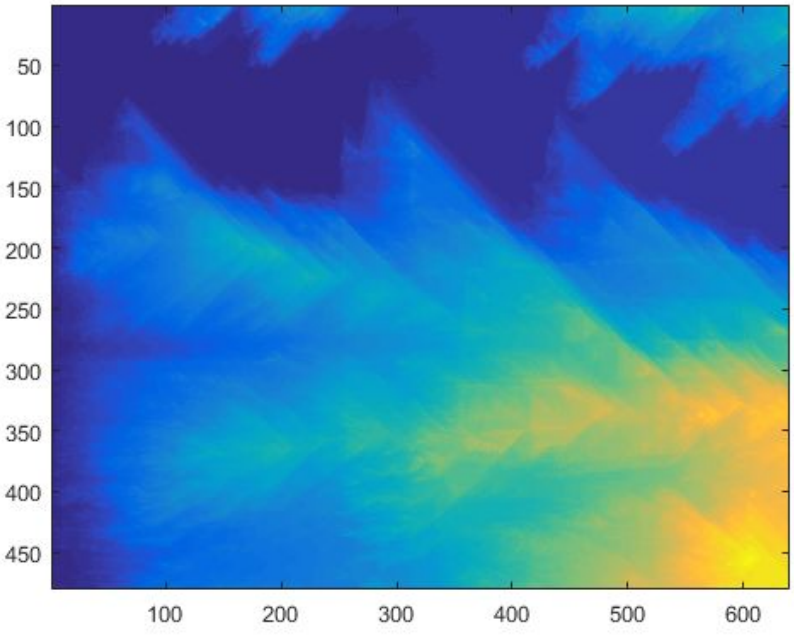
2. outputReduceHeightPrague:

outputReduceHeightMall:

3. Output of the Energy Map of inputSeamCarvingPrague.jpg:


50
100
150
200
250
300
350
400
450
100
200
300
400
500
600


50
100
150
200
250
300
350
400
450
100
200
300
400
500
600



Taking into account what each of the functions (energy_img() and cumulative_min_energy_map() with both ‘VERTICAL’ and ‘HORIZONTAL’ arguments) are doing in each of the cases they are applied to the inputSeamCarvingPrague photograph makes explaining their displays fairly straightforward. In the energy case, the darker a pixel appears, the smaller the gradient is at that location. That is, they are areas of small change in the grayscale intensity between neighboring pixels. Meanwhile, what one might consider to be “hard” edges of the original show up as bright, intense areas of change.

In the case of the cumulative minimum energy functions, the color displayed by imagesc change from dark to light as the cumulative sum grows. Unsurprisingly, this means that the vertical version brightens from the top down and the horizontal version brightens from the left right. This extremely bright areas appear first in areas that have the highest total energy coming from either direction; this tends to mean near the boat and its reflection on the water.

4.

Original image:

a. first selected horizontal seam

Explanation: The first horizontal Seam follow through the sky because the sky is where it has the least texture, so it undergoes the least changes, which means it has least Energy.

b. first selected vertical seam

Explanation: The first vertical seam goes through the part of the vertical area that as the most sky (no leaves) and then goes through the house to get to the water, this may be etter than going through the bridge which has more texture, in the water it also goes through the white reflection of the house, which has more blur , that may be why it has least Energy.

5.

a.

Explanation：The first horizontal Seam remains the same because even when we accentuate the edges using sobel, the sky is still pretty textureless, not much is going on.

b.

Explanation: The first vertical Seam actually changes, instead of going through the white houses, it goes through the black tower, then to the red roof top, then out to the sky.

6.

Original

Seam carving

Imresize

A.

Original:

Seam-Carving:

Imresize:

Dimensions:

Input: 600 *1200

Output: 600* 900

Removals: a 300 pixels cut in width

Explanations: We thought this one would messed up more, but it didn't turn out that bad! I guess sushi are just too delicious to look bad! But all jokes aside, it didn't decrease the aesthetic of the picture for sure, the sushi looks more crowded and less refine, and less shapely. This round is kinda tough, it's hard to tell who wins, even though seam-carving preserve the 3D feeling of the sushi, the sushi looks a little bit out of shape and crowded. So it's not a clear win for either.

B.

Original:

Seam-Carving:

Imresize:

Dimensions:

Input: 768 * 1366

Output: 500*1366

Removals:

A 268 cut in height

Explanations:

In this we have a clear winner: our seam Carving is so much better than imresize. The shape of the little girl is preserved as only the background pixels are removed. Imresize squeezes the little girl.

C.

Original

Seam carving

Imresize

Original:

Seam-Carving:

Imresize:

Dimensions:

Input: 1000 * 1500

Output: 500*1000

Removals:

Remove 500pixels in width first, then Remove 500 pixels in height

Explanations:

In this one the Imresize is clearly the winner, the Korean BBQ is very warped in the seam-carving one, while the imresize although a little bit squashed vertically, the food still remains recognizable and delicious, contrary to the food in the seam carving picture. For the ones that do change both width and height a little proportionally(not quite just a little), imresize will probably be better.

Extra Credit

3.

Original: 466 *700

Increase Height 466*750

Increase width: