

CS 4476: Computer Vision, Fall 2020

PS1

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## Short Answer 1

The associative property of convolution allows for the convolving of multiple filters before convolving with the image.

## Short Answer 2

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

## Short Answer 3

$$\begin{bmatrix} 1/4 & 0 & -1/2 & 0 & 1/4 \end{bmatrix}$$

## Short Answer 4

One can reduce the amount of fine, detailed edges by

- a. increasing the threshold value so it is less likely to detect the fine edges
- b. using a filter that will slightly blur the image, which will remove the fine edges detectable by the Canny filter

## Short Answer 5

Real image noise would not usually be randomly distributed as Gaussian noise would be.

## Short Answer 6

- Assume that only one part passes through the camera at a time so parts do not become part of each others' backgrounds
- Assume there is a part texture database and a part shape database along with thresholds that determine whether an object matches closely enough with a part
- Run a texture analysis on the part to see how closely it matches with the textures in the database. This can be used to determine flaws such as corrosion.
- Run a Canny edge detector with non-maximum suppression and hysteresis thresholding for edge analysis then use Chamfer distance to compare the shape of the part with shapes of parts from the database
- Combining the results of the texture and shape analysis, find the part from the database that matches most closely with the scanned part. If the thresholds for that particular part are not met, whatever differences deemed important enough will be reported as flaws.

## Experimentation 1



Figure 1: Reduced Width Prague



Figure 2: Reduced Width Mall

## Experimentation 2



Figure 3: Reduced Height Prague

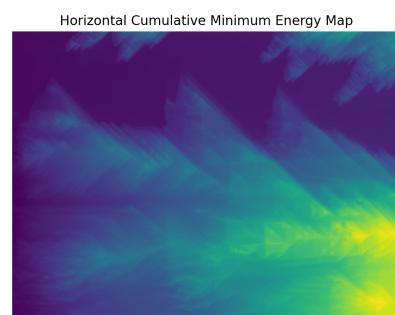
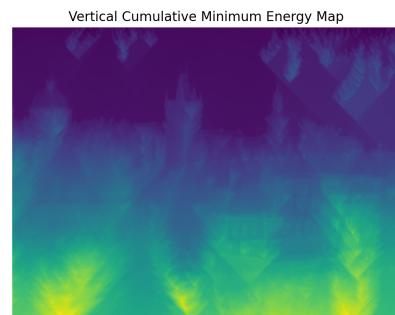


Figure 4: Reduced Height Mall

## Experimentation 3



(a)



(b)

- (c) The energy image highlights the high energy pixels which will largely be preserved during seam carving. The vertical energy maps and the horizontal energy maps are brighter towards the bottom and right respectively because each row or column is adding the lowest energy cost pixels from the previous row or column.

## Experimentation 4



(a)

Figure 5: Vertical Seam



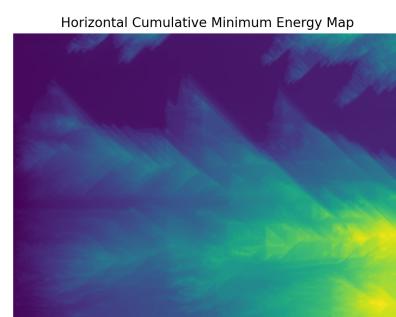
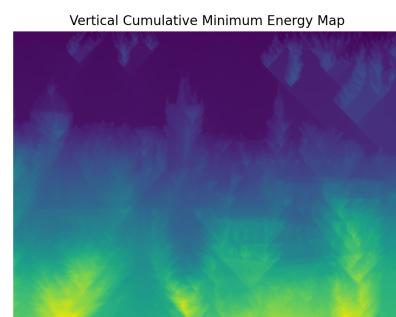
(b)

Figure 6: Vertical Seam

- (c) The seams are optimal because they are less likely to be noticed when they are removed due to being low energy seams.

## Experimentation 5

- Switched to Sobel filter
- The Sobel filter didn't make any noticeable difference in either the energy maps nor the seams.





## Experimentation 6



(a)



(b)



(c)

- (d) Input: 800x450  
Output: 700x350
- (e) 100 px height removal followed by 100 px width removal.
- (f) Much of the triangle's prominent features, such as its facial features, hands, and feet, are preserved. However the top of its head has clearly been removed by the seams and its lower left corner is warping to fit around its unchanged hand. Much of the background that is largely monochromatic has also been removed.



(a)



(b)



(c)

- (d) Input: 1000x562  
Output: 900x462
- (e) 100 px height removal followed by 100 px width removal.
- (f) Much like the triangle, most of Shrek's facial features are preserved, and somewhat shrink-wrapped by his reduced head size, with his forehead and right cheek taking the brunt of the seams. The blue sky has been significantly cut away at by the seams.



(a)



(b)



(c)

- (d) Input: 900x632  
Output: 800x532

- (e) 100 px height removal followed by 100 px width removal.
- (f) Probably due to the more varied coloration, the bird of paradise has not been warped quite as much as Shrek or the triangle. However, its head, which is mostly black does have some removal going on, making it seem squished in comparison with the original. Otherwise, even the changes in the background are subtle in comparison to the previous images, largely due to their more varied color palette.