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PS1

Short Answer Problems:

1. In the scenario where two filters need to be applied to an image, instead of filtering one filter with the image and then filtering the whole output with another filter, you can use the associative property of convolution to apply the filter to the secondary filter and use the result to filter the image and the result would be the same. Since the filters are grouped together, the filter application process becomes one step rather than two.

2. Output: [1 1 1 1 1 1 1 1]

3. A possible flaw of using additive Gaussian noise to represent image noise is that it is limited by the fact that it cannot represent salt and pepper noise. Gaussian noise is created from using random variations in intensity which are drawn from Gaussian normal distributions on each pixel. Since salt and pepper noise is random occurrences of black and white pixels on an image, those black and white pixels represent opposite ends of the intensity spectrum (0 and 255 respectively). As stated previously, Gaussian noise is dawn from a Gaussian normal distribution so it will not display these extremes as would occur in salt and pepper noise in an image.

4.

Assumptions:

- The automotive part's intensity distribution is distinct from its background
- The automotive parts are all in the same orientation
- A clear still frame of the automotive part can be taken from the video data

- When the still is extracted the automotive parts are in the same position in the frame
- There's only one automotive part at a time in the picture
- We have a binary image of how the automotive part is expected to look and the part in the image is positioned and oriented in the same way as the still frames that are taken from the video data

Process:

1. Extract still from video data of automotive part
2. Convert the still into binary form by changing image to greyscale and thresholding
3. Remove noise from the binary output from the thresholded image by using erosion to remove noise and dilation to fill any holes that might be present
4. Compare the final image from the previous step to the binary image we have of the ideal automotive part and if the two images differ too much then a flaw can be reported

Programming Problems:

1. Seam carving width outputs are shown below.

Output Reduce Width Prague:

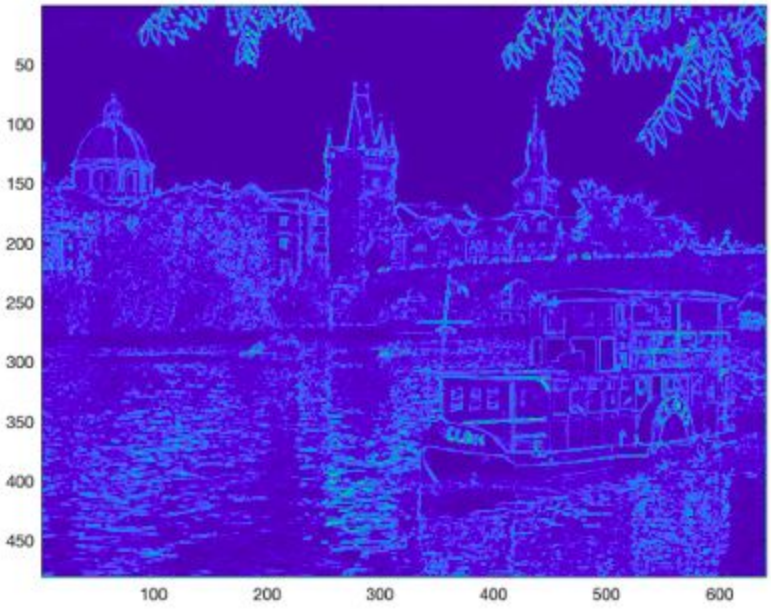
Output Reduce Width Mall:

2.

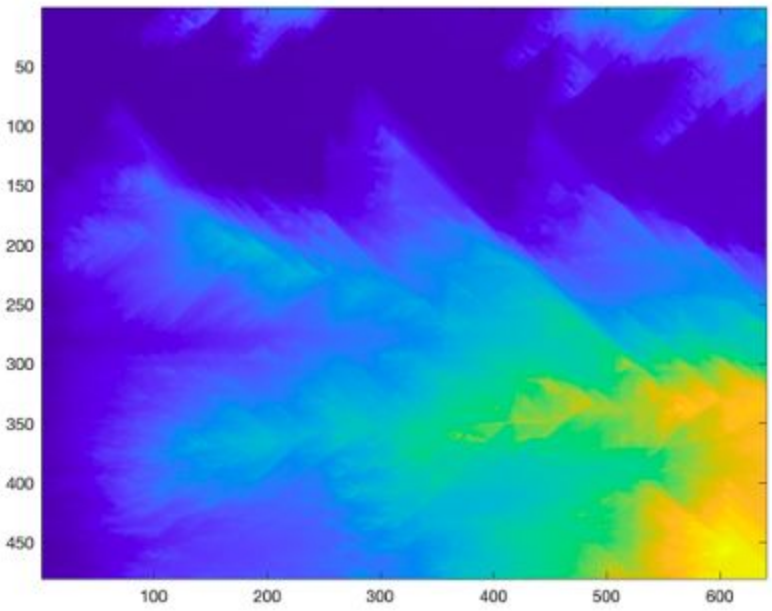
Output Reduce Height Prague:

Output Reduce Height Mall:

3.

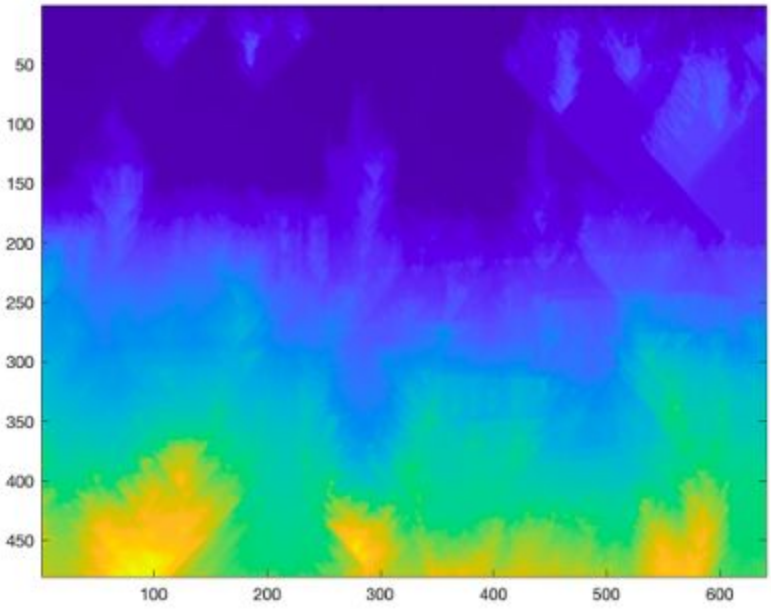


The energy image's output looks this way due to the fact that high values in the image are located on the edges and low values on the other areas of the image. The areas with high-value show portions of the image with the most importance (the edges of the image). In essence, the brighter areas, parts of the boat, indicate the important features, and the darker areas, like the sky, signify low importance.



Horizontal:

The smooth portions in the image shown below represent the less important portions of the image which our program focuses on when it comes to seam removal. In the image below we can see the smooth portion corresponds to the sky in the original pic, an area where there is the least going on. The inexpensive paths are the area up in the sky, which is actually what was selected to be removed. The bright parts of this image are where the boat is. This is the case the filter has detected a lot of edges in this area. This is the area that we do not want to remove because this is an important part of the picture, unlike the sky area.



Vertical:

Vertically is more difficult in this scenario, mainly so because the lower half of the picture is crowded with a lot of stuff going. As with the horizontal, the boat has a lot of edges so this area is very bright and should not be picked to remove. On the opposing side, there is also a decent amount of brightness which is attributed to the buildings that are also important to the picture. The darkest path is around 150, which is the area avoiding the boat and the bushes. As with the horizontal, the darker areas are less important and will be likely targeted to be removed first.

4.

Original Prague image

a) First selected horizontal seam

b) First selected vertical seam

For 4a, the first horizontal seam, this is the optimal seam because it is cutting through the area in the sky with the least energy. The area with the least energy is the dark area from the previous pictures and is basically the sky due to its lack of edges and solid coloring.

For 4b, the first vertical seam, has avoided the bushes and the boat. This is because these are the areas of the image with high importance thanks to their edges,

5.

Horizontal:

Vertical:

We used a Sobel filter now, instead of the [-1, 1] filter. For the horizontal seam, it is very similar to the original filter we used. This is the case because there aren't many edges in the sky and therefore, less energy. Thanks to this, the seams from both the filters are very similar.

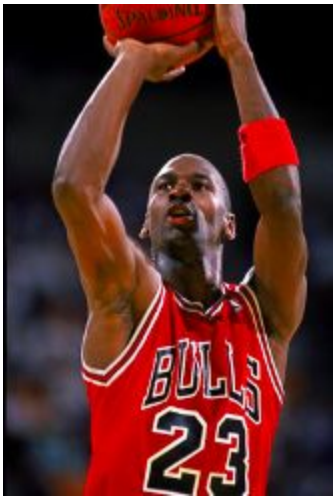
For the vertical seam, the path goes a little more toward the right. It actually tries to stay clear of the bushes from more than the previous filter. The Sobel is a more complex filter, which is probably why the seam is very close to the dark building.

6.

(Images were showing up in low resolution when downloaded from their subplot image so I included the high quality downloaded version of the image as well. (subplot on left, high quality on right))

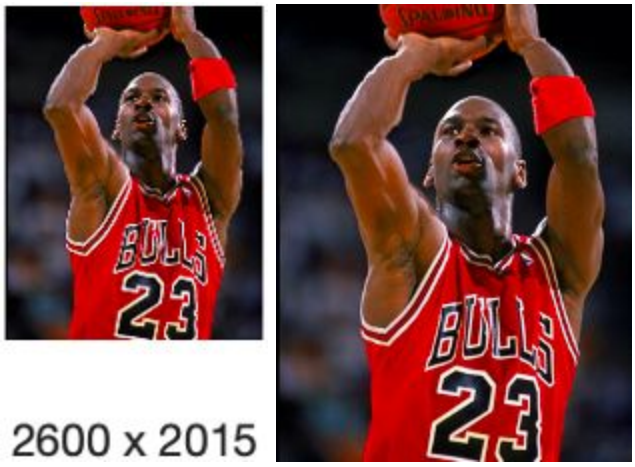
Jordan Picture:

Original Image (3000 x 2015):



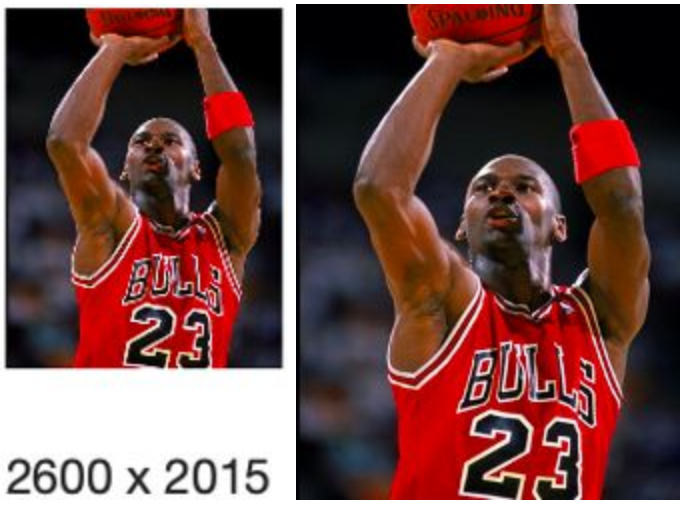
Seam Carved Image(2600 x 2015):

Image was decreased in height by 400 pixels using the seam_carving_decrease_height.m function. From the image, we can see our program removed seams in the region between the basketball and Jordan's head, mostly at the cost of the pixels located in his forearms. After the function was ran, Jordan's hands look shorter and more leaned back than before. The program recognized that the face, body, and basketball were important regions of the photo and left it for the most part unaltered. Overall, the image was a bad outcome because the final product features a distorted arm which is clearly discernable to any viewer.



Resized Image(2600 x 2015)::

The image was decreased in height by 400 pixels using Matlab's imresize function. We can see the image appears to be more compressed than the original image however it is nowhere near as distorted as in our seam carving function result.



Tesla Picture:

Original Image (601 x 1200):

Seam Carved Image(601 x 1000):

In this image, the seam_carving_decrease_width.m function was used to reduce the width of the original image by 200 pixels. The program did an amazing job in this image and it's difficult for me to pick out any distortion or even where the program removed the seams from. After a comparison of the image with the original image, it can be inferred that the seams were removed from the areas that spanned through the car in the image making it seem more compressed.

601 x 1000

Resized Image (601 x 1000):

In the image below Matlab's imresize function was called to reduce the width of the original tesla image by 200 pixels. As usually the imresize function did a clean job and the new image looks like a compressed version of the original. When compared to the image produced by our seam carving algorithm, since it did not do a bad job, they look relatively the same.

601 x 1000

Starry Night Picture:

Original Image (1264 x 1600):

Seam Carved Image (1164 x 1600):

In this image, the decrease_height.m function was used to decrease the height of the original image by 100 pixels. The program did such an effective job that it's difficult to see from the image where the seams were even removed from, even when compared with the original image.

Resized Image (1164 x 1600):

In the image below, the Matlab imresize function was used to decrease the height of the original image by 100 pixels. As usual, the function did a clean job and the final product does not look too different from the original. When compared with the seam resized image there is no real discernable difference as well.

References

Michael Jordan Picture:

https://www.dailyrepublic.com/all-dr-news/sports/the-pose-the-flu-game-the-shrug-michael-jordans-top-56-moments-of-his-career-in-honor-of-his-56th-birthday/attachment/56-get-used-to-it/

Tesla Picture:

https://www.caranddriver.com/tesla/model-3

Starry Night Picture:

https://www.britannica.com/topic/The-Starry-Night