Implementation of "Seam carving for content-aware image resizing"

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(a) (b)

Figure 1: Results of seam carving. (a) Original images. (b) Results.

0.1 Seam carving for content-aware image resizing [1]

This paper considers the problem of image scaling. The resizing process is usually based on interpolating unknown pixels in the new image in order to reduce or expand the image's dimensions. However, the content of the image is discarded and all pixels are treated equally without giving any preference to the important pixels, i.e. pixels represent some details in the image. Thus, instead of resizing the image in the traditional way, a set of seams can be removed from or added to the image in order to change the image's dimensionality. To explain further, a set of optimal 8-connected path of pixels on the image going from top to bottom, or left to right, are used as seams. Removing or adding these seams is based on the image energy function, which is simply the gradient of the image, defining the importance of pixels. Refer to the paper for more information.

(a) (b) (c)

Figure 2: Enlarging image by 20x20 pixels. (a) Original images. (b) Result. (c) Seams that are duplicated.

0.1.1 Implementation

Instead of resizing the image using a uniform weight for all pixels (interpolation methods), the less significant pixels are removed. The significance is calculated based on an energy map, i.e. the gradient map of the given image. That is, the gradient of the given image is calculated and a set of paths that go from the top to bottom (or left to right) of the image are calculated. Each path is generated by picking the lest significant pixels at the first layer (top or left). The path is reconstructed by finding the less significant neighbors in the next layer, and so on. Finally, the total score of each path is calculated and based on that score, the weakest path is removed and the map is updated. Actually, all possible paths are calculated as a pre-processing step. Then, the scores are calculated dynamically and the paths with lowest scores are picked. After removing c paths, the predefined paths are updated to avoid picking pixels that already have been removed. The GUI of the presented source code is shown in Figure 2. It can be used to determine ROI (markup) that has high or low weight in the seam carving process. The high weight refers to the importance of this region and the low weight indicates that this region is less important than other pixels in the image; that usually leads to remove this patch from the image in the resulting image.

0.1.2 Results

Figure 3 shows samples of the results generated by the attached Matlab source code. Figure 4 shows colored seams that are picked to enlarge a given image. Figure 5 shows the effect of using markups to keep some pixels. Eventually, Figure 6 shows an example of removing object using markups.

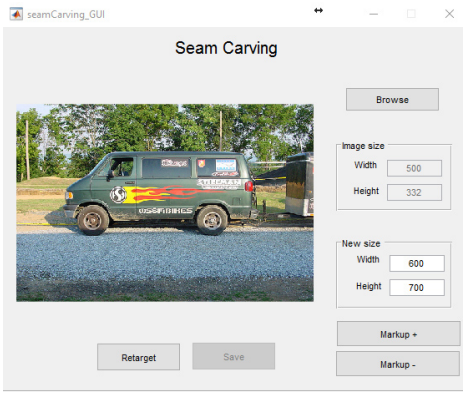
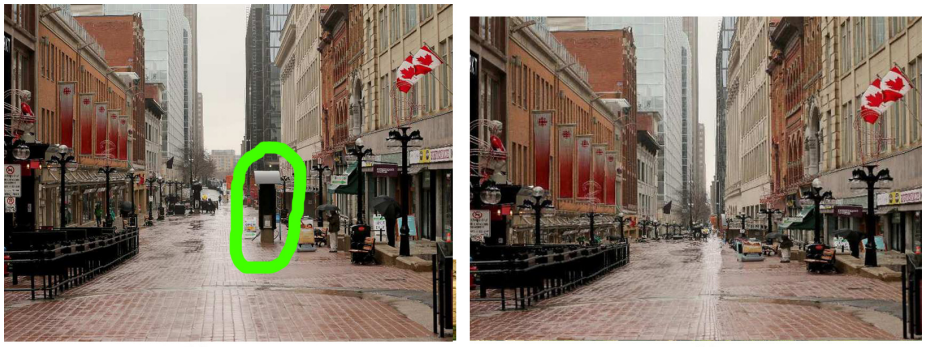


Figure 3: The GUI of the seam carving.

(a) (b)

Figure 4: Results of using markups. (a) Without using markups. (b) After using markups.



(a) (b)

Figure 5: Results of removing object. (a) Original image. (b) Resulting image.

Bibliography

[1] Avidan, Shai, and Ariel Shamir. "Seam carving for content-aware image resizing." ACM Transactions on graphics (TOG). Vol. 26. No. 3. ACM, 2007.