Methods in Segmented Image Seam Carving

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Abstract

Seam carving deals with the task of taking an input picture and re-sizing it to fit another screen type and aspect ratio. In this paper, we discuss possible methods to improve the algorithm, and also make it work faster. We approached this problem using the segmentation approach, and got promising results.

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I.4.10 [Computing Methodologies]: Image Processing And Computer Vision—Image Representation;

Keywords: Image resizing, Image retargeting, Image seams, Content-aware image manipulation, Display devices

1 Introduction

With the recent advances in imaging technology, digital images have become an important component of media distribution. Images are frequently used in news stories, and people post their pictures online to be seen by family and friends. Images, however, are typically authored once, but need to be adapted for consumption under varied conditions. As an example, pictures are often displayed on different screens, where the area available for the picture may have a different aspect ratio than the original image has for layout reasons. Dynamically changing the layout of web pages in browsers should take into account the distribution of text and images, resizing them if necessary. The use of thumbnails that faithfully represent the image content is important in image browsing applications. In addition, a variety of displays can be used for image viewing, ranging from high-resolution computer monitors to TV screens and low-resolution mobile devices. This diversity of image consumption conditions introduces a new problem: images must be resized for optimal display or use in different applications. The process, also known as image re-targeting or image resizing, consists of modifying the images aspect ratio and size in order to best satisfy the new requirements. However, straightforward image resizing operators, such as scaling, often do not produce satisfactory results, since they are oblivious to image content. To overcome this limitation, a class of techniques attempt to resize the images in a content-aware fashion, i.e., taking the image content into consideration to preserve important regions and minimize distortions. This is a challenging problem, as it requires preserving the relevant information while maintaining an aesthetically pleasing image for the user.

One of those techniques is Seam Carving, where the general idea is to decrease the image width (or height) one pixel at a time, by removing a seam of minimal importance. A seam is defined as an 8-connected path of pixels (from top to bottom, or from left to right of the image, depending on which dimension is being reduced) that contains only one pixel per row (or column). When the importance map is based on gradient energy, the first removed seam will be in a homogeneous area. The image is then readjusted by shifting pixels left or up to compensate for the removed seam, resulting in an image which is one pixel smaller, either on width or height. So the image changes only at the seam region, while the other areas remain intact.

In the original paper, the optimal seams are computed using dynamic programming, and an algorithm for resizing in both dimensions by choosing between optimal vertical or horizontal seams is also presented. The technique can be used for enlarging the image, by finding seams to be removed and duplicating them. It produces impressive results when there are enough low-importance seams to be removed, but creates distortions and artifacts when seams cut through important areas.

Motivated by the compelling applications and the challenges related to the problem, we proposed to use image segmentation to improve the seam carving algorithm.

$$\sum_{j=1}^{z} j = \frac{z(z+1)}{2} \tag{1}$$

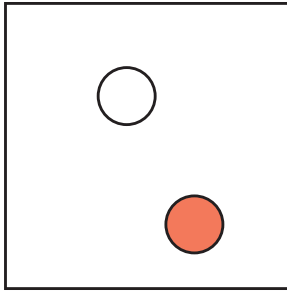$$x \quad \ll \quad y_1 + \cdots + y_n \tag{2}$$
$$\leq \quad z \tag{3}$$

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2 Exposition

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Figure 1: *Sample illustration.*

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3   Exposition

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4   Conclusion

There is much future work to be done in the area of image resizing and Seam Carving. We didn't have enough time to investigate other methods to segment a picture, like image saliency as shown in

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