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Seam Searching based Image Retargeting and Content Amplification

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Abstract — *Image retargeting is a technique to alter the size of an image to display size of various resolution such that they can be viewed on display devices such as mobile phone, PDA, TV etc. The traditional techniques have weak performance in resizing since they only focus on the display size without considering the image content. . So the content-aware image retargeting methods have recently received increasing attentions. The proposed technique uses seam searching based pixel fusion which include (a) horizontal (width) retargeting, (b) vertical (height) retargeting and content amplification. The technique starts with generation of saliency map representing the salient location of the image. Then seams are searched on the saliency map for pixel grouping and coherence filtering is performe. Later, pixel fusion is performed based on the scaling factor. Finally content amplification is performed on the resized image. The retargeted image thus obtained gives better result when compared to the existing methods.*

Keywords- *Image retargeting (IR), seam searching, coherence filtering, pixel fusion, scaling factor.*

I. INTRODUCTION

With the use of fast increasing the display devices such as TV, PDA , mobile phone and other devices, consumers often browse images (e.g. high resolution photos, paintings) on the versatile screens. However, the resolution of a display device is fixed while the resolution and aspect ratio of images differ from each other. To optimize the screen use is essential for displaying the source image. Image retargeting adapts the images of various aspect ratios to the target screen and maximizes the viewer experience.

Traditional automatic retargeting techniques are broadly classified into two approaches viz., brute force and content-aware retargeting. Brute force technique uses scaling and cropping whereas content aware method involves resizing of the image giving importance to the content of the image. Both these methods are pretty simple and easy to implement. However, these methods have weak performance in resizing since they only focus on the display size without considering the image content. The uniform scaling method always distorts the important regions especially when the change in the aspect ratio is large. On the other hand, the cropping method always loses important regions especially when the target size is reduced sharply. To overcome the limitation of brute force techniques, content-aware image-retargeting approaches have been proposed. These techniques used to resize the image to the display size without losing its contents. They calculate the energy of each pixel in the original image and try to reduce the information loss by retaining high energy pixels in retargeting.

Image retargeting is an important tool in the field of image processing applications such as image editing, object removal, image enlargement and content amplification. The major scope of the present study is to develop a new method for content-aware image retargeting and content amplification based on seam. The specific purposes include:

- Can focus the important object more clearly.
- Can identify the salient region in the image.
- It is for object identification
- To retarget the image both horizontally and vertically based on seam searching and pixel fusion.
- To amplify the important contents of the resized image thereby preserving the important features of the original image in the retargeted image.

II. LITERATURE SURVEY

The saliency detection method is the important steps in image retargeting method. To preserve the salient regions of the image during resizing, the saliency measure becomes a vital step for image resizing. The saliency measure is accomplished by mapping each pixel of an image to the interval [0, 1], where `1' represents the most important (salient) region. According to the saliency, each pixel is ranked in the mapping image. The saliency map represents the image areas, which draw more human attention. The saliency measure is an important research area in computer vision. There are two categories of approaches to automatically estimate saliency. These are bottom-up methods, and top-down

methods. Bottom-up methods are based on low-level features such as edge orientation, color, and intensities, while top-down methods make use of semantic information, such as the locations of important objects (e.g., faces, bodies, and text), structures, and symmetries. Face detectors are popular among retargeting approaches that use top-down methods. The saliency measure in image resizing mainly uses bottom-up methods than top-down methods. The importance map is calculated by gradient, saliency, entropy, segmentation and histogram of gradient. The content-aware methods contain two main steps, measuring importance and resizing images using the importance-based resizing operator.

METHOD	ADVANTAGE	DISADVANTAGE
Croping [1]	Simple	Losing important contents lying on the periphery of an image
Scaling [2]	Simple	Distortion
Seam Carving [3]	Preserve salient objects and maintain the scene layout better	Distortions when removing seams that go across important areas or internal structures
Mesh Parametrization [4]	Emphasizes the important image content	Object loss near the salient object
Multi-Operator [5]	Preserving important content	Complexity
Seam Searching based Pixel Fusion [6]	More suitable for horizontal resizing	Vertical resizing is not possible

Some important existing systems for image retargeting have some limitations,

- Cropping method is very simple. However, it has a limitation of losing those important contents lying on the periphery of an image. So, the effect is seriously damaged.
- The scaling methods can bring artifacts, such as an artificial block and aliasing. Scaling causes obvious distortion if the aspect ratio of the input image is obviously different from that of the output image and creating the patch is computationally expensive.
- There are mainly two major factors that limit seam carving approach. One is, If the image is too condensed, in the sense that it does not contain `less important' areas, then any type of content-aware resizing strategy will not succeed.
- The second type of limitation is the layout of the image content ie., the content is laid out in a manner that prevents the seams from bypassing important parts.
- The mesh parameterization methods fails to capture some important human bodies with varied face poses or illumination and emphasis of relative scale of salient object however will inevitably distort its nearby objects.
- The multi-operator methods are time-consuming and do not consider users preferences and this method might damage the global spatial structure of the image.

III. PROPOSED METHODOLOGY

The technique starts with generation of saliency map representing the salient location of the image. Then seams are searched on the saliency map for pixel grouping and coherence filtering is performed . Later, pixel fusion is performed based on the scaling factor. Finally content amplification is performed on the resized image. The same is depicted in fig ure 1. The proposed method include (a) horizontal (width) retargeting, (b) vertical (height) retargeting, and content amplification. The method is performed in five stages. 1st to 4th stages are for resizing the image whereas the 5th stage is to amplify the content of the resized image. The stages are given below.

1.Generation of Saliency Map

2.Pixel grouping based on seam searching

3.Coherence filtering

4.Pixel fusion using scaling factor

5.Content amplification

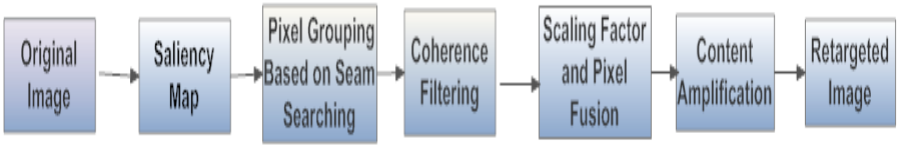

Figure 1. Flowchart of proposed method.

Generation of a saliency map is the most important and primary step in the image retargeting. The concept of saliency map is used to model the human attention. In the image saliency detection, bottom-up model is more common than top-down model. The most standard model is the Itti's model shown in Figure 2. Based on human visual properties, Itti's algorithm [7] uses Gaussian Pyramid to conduct non-uniform sampling and generates 9-scale images. Then computes the color, luminance and the orientation of this 9 scale maps. Finally, saliency maps according to the center-surround differences is obtained. The saliency measure is accomplished by mapping each pixel of an image to the interval [0, 1], where '1' represents the most important region. The Pixel Grouping stage is more time consuming as it is based on seam searching. The seam carving method is used to change the size of the image by modifying the least important pixels in an image by deleting the pixel. In seam searching[8], none of the pixels are deleted. Here, each pixel in each seam will be assigned an ID as i, which can be denoted as Pi(x,y). Then, except for the pixels in seams, each remaining pixel in every row and column will assigned an ID sequentially from left to right and top to bottom. In this way, every pixel in the same group of rows and columns of the original image I(x, y) is assigned a unique ID.

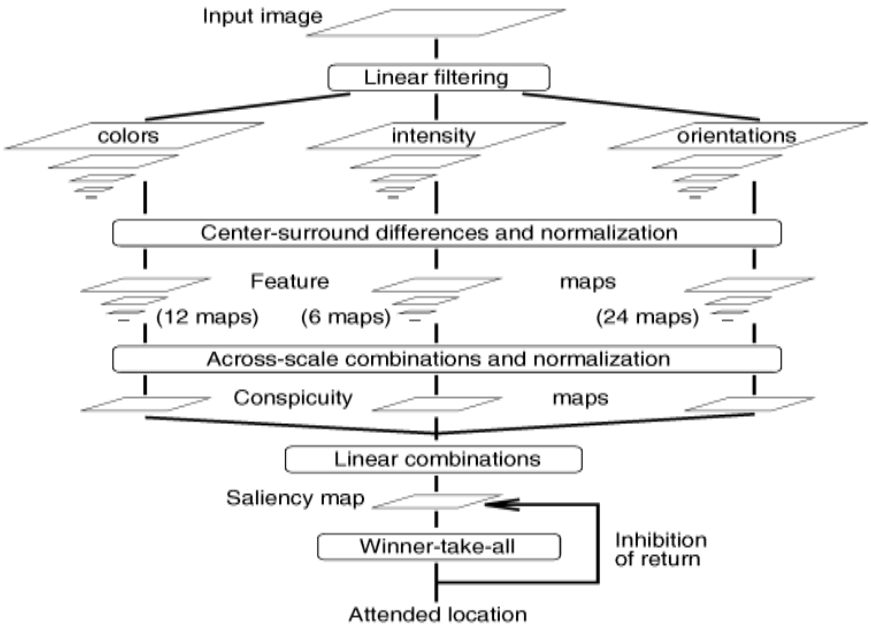

Figure 2. Itti's approach for saliency map.

Coherence filtering [8] is done for reducing image noise without removing significant parts of the image content, such as edges and lines. Coherence filtering plays a major role in maintaining the spatial coherence of the retargeted image. The pixel fusion stage is based on the scaling factors. Scaling factor is used to resize the image, that are allocated to each pixel to indicate its resizing degree. An image is made up of large number of pixels. Each pixel is treated as an individual basic unit whose width and height are horizontally and vertically scaled from its original size, which is considered as 1, to the scaling factor value, which is a non negative fractional number. As a result, the sum of the scaling factors in every row and column will be the target size of the image. Pixel fusion is the process of combining the pixel information in an image. The resulting resized image will be more suitable for display devices than the original image. Pixel Fusion is performed after obtaining the scaling map for each group. Here, the image is resized horizontally and vertically. As a result the width and height of each pixel will be scaled from unity to a fractional number according to the scaling factor of the pixel. Then, the linear combination of pixels, weighted by their width and height, composes the resized pixels. The method of pixel fusion reconstructs the resized pixels from the combination of original pixels instead of certain pixels from the original image. This makes the resized image much smoother.

The resized image is finally subjected to Content Amplification. A combination of seam carving and scaling is used to amplify the image content while preserving its size. This retains the image content as much as possible. The first step is scaling of the entire image in which both the content and non-content areas are subjected to scaling. In the next step Seam Carving is done to shrink the scaled image and to carve the non-content parts of the image.

IV. EXPERIMENTAL RESULTS

Figure 3. shows the results of the proposed scheme, (a) shows the input image (b), (c), (d), (e) are horizontal resized image, vertical resized image, combination of horizontal and vertical, content ampliflied image respectively.

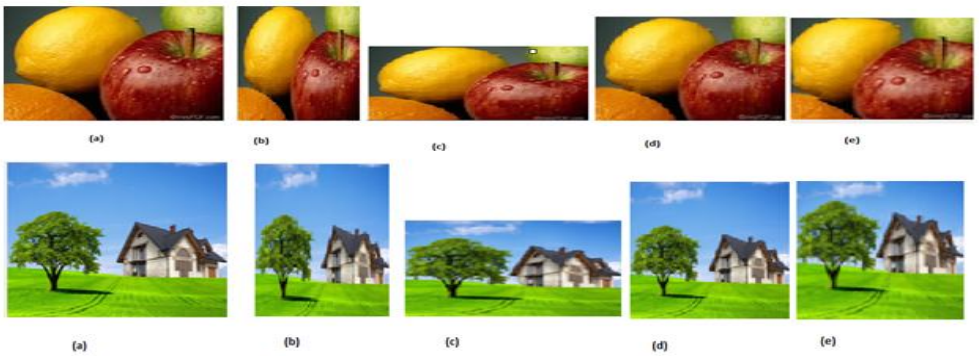

Figure 3. Shows the results of the proposed scheme

In the proposed system can conclude that, when the content is placed in horizontally the vertical resizing is better and when it is placed in vertically the horizontal resizing is better. The comparison of our method with seam carving method is shown in Figure 4.

Figure 4. Compariaon of seamcarving result(a) and our result(b)

The proposed system have high structural similarity with original image is shown in Figure 5. The seam carving method deform the image content when resizing.

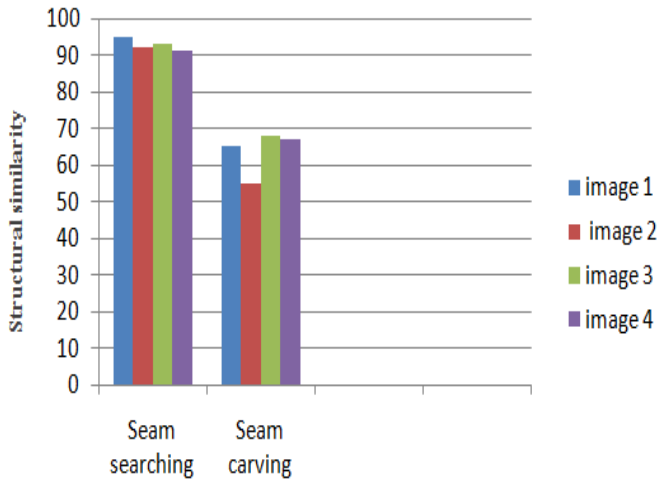

Figure 5: Structural similarity graph of our result and seam carving result

V. CONCLUSION

The proposed image retargeting system are suitable for aspect ratio change, content amplification and object removal. Also the image can be retargeted in (a)horizontal (width) retargeting, (b) vertical (height) retargeting, combination of a b and content amplification. Here, the images with saliency provides a feasible way for image retargeting with the use of seams. Experimental results demonstrate that, in most cases, our proposed system produces better results compared to common retargeting schemes found in literature.

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