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Image Enlargement Using Absolute Energy in Retargeting

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Abstract*— The aspect ratio of the display unit makes the image retargeting as a demanding process. Fitting the image into the different sizes must result in less detail loss. In this dissertation image enlargement with less distortion and artifacts is provided. Both vertical and horizontal enlargement of detailed image is done. The absolute energy cost is used to calculate the cost of the image pixel. This method not only reflects on the global extrema but also on the local extrema while selecting seams. The seams are rejected during selection process when the seam crosses the extrema. The detailed or more concentrated images are resized with less information loss.

***Keywords*—.Image Re-sizing; Image Retargeting; Seam carving, Image Enlargement**

I. Introduction

Displaying images in various aspect-ratios is a demanding work. According to the size of the display unit the image gets enlarged or shrinked which changes the image size, content and attributes defectively. The loss of important image details is avoided by the development of novel method that removes only unimportant pixels by preserving the content of the image. These requirements direct to the development of image retargeting techniques. The process of resizing the image for finest display or various applications is known as image retargeting. Retargeting is very necessary in this modern era due to various models of smart phones and personal digital assistants. Need to display the images without losing the quality of the image which is almost similar to cross browser issue in different layouts. The traditional method for image resizing are scaling and cropping. Outcome of both of these techniques are rich in visual distortions, artifacts and the loss of image details. To overcome this demand, various image retargeting techniques are proposed by taking the image details in to concern to retain important regions and minimize artifacts and distortions.

For a given image I of size h * w with h rows and w columns to retarget, the image size is altered to the desired size I′. The provided image I′ must preserve important content by avoiding misrepresentation and visual artifact. It is a challenging work to display image to the small screen or big screen of the display unit. High detailed and high resolution image have more image detail loss when it is retargeted in a device unit with very less resolution and aspect ratio. Various attributes [1] of image affects the image quality when retargeting. These attributes are mostly changed to reduce the image size. The image information is altered due to the presence of objects such as faces, text and crowed scenes. The specific range of importance in images is different for each application. Majority of them define important and unimportant image pixels subjectively. This definition plays a major role in estimating importance map of the image. Importance map is the fundamental component of the image retargeting technique. Content-aware image retargeting when using importance or saliency map that determines the important area of the image obtained satisfactory result. The traditional content aware image retargeting techniques such as automatic cropping [2] and scaling variants [3] resulted in distortions and visual artifacts. Other techniques like segmentation [4] and warping [5] preserves the region of interest (ROI) by using the complex operators. Among all the techniques for content-aware image resizing, a very popular technique proposed by Avidan and Shamir [6] is the seam carving technique that removes the connected path of insignificant pixels known as seam. Vertically or horizontally the seams are selected and removed from the image for the desired target image size. Vertical seam reduces the width of the image whereas the horizontal seams reduce the height of the target image. Per pixel per row is selected to form a seam and removed. After the removal the image is adjusted by shifting the pixels up or left resulting in an image with one pixel less either in column or row.

II. Related Work

Many improvements are done by other authors on seam carving technique. Depending upon the applications the different methodologies are proposed for improving the image resizing in content-aware display. The following section briefs about the existing system experimented by many authors.

A. Forward Energy Criterion On Seam Carving

Forward energy criterion proposed by Rubinstein et al. [7] to introduce minimum amount of energy after the removal of seam. The forward energy which is the cumulative energy map calculates importance map from the energy gradient. The authors also formulated to find optimal seam as a graph cut in video retargeting. As the limitation forward energy results in unpredicted outcome due to motion and camera movement and this method works on video in batch mode.

B. Importance Diffusion In Seam Carving

Importance diffusion proposed by Cho et al. [8] increments the cost of pixels in the importance map, that are adjacent to seam being removed. The importance diffusion holds the importance of the information that is being carved as seam by adding it to the neighboring pixels. As an advantage the importance diffusion simply removes row/column as produce result as equivalent to uniform sampling or scaling. Uniform sampling preserves the image structure but not the detail and scale of the original image. But the non-uniform sampling is performed by the seam carving where the detail of the image is preserved.

C. Saliency Map In Seam Carving

Achanta and Su¨sstrunk [9] proposed a new method for detecting saliency. The pixels distance in a blurred version is calculated from the image to the average color in the Lab colour space of the original image. The forward energy map computed in such a way to consider color. The authors claim that this saliency measure is more robust to noise due to smoothing.

D. Context-Aware Saliency Map In Seam Carving

Goferman et al. [10] proposed a method that in addition finds salient areas, which includes regions closer to the salient objects which are considered to provide context to them. The determined saliency map is enhanced to give weight age to pixels according to proximity to most salient areas to preserve context. The seams are penalized when it cuts through important objects.

E. Absolute Energy Cost In Seam Carving

An enhanced seam carving was introduced by Michael Frankovich and Alexander Wong [11] where both forward energy and backward cost funtionals are extended with energy gradient functional to determine the absolute cost functional. High detail concentrated images has smaller amount of visual distortions and artifacts.

III. Implementation

This dissertation aims in enlarging the input image to fit them in the different aspect ratio of display unit. The major problem of distortions and artifacts that commonly occurs in the image resizing is taken in to consideration and then applied enhanced seam carving [11] for seam selection. The following steps include the methodology.

A. Step 1

Find the gradient energy ‘e’ of the input image I as shown in Fig.1 using the sobel matrix on the average value of vertical gradient ev and horizontal gradient eh pixels of RGB image as,

```
sobel = [ -1 0 1;-2 0 2;-1 0 1] ;                    (1)
eh(:, :, i)=conv2(I (:, :, i), sobel, 'same') ;      (2)
ev(:, :, i)=conv2(I(:, :, i),sobel.',‘same') ;       (3)
e(:, :, i)=eh(:, :, i) +  ev (:, :, i) ;             (4)
e=1/dim * sum (e,3) ;                                (5)
```

The image in Fig.1 is a high detailed image with many number of edge important pixels.

Fig.1 Grass image of size 350x233

Fig.2 Gradient energy image by step 1.

B. Step 2

Calculate absolute energy [11] of the image using gradient energy as shown if Fig. 2, backward energy [6] and the forward energy [12]and the result is shown in Fig.3. Absolute energy is a variation of forward energy that includes forward energy functionals C_L, C_U, C_R.

$$C_U(i,j) = |I(i,j+1) - I(i,j-1)|, \tag{6}$$
$$C_L(i,j)=C_U(i,j)+|I(i-1,j)-I(i,j-1)|, \tag{7}$$
$$C_R(i,j)=C_U(i,j)+|I(i-1,j)-I(i,j+1)|, \tag{8}$$

The absolute energy is given by,

$$e(i,j) = e(i,j) + |e(i,j+1) - e(i,j)| + |e(i+1,j) - e(i,j)| + \min(e(i-1,j-1) + C_L(i,j), e(i-1,j) + C_U(i,j), e(i-1,j+1) + C_R(i,j)) \tag{9}$$

C. Step 3

First the seam s with minimum total energy E of the path, where n represents the number of seam pixels that is determined on the absolute energy image in Fig.3 by the definition,

$$s = \min\{E(s)\} \tag{10}$$

D. Step 4

By backtracking method, a best vertical seam is found by searching the minimum pixel energy right from the last row first column to the first row last column of the absolute energy image as given by,

$$seam(i,j) = e(i,j) + \min(seam(i-1,j-1), seam(i-1,j), seam(i-1,j+1)) \tag{11}$$

Fig.3 Absolute energy image by step 2.

A best horizontal seam is determined by transposing the absolute energy image and then follow step 4. From the best seams the seam vector is generated. This seam vector is applied on the input image to enlarge the image size. Actually the seam is duplicated to the right side of the seam to achieve image enlargement in a detailed image with less distortions and artifacts. The determined seam vector can be used to enlarge image vertically or horizontally. In case of width enlargement the vertical seams are duplicated in the image whereas in the height enlargement the horizontal seams are duplicated in the image.

The Fig.4 shows the original grass image with vertical seam and Fig.5 shows the 35% image enlargement in width. Fig.6 shows the original grass image with horizontal seam and Fig.7 shows the result of 35% image enlargement in height.

Fig.4 Image with a vertical seam

Fig.5 35% Enlarged width from original image

The seam insertion on the original image is very challenging work. Image enlargement on fine detailed or concentrated image is done by absolute energy cost of the image pixels. The result shows resized image in Fig.5 and Fig.7 where the artifacts are reduced.

Fig.6 Image with a horizontal seam

Fig.7 35% Enlarged height from original image.

IV. Conclusion

Image retargeting using absolute energy reduces the distortions and artifacts in image reduction and enlargement. In future, image resizing can be done with more content-aware in frequency domain rather than directly on pixels. Even the less important pixels in image can be searched by any heuristic algorithm like genetic algorithm to achieve image enlargement both in vertical and horizontal. Object removal is another feature that could exploit the proposed method. For this the user could define the area to be removed, so that the proposed algorithm selects pixels inside the area of interest.

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References

[1] Daniel Vaquero, Matthew Turk, Kari Pulli, Marius Tico, and Natasha Gelfand, "A survey of image retargeting techniques," in Proceedings of SPIE 7798, Applications of Digital Image Processing XXXIII, 779814, September 07, 2010.

[2] Suh, B., Ling, H., Bederson, B. B., and Jacobs, D.W., "Automatic thumbnail cropping and its effectiveness," in [ACM Symposium on User Interface Software and Technology], 95–104 (2003).

[3] Mu˜noz, A., Blu, T., and Unser, M., "Least-squares image resizing using finite differences," IEEE Trans. on Image Processing 10(9), 1365–1378 (2001).

[4] Setlur, V., Takagi, S., Raskar, R., Gleicher, M., and Gooch, B., "Automatic image retargeting," in [ACM Intl. Conf. on Mobile and Ubiquitous Multimedia], 59–68 (2005).

[5] Liu, F. and Gleicher, M., "Automatic image retargeting with fisheye-view warping," in [ACM Symposium on User Interface Software and Technology], 153–162 (2005).

[6] Avidan,S. and Shamir, A.,"Seam carving for content-aware image resizing," ACM Transactions on Graphics (TOG) - Proceedings of ACM SIGGRAPH 2007, Volume 26, Issue 3, Article No. 10,July 2007.

[7] Rubinstein, M., Shamir, A., and Avidan, S., "Improved seam carving for video retargeting," ACM Transactions on Graphics SIGGRAPH 2008, Vol. 27, Article 16, pp. 1-9, Aug. 2008.

[8] Cho, S., Choi, H., Matsushita, Y., and Lee, S., "Image retargeting using importance diffusion," in Proceedings of the IEEE International Conference on Image Processing (ICIP), pp. 977-980, 2009.

[9] Achanta, R. and Su¨sstrunk, S., "Saliency Detection for Content-aware Image Resizing," in IEEE International Conference on Image Processing, Cairo, Egypt, November 7-11, 2009.

[10] Goferman, S., Zelnik-Manor, L., and Tal, A.,"Context-aware saliency detection," in proceedings of the 2010 IEEE computer society Conference on Computer Vision and Pattern Recognition (CVPR'10), pp. 2376–2383.

[11] Michael Frankovich and Alexander Wong, Member," Enhanced Seam Carving via Integration Of Energy Gradient Functionals," in proceedings of IEEE Signal Processing Society, pp. 375-378, 2011.

[12] S. Avidan and A. Shamir, " Seam carving for media retargeting," Communications of the ACM, 2009, Vol 52, No. 1.

