Image Compression For MRI

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Abstract- Image compression is a technique used to resize an image by reducing redundant data in an image . It decreases the background, enhancing significant data in an image. This is done to reduce the memory requirement of the image so that it is suitable to store the image as well as for transmission on web. The technique used in this study aims to shrink the image and at the same time retain the important features in resized image.

Index terms- seam carving, compression, resizing, pixels, 8 point connectivity, gradient, energy image.

1 INTRODUCTION

In many aspects of digital image processing, image resizing is a useful and fundamental tool. Image compression is mostly used to see the bigger image with high resolution in small resolution screen. With the development of computerized imaging systems and digital storages Image compression also become essential in medical images which demand large memory and are at the same time required to be stored for very long time. To address this problem this paper suggests use seam carving method. The algorithm for image compression using seam carving method allows content aware compression of images by reducing insignificant information to a large scale an retaining the significant features. For realizing the algorithm to study its efficiency, MATLAB software is used.

2 SEAM CARVING

Seam Carving is an image resizing method. It is based on elimination of seams from an image to be compressed. A seam is a path from top to bottom or from left to right through the image which joins pixels with least significance. To trace this path 8 point connectivity of each pixel is considered.

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The seam thus traced has least having least information and hence is removed retaining the important features from the original image. Seams can be either vertical or horizontal. A vertical seam is a path of pixels connected from top to bottom in an image with one pixel in each row. A horizontal seam is similar with the exception of the connection being from left to right. For reducing image horizontally vertical seam is removed and for image reduction in vertical direction horizontal seam is removed.

3 LITERATURE REVIEW

Many researchers have worked and are working on various aspects of image processing. Especially many are working on development of efficient image compression techniques. Few people have used the seam carving technique for compressing and resizing the images. M. Rubinstein, A. Shamir, and S. Avidan [5] have used seam carving technique for video retargeting. Avidan and A. Shamir [4] suggested that seam carving algorithm can be content aware while compressing the images. Yuichi Tanaka, Madoka Hasegawa and Shigeo Kato [2,3] used seam carving method for dilation and compression of images.

4 APPROACH FOR IMPLEMENTATION

Steps involved in this algorithm used in this study are:

- gradient of an image
- Energy image
- Tracing seam
- Removal of traced seam and

- copying the resultant compressed image in an output image.

Block diagram implementation of algorithm is as shown:

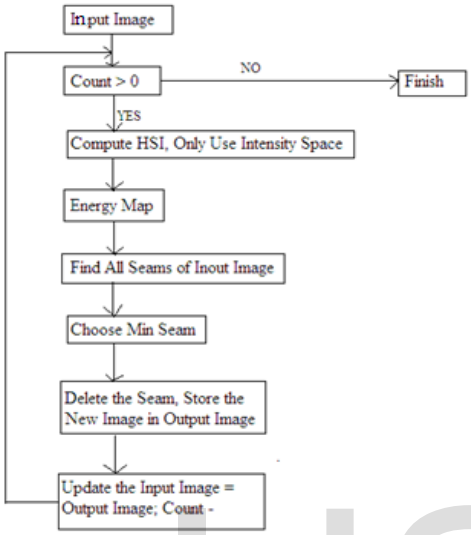

Fig. 1. Algorithm for using seam carving method

3.1 Derivative

The image that is to be compressed is taken as input image. The gradient of an input image is taken. It is important to take gradient of an image because the regions important to the viewer contain drastic changes in its intensity; therefore having a large derivative at a certain pixel corresponds to the important information in an image. Similarly small derivative of a pixel corresponds to less information image. Let input image be I and gradient function be F. The gradient of an image is given by the formula:

$$\nabla F = \frac{\partial F}{\partial x}\hat{x} + \frac{\partial F}{\partial y}\hat{y}$$

Where,

$\frac{\partial F}{\partial x}$ = | I(x+1, y)-I(x-1, y)| /2 = gradient in x direction.

$\frac{dF}{dy}$ = |I(x, y+1)-I(x, y-1)| /2 = gradient in y direction.

3.2 Energy Image

Energy image is calculated separately for horizontal seams as well as vertical seams. It also needs to be recalculated after removal of every seam. It is calculated as follows: for each pixel in the gradient image the value in the energy image is the sum of the current value from the gradient image and the minimum from the three neighboring pixels from the previous row for vertical seam and for horizontal seam the minimum is from the three neighboring pixels from the previous column.

3.3 Tracing seam

For vertical seam tracing, find the minimum from the first row, save the pixel location for use in removal, then working forward by finding the minimum of the 3 neighboring pixels from the next row and saving that pixel to the seam path. This process is repeated until the last row is reached, and results in the optimal seam. Similarly, for horizontal seam tracing, find the minimum from the first column, save the pixel location for use in removal, then working forward by finding the minimum of the 3 neighboring pixels from the next column and saving that pixel to the seam path.

3.4 Removal of the traced seam

After the optimal seam is found, the path of pixels that make up the seam are removed from both the gradient image and the original image and the remaining pixels are shifted to right or up to form a continuous image. The process can be repeated to remove a set of seams, horizontally or vertically and will result in an image with reduced dimensions, but with the overall scene content intact.

3.5 Copying the resultant compressed image in an output image

The image that is shifted and compressed is then copied to the new output image such that the last rows and columns which contain no image

information is deleted. Therefore the new image contains the final compressed image.

5 RESULTS

In this the image that is taken as an input image is compressed such that the compressed image retains the important information deleting the less important information. The input image is as shown below:

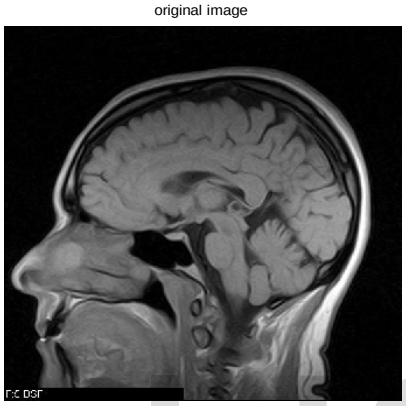

Fig. 2. Original Image

Gradient of an image is taken in both the direction. The gradient of an input image is as follows:

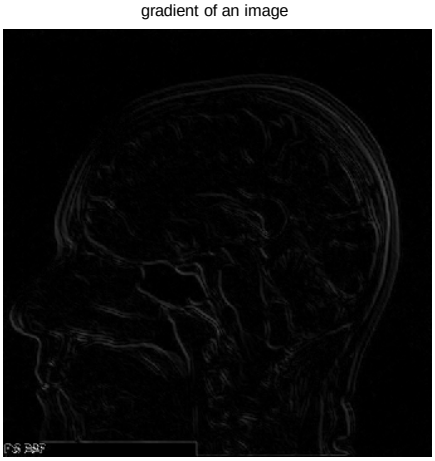

Fig. 3. Gradient Of Image

Energy image is to be calculated separately for vertical as well as horizontal seam. For computing vertical seam the energy image was obtained as shown below:

Fig. 4. energy image for vertical seam removal

The single vertical seam traced is displayed in red colour in following image:

Fig. 5. Vertical seam traced

For horizontal seam removal the energy image calculated is as shown as follows:

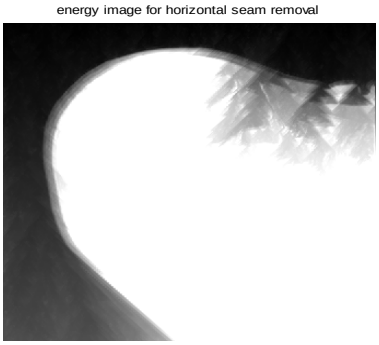

Fig. 6. Energy image for horizontal seam

The single horizontal seam traced is as displayed in red colour in following image:

Fig. 7. Horizontal seam traced

The comparison of compressed images with the original image is as shown as follows:

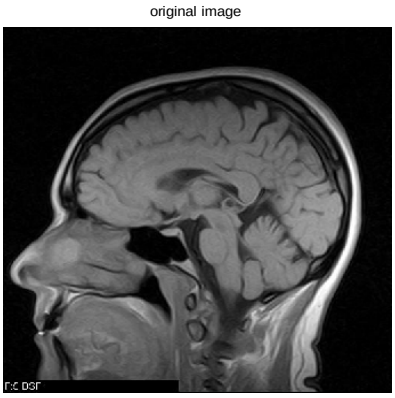

Fig. 8. Original image (Image contains 512*512 pixels of file size 40.2KB)

Fig.9. Compressed image (Image contains 502*502 pixels of file size 28.0KB)

6 CONCLUSIONS

This study worked well in removing the least important data in the image and at the same time, retaining the important information of the image based on intensity variations. It is based on the top to bottom approach to calculate optimal seams. This method thus can be used to compress the medical image data for long term storage. Limitations come only when the image is compressed more than an optimal level, since it takes the minimum from the given number of pixels in a row or column. In some medical image where even small intensity variation is also significant, this method may lead to loss of important feature if optimal level of compression is not used.

REFERENCES

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