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Liquid resizing:Content aware scaling

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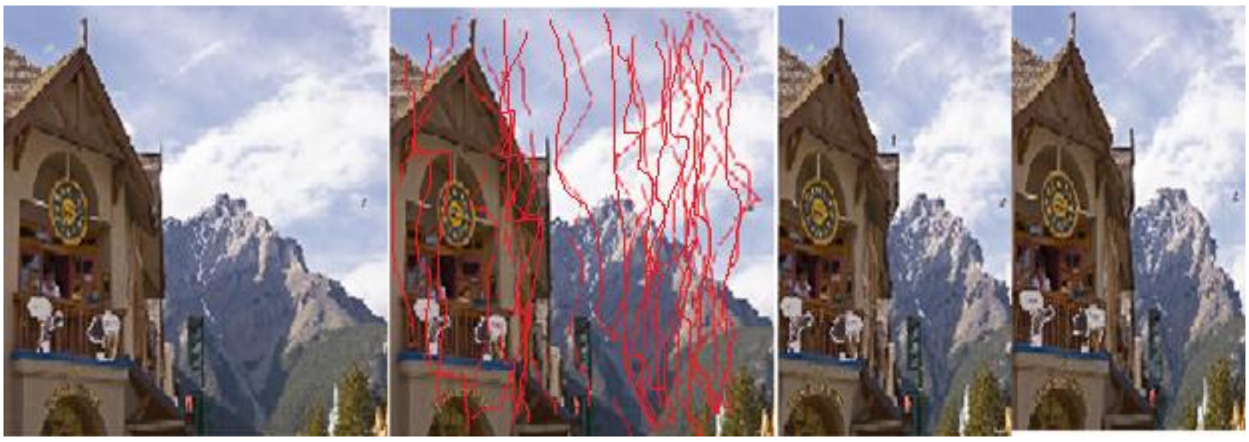

(a) (b) (c) (d)

Figure1: (a) original image (b) the seams removed to obtain image (c) seams duplication to increase the width of the image to obtain the image (d)

ABSTRACT

Now a day's display devices has display cheaper and integrated into more and more devices, so it will results that it increased center of attention on image resizing techniques to fill an image to any random screen size. Effective resizing of images should not only use geometric constraints, but consider the image content as well. Here a simple term called liquid resizing that supports content aware image resizing used for expansion and reduction. Liquid resizing can be said as *seam carving or liquid rescaling*. There is some traditional methods like cropping, resampling can cause disagreeable losses of information or deformation in perception. To produce a retargeted image this method removes pixels effectively form an image. This method can be used for object removal, image enhancement etc. However, there are many cases where it can fail. In this paper we advise an improved liquid resizing algorithm which includes anti-aliasing and thresholding techniques. By arranging the order of seams in an image we create multi size image that are able to continuously change in real time to fit a given size.

Index Terms— image resizing, liquid resizing, image retargeting, cropping, resampling, content-aware image

1. INTRODUCTION

In digital media, now a day there is very diversity and versatility of display devices. Recent advance technology digital image processing images have become a ordinary substance for media distribution and display devices such as PDAs, T.V., laptops, personal computers monitors, smart cell phones etc consist of more than 80 % of communication devices today.

Standard image scaling is not sufficient since it is oblivious to the image content and typically can be applied only uniformly. Cropping is limited since it can only remove pixels from the image periphery. More effective resizing can only be achieved by considering the image content and not only geometric constraints.

2. WHAT IS SEAM?

The seam consists of finding the path of minimum cost from one end of the image to another. These seams can be of two types. Depending upon the problem and requirement of an image seams are taken in to consideration for better image enhancement.

2.1 Vertical seam

A vertical seam is a path of pixels connected from top to bottom in an image with one pixel in each row.

2.2 Horizontal seam

A horizontal seam is similar with the exception of the connection being from left to right.

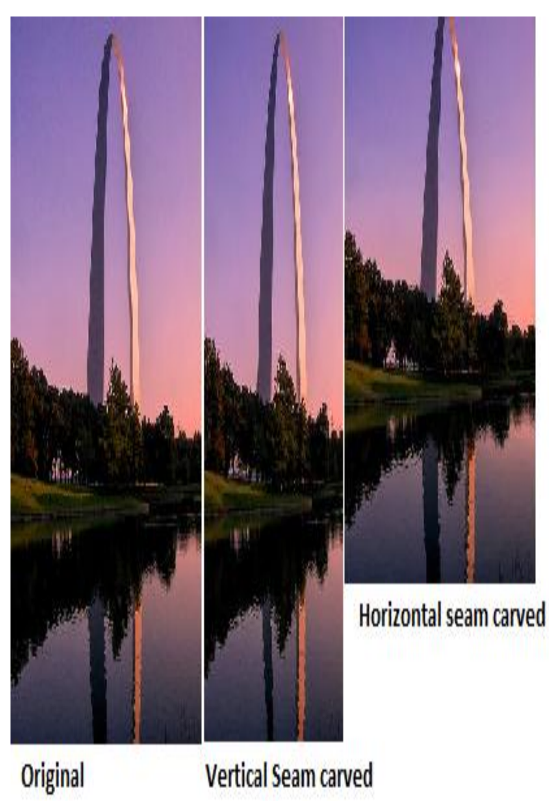

Figure2: vertical and horizontal seam carved

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Liquid resizing may use some energy functions such as gradient magnitude, visual saliency, entropy, eye-gaze movement etc that use for defining features of pixels. A seam is a connected path of low energy pixels which cross the image such as top to bottom or left to right. There is no necessity that path should be straight line only. It can be random. By successively removing or inserting a seams image can be reduced, or enlarge. Main steps which are followed in most of the techniques are as follows:

- In first step seam carving has been defined and it will present its properties.
- Then algorithm for enlarging of image has been presented using insertion of seam.
- Seams can be used for manipulations of content aware image size.
- For continuous image retargeting multi size images are defined.

3. BASIC IDEA

Remove unimportant pixels from the image and there are two primary criteria for describing the energy of a seam: backward-energy and forward-energy.

- The backward-energy criterion uses an energy map which defined in equation is the L1-norm of the image gradient.

$$E_1(\mathbf{I}) = |\frac{\partial}{\partial x}\mathbf{I}| + |\frac{\partial}{\partial y}\mathbf{I}|.$$

Important objects have a definite edge and, consequently, a high gradient value along that edge so this energy criteria is better. With the use of this map dynamic programming is implemented for finding the minimum energy path.

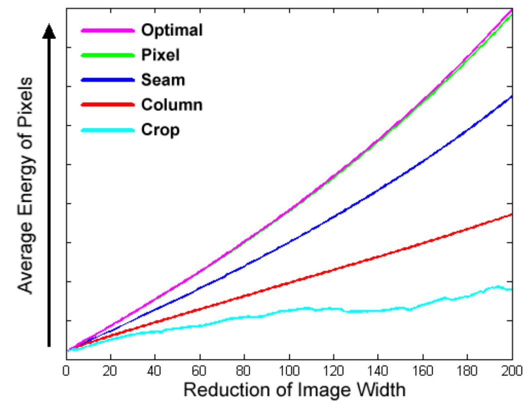

Figure 3: Image energy conservation. A assessment of the conservation of content measured by the average pixel energy using five different strategies of resizing.

- Let I be an n×m image and define a vertical seam will be:

$$s^x = \{s_i^x\}_{i=1}^n = \{(x(i), i)\}_{i=1}^n, \text{ s.t. } \forall i, |x(i) - x(i-1)| \leq 1$$

Where x is a mapping x: [1 . . . n] ! [1 . . . m].

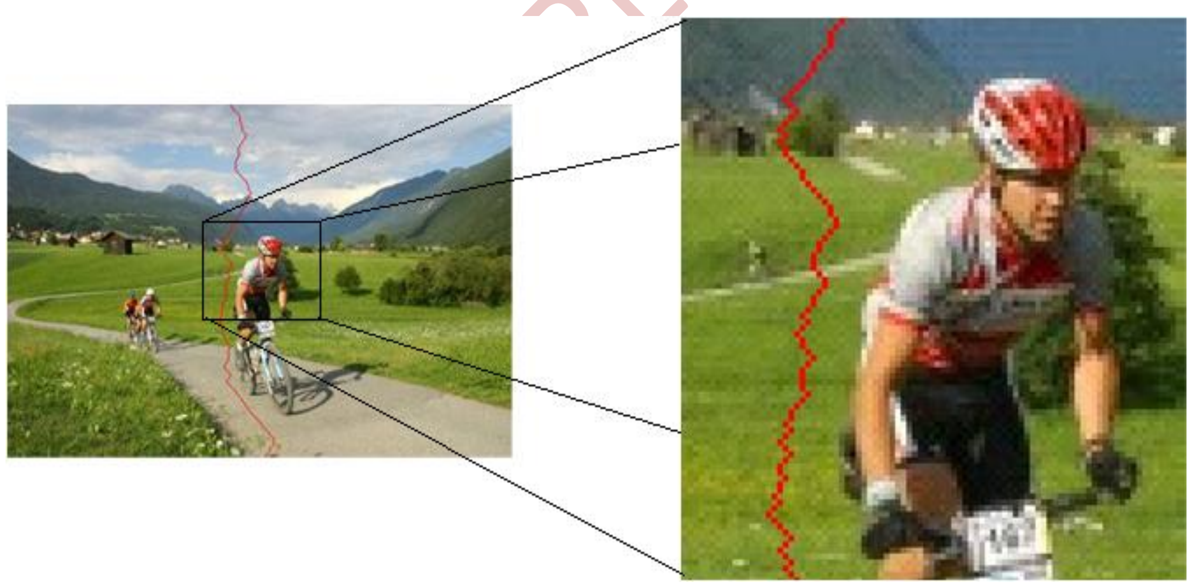

Figure3: A seam is connected path of pixels from top to bottom or left to right.

- Vertical seam can be found by 8-connected path of pixels in the image from top to bottom, there is one, and only one, pixel in each row of the image in each vertical seam.
- It finds the path which has minimum total differences between the pixels bring together upon the removal of the seam. Each point of
- this map relates to the minimum increasing energy of a seam ending at that point; we can define the individual energy of each point along a seam as where *si* is the location of the i^th^ pixel in the seam ***s***.

$$\mathbf{(I;si) = (si) - M(si-1)}$$

- if y is a mapping y : [1, . . . ,m]![1, . . . ,n],then a horizontal seam is:

$$s^y = \{s_j^y\}_{j=1}^m = \{(j, y(j))\}_{j=1}^m, \text{ s.t. } \forall j |y(j) - y(j-1)| \leq 1$$

- Energy map is no used directly by forward-energy criterion.

$$\mathbf{s = \{si = (i, xi)\}\ 1 \leq i \leq m}$$

- Removing the pixels of a seam from an image has only a local effect: all the pixels of the image are shifted left (or up) to compensate for the missing path.

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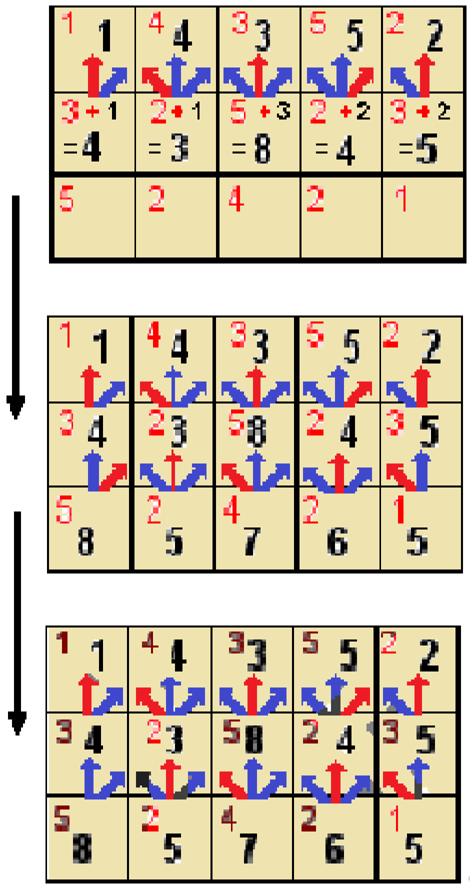
4. CALCULATION STEPS

Algorithm that used in seam carving calculations is as follows:



I. In 1st row there is no above row. So, sum is the energy value of the current pixel.

II. In 2nd row for example (2, 2) position has three possibilities 1, 4 or 3.here min is 1 so sum = energy value + 1.

III. Like this all pixels are take in to consideration.

IV. Steps will be up to final cumulative sums for the seams/paths.

Steps will be up to final cumulative sums for the seams/paths.

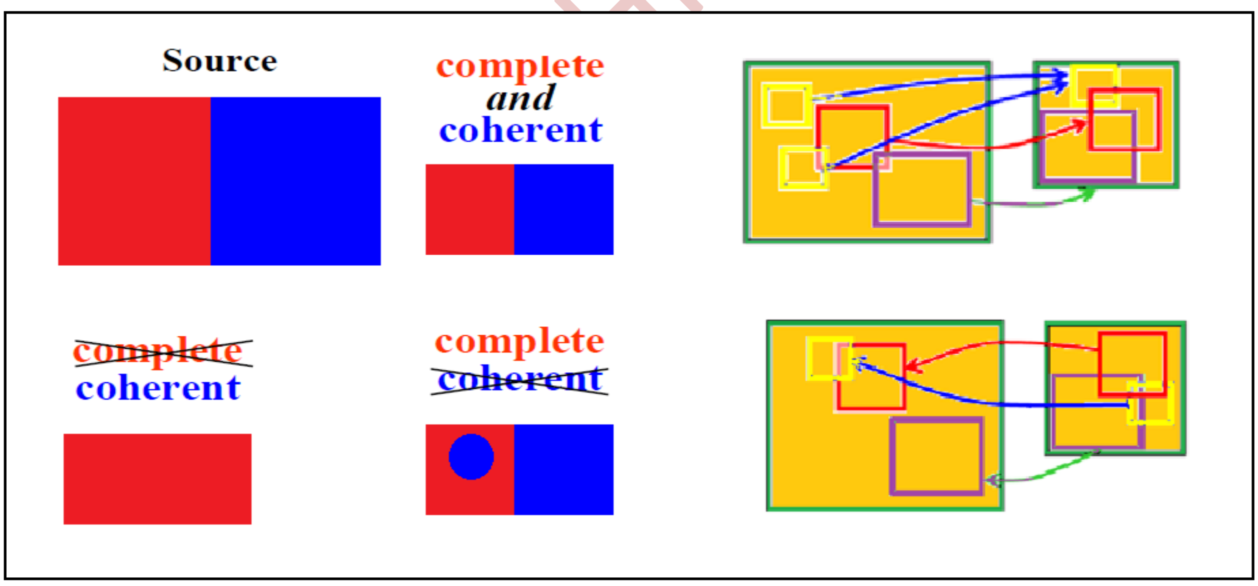
The cost values in each table cell are the energy of the corresponding pixel plus the total energy so far of the optimum path to reach that cell. Evaluating the value at each table cell is a recursive function defined as:

T(i,j)=e(i,j)+MIN(T(i,j-1),
T (i+1, j-1),
T (i-1, j-1))

T (I, j-1)← moving straight down
T (i+1, j-1)← moving down and to the left
T (i-1, j-1)← moving down and to the right

Where e(i,j) is the energy of the pixel located in the image at (i,j).

5. BIDIRECTIONAL SIMILARITY



$$d(S,T) = \overbrace{\frac{1}{N_S}\sum_{P\subset S}\min_{Q\subset T} D(P,Q)}^{d_{\text{complete}}(S,T)} + \overbrace{\frac{1}{N_T}\sum_{Q\subset T}\min_{P\subset S} D(Q,P)}^{d_{\text{cohere}}(S,T)}$$

Figure 4: The bidirectional similarity is a combination of (Completeness + Coherence).Two signals are measured visually similar if all patches of signal are enclosed in the other signal, and vice versa. The patches are taken at multiple scales: like spatial scales, space-time scales etc.

Here S→ input source signal
T→output target signal

There is no need of S and T of same size. If T is same as S then it will data summarization. If T is larger than S then it will data synthesis. This equation is a distance between two patches.

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Now P and Q are patches in S and T. Let NS and NT are the number of patches in S and T respectively. For every patch Q _ T we search for the most similar patch P _ S, and measure their distance D(,),and vice-versa. The patches are taken around every pixel and at multiple scales, resulting in significant patch overlap.

Like coherence and completeness other measures are also there in seam carving. The "Jigsaw" work like "Epitome" generates a brief complete demonstration by learning non-regular shaped image parts 'jigsaw pieces'. The correspondence measure proposed by can be regarded as maximizing coherence with respect to the input, but is unconcerned to preserving completeness (it is a single directional measure).

The bi-directional similarity measure is optimized problem that is summarization or retargeting. Summarization results for image and video data. it also used to address a variety of other problems, including automatic cropping. Completion and synthesis of visual data, image collage, object removal, photo reshuffling etc.

6. OBJECT EXCLUSION

Images varied by its some factors like content, object size, color, texture, foreground and background composition of test images. First user has to choose whether he wants to pair horizontal seams, vertical seam or a combination of both seams. So for that he must select an appropriate algorithm for computing the energy of a desired image. The user marksthe target object to be removed and then seams are removed from the image until all marked pixels are gone. Decisions are made by the designer but choosing of appropriate method will be done by user. Depending upon the decision the program should able to run the image energy and discard seams.

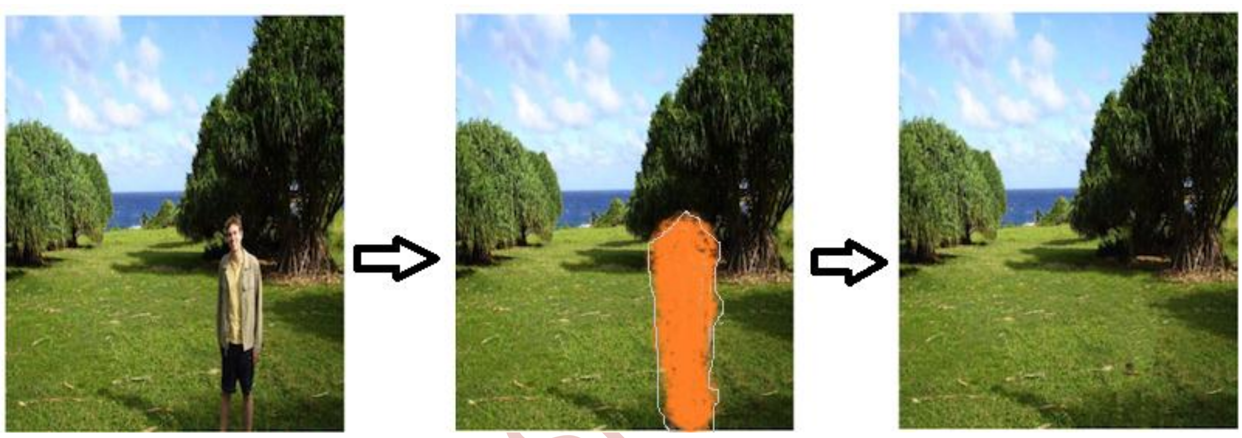

Figure 4: object exclusion after selecting object (man).

Object exclusion algorithm is select by visually analyzing the result on a progression of test images. The most ubiquitous of which are Histogram of Gradients and gradient magnitude.

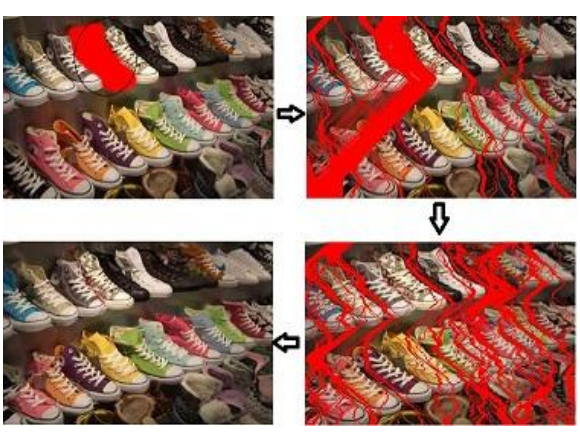

Figure5: finding missing shoe. By selecting object, seams consideration, seam removal and object will be removed by these steps.

Object removal can be easily understood by example. Shoes are arranged in rack. As shown in figure there are many shoes which are well arranged in each rows. Now we consider one problem when in line of shoes if some shoes are not appropriate to that line or they don't want those shoes in the rack. So for that we have to discard one shoe form row of shoes. But there should be no affection by deletion of neighboring shoe. All shoes should be same as original image. So for that problem liquid resizing is used. It first mask the shoe which need to be discarded.

Then seams are taken to shrink an image. So by doing this shoe will be deleted. But image will be same as original image. So it needs to be enlarging. So in 3rd step seams are used to enlarge an image. So after processing this tasks shoe will be removed without affecting any other object. Now, the shoe is missing!

The algorithm performed well for targeted object of size small and medium, Image is unrecognizable when large object is removed. To see the arguments were immediately evident we perform basic visual saliency. Bed result produced by large object because the large number of seams that will be removed to exclude the entire object. Algorithm is applied only if it gives good result for cluttered and plain background. In order to better create in your mind how object will be manipulated, visual displays of the selected visual seams and image energy function will be produced.

7. CONCLUSION

Liquid resizing works best when seams were found at low energy. When from the background, removal of missing information of an image has been done then seam carving is works very well. If object which needs to be removed is moderately small then it will be works better. When desired object is on diagonal lines/textures, liquid resizing doesn't works well. When the size of an object is large then also seam carving face some difficulties. So from this we can conclude that it is ideal for image scaling but can produce enviable results when used for object elimination.

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