Project Title: ***Content Aware Image Resizing***

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The availability of sophisticated source attribution techniques raises new concerns about privacy and anonymity of photographers, activists, and human right defenders who need to stay anonymous while spreading their images and videos. An image can be a combination of both significant (foreground) objects and some less significant (background) objects. Content aware image resizing (CAIR) algorithm uses the different edge detection methods to segregate the useful objects from the background. When applied to an image, CAIR can resize the image to a very different aspect ratio without destroying the aspect ratio of the useful objects in the image. In this project, we simply implement a content aware image resizing (CAIR) in MATLAB environment. The main idea to implement CAIR is to remove or insert the vertical or horizontal seams (paths of pixel) having the lowest energy. After implanted the Seam Carving Algorithm for Content aware image resizing (CAIR), analysis shows that the implemented seam carving for CAIR can generate more desirable resized images than cropping, resampling, and conventional seam carving techniques.

Objectives of the Projects:

1. Implements the seam curving to get desired image size from edge information.
2. Add some positive energy to ROI for keeping unchanged after reducing size.
3. Add some negative energy to ROI to abolish it from the reduced image
4. Enlarge the image without discontinuity of the nonboring pixels.

Methodology

The overall project works are described in several subsections and blocks that are described below step by step-

The workflow for the image shrinking is shown in the Fig. 1. Firstly, we need to find out gradient based energy that contains edge information of the image. The Sobel operator is a discrete differential operator which utilize two 3x3 kernels/ mask as shown in Table-1. The block presentations of the gradient/ edge information determinations are shown in Fig. 2.

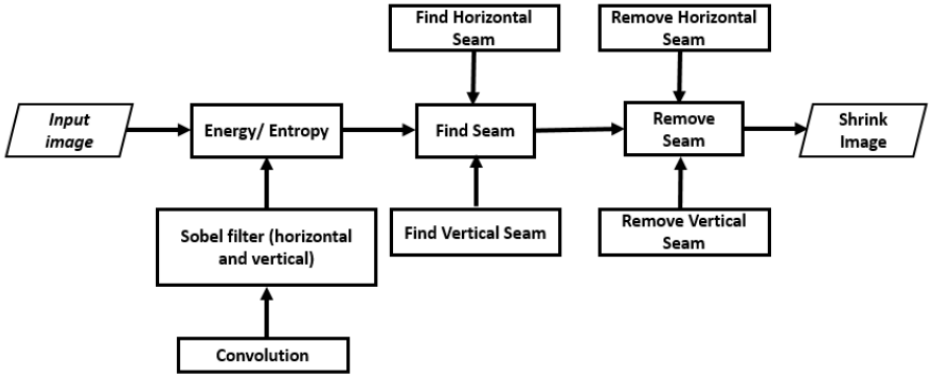


Fig 1: Seam Removing/ Image Shrinking block diagram

Table-1: Representations of the Sobel kernel/Mask

Gradient Direction			
→	-1	0	+1
	-2	0	+2
	-1	0	+1

Gradient Direction			
↓	-1	-2	-1
	0	0	0
	+1	+2	+1

A seam is a connected and monotonic path of low energy pixels connecting the two sides of the image either horizontally or vertically. The crucial goal in the seam carving algorithm that is shown in Table 2 is

how choose the right seam to remove? The workflow block diagram for the image enlarging is shown in the Fig. 3 which is a similar task to making them shrink, except now it makes sense to duplicate seams in order of least importance.

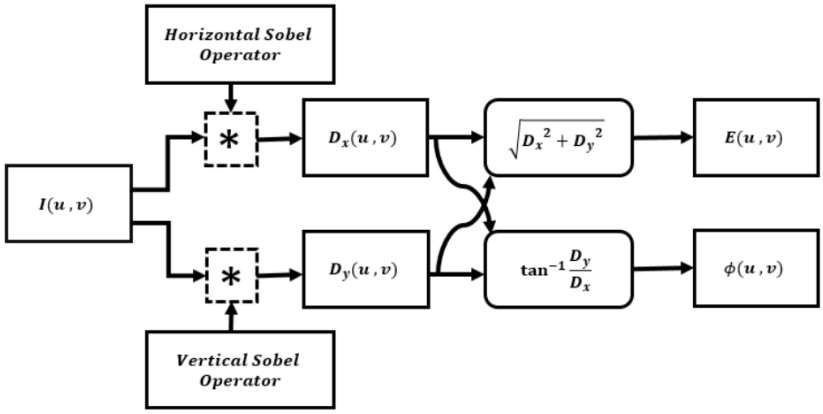


Fig. 2: Computational flow diagram of the Image energy or Image Gradient

Table-2: Representations of seam curving algorithm

Step-1: For each color channel (if RGB), the energy matrix (Taking gradient in both horizontal and vertical direction) is calculated. The energy for all color channels is summed into one 2D image to create the energy map.
Step-2: Find an optimal seam using Dynamic Programming. We have used a "forward energy" formulation in order to decrease the energy added to the image after seam removal.
Step-3: The minimum seam coordinates from *Step-2* are then used to remove the minimum seam. All the pixels in each row after the pixel to be removed are shifted over one column. Finally, the width of the image has been reduced by exactly one pixel.
Step-4: Repeat *Steps-1* to *Step-3* until desired number of seams are removed.
Step-5: Repeat *Steps-1* to *Step-4* for left to right edge.

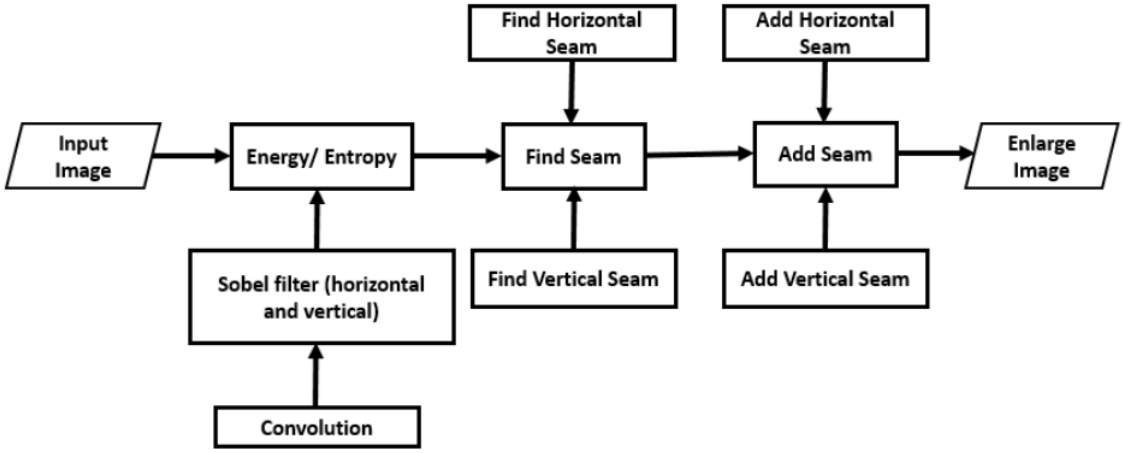
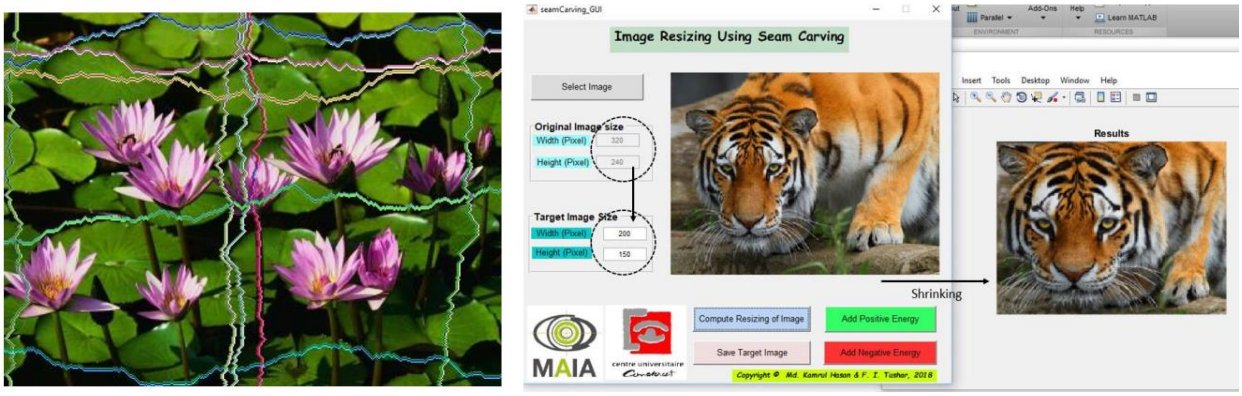


Fig. 3: Seam Adding/ Image Enlarging block diagram

Results and Discussion

To depict the result of this projects, we have designed a GUI as shown in Fig. 4 in MATLAB environment to make it user friendly. Fig. 5 (a), shows the selected low energy path that called seam to be deleted or copied for shrinking or enlarging respectively. But, in Fig. 5 (b), we can select the desired pixel size to resizing. If desired value of pixel is less than the original value, it will be shrink or vice versa. Fig. 6 indicates that if we add energy to the ROI of the image no seam can touch that region. So, after shrinking this region will be unchanged and vice versa.

Fig. 4: Different features of Implement GUI for seam carving



(a) (b)

Fig. 5: a) Selected low energy path called seam for shrinking or enlarging b) Image shrinking

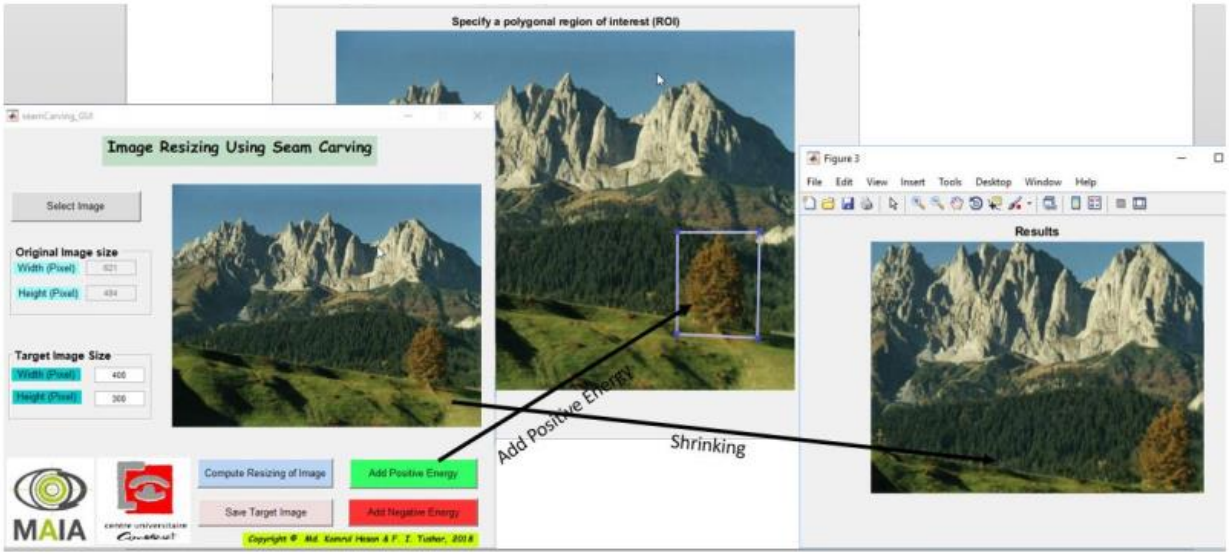


Fig. 6: Add positive Energy and Shrinking for tree (ROI)

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