Technical Guide for Image Resizing Based on Seam Carving in MATLAB GUI

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Content-aware image resizing, also called "Seam carving", is a method of resizing an image while preserving the structure of important objects. It's better than traditional image resizing because it doesn't squish or stretch content. It's also better than cropping because it doesn't omit important content. The algorithm was developed by Shai Avidan, of Mitsubishi Electric Research Laboratories (MERL), and Ariel Shamir, of the Interdisciplinary Center and MERL. It functions by establishing a number of seams (paths of least energy or entropy or information) in an image and automatically removes seams to reduce image size or inserts seams to extend it. Seam carving also allows manually defining areas in which pixels may not be modified, and features the ability to remove whole objects from photographs.

How does it Work?

Some energy function is defined on the image such that higher energy implies greater importance. In this project, we used gradient magnitude from the *sobel gradient operator* as an energy function, though there are other choices which yield different results. A seam is a path of pixels that runs vertically or horizontally along the image. The seam that runs through the least amount of energy is the best seam to remove because it contains the least important pixels or least information. This optimal seam is computed by first computing a cumulative minimum energy map, which maps each pixel to the minimum amount of energy required to reach it. Such a map is efficiently computed using a dynamic programming algorithm [1], [2].

Implemented Graphical User Interface (GUI) in MATLAB

The features of the implemented GUI interface is shown in the Figure 1. to make it user friendly.

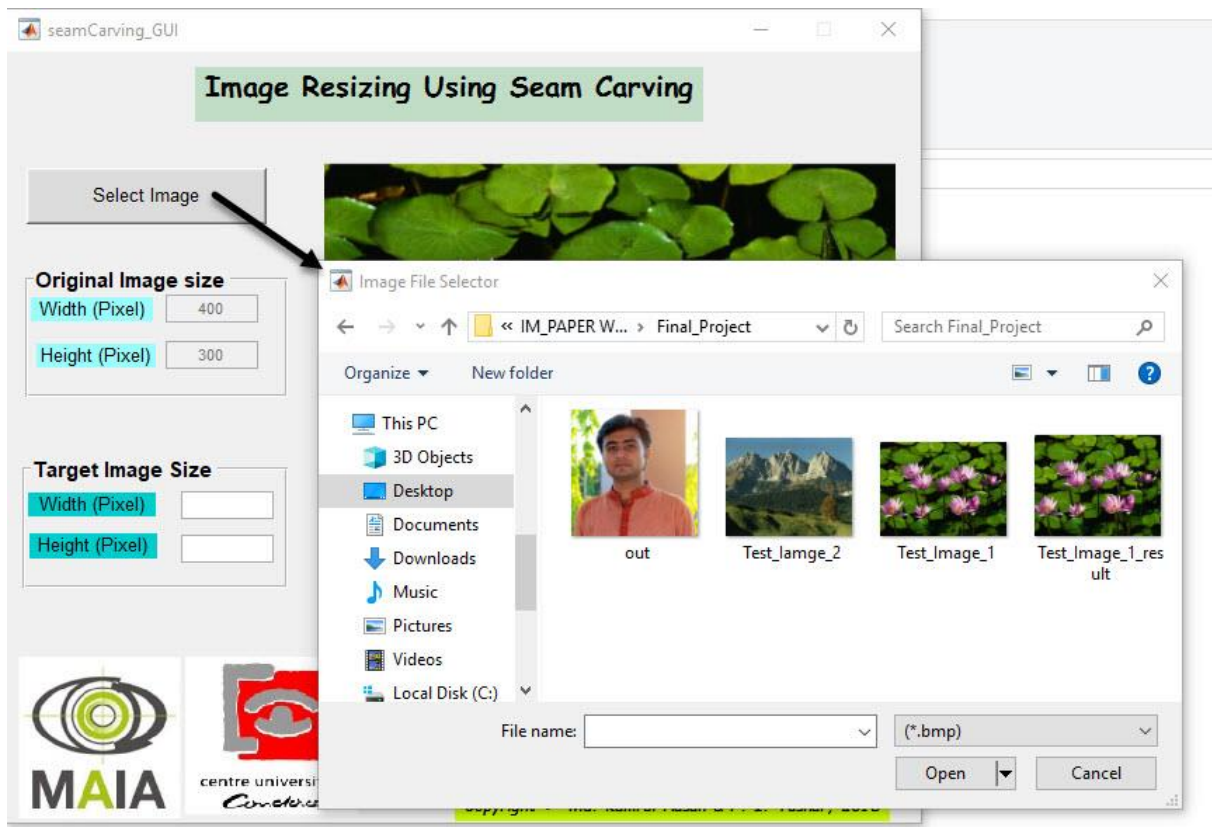Figure 1. Different features of Implement GUI for seam carving.

Figure 2. Selecting the image for resizing using seam carving GUI.

From the given input section 1 (shown in Figure 1), you can select the image that you want to resize by the Seam Carving technique. When you click that Icon it will give you the following outcome as shown in Figure 2. to select the image from the directory. Here, it is mentionable that all the desired images should be in the same locations of the GUI file and images format should be .bmp (bitmap image file).

In section 2 as indicated in Figure 1, it will provides you original size (Number of pixels) of the image. In section 3 (shown in Figure 1), you can put your desired size to be resized of the original image as shown in Figure 3. If the given vale of pixel in section 3 (shown in Figure 1) is less than the original size image will be shrink or vice versa.
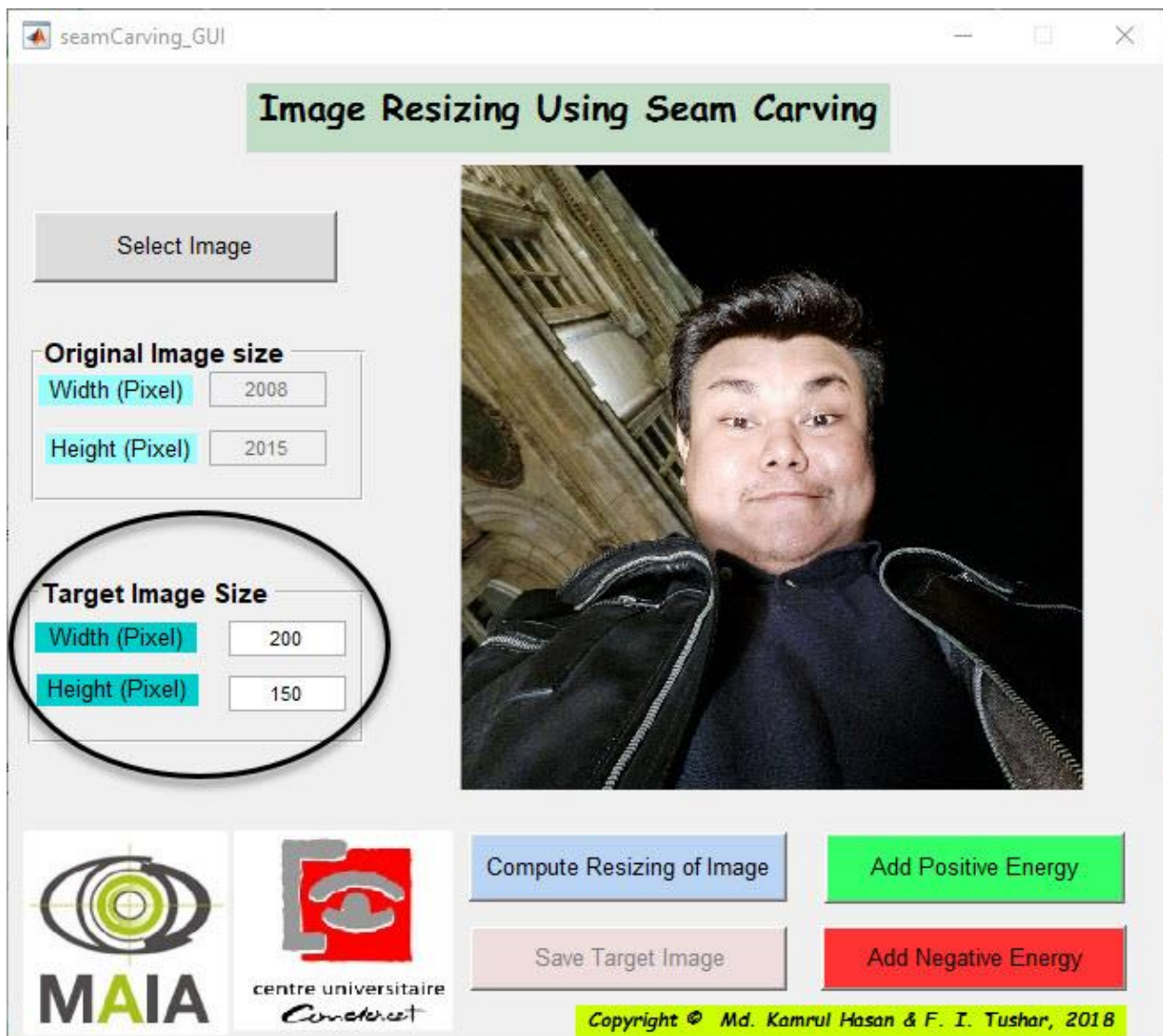

Figure 3. Providing the target image desired size.

After selecting the desired pixel size, you need to go section 4 (shown in Figure 1). When you will click the section 4 (shown in Figure 1) button it will takes some times depending of the amount of shrinking and enlarging as shown in Figure 4.
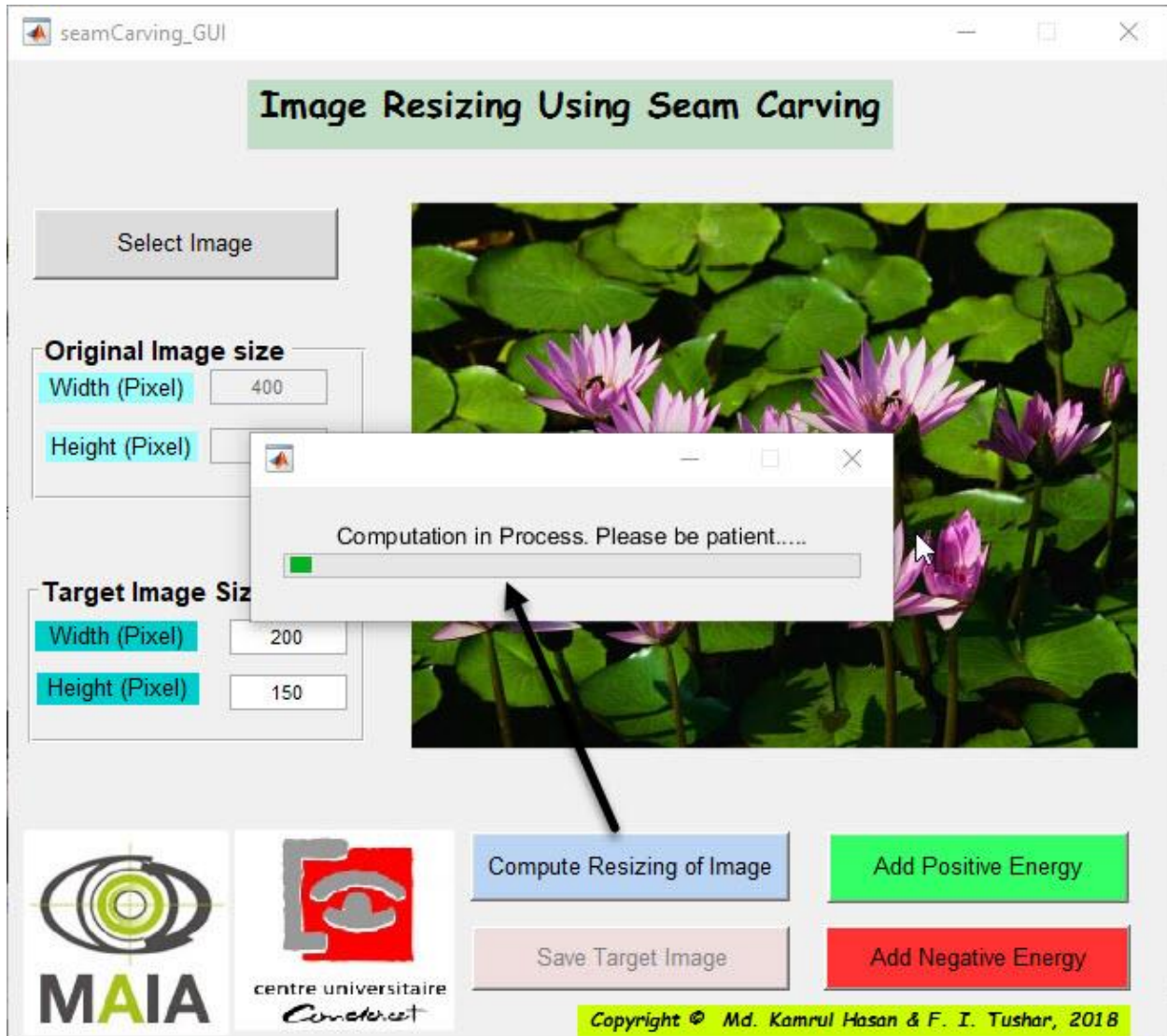

Figure 4. Computing resizing of the input image.

After that, if you want to save your desired image, just click on the section 7 (shown in Figure 1) button as shown in Figure 5. The output image will be save at the locations of your original images. One interesting feature is that you can add or subtract some energy in the desired Region of Interest (ROI) of the target image. If you add energy to the ROI of the image no seam can touch that region. So after shrinking this region will be unchanged. Similarly, if you subtract energy from the ROI, after shrinking that region will be vanished. The adding and subtracting of the energy is shown in Figure 6 (a) and 6 (b).
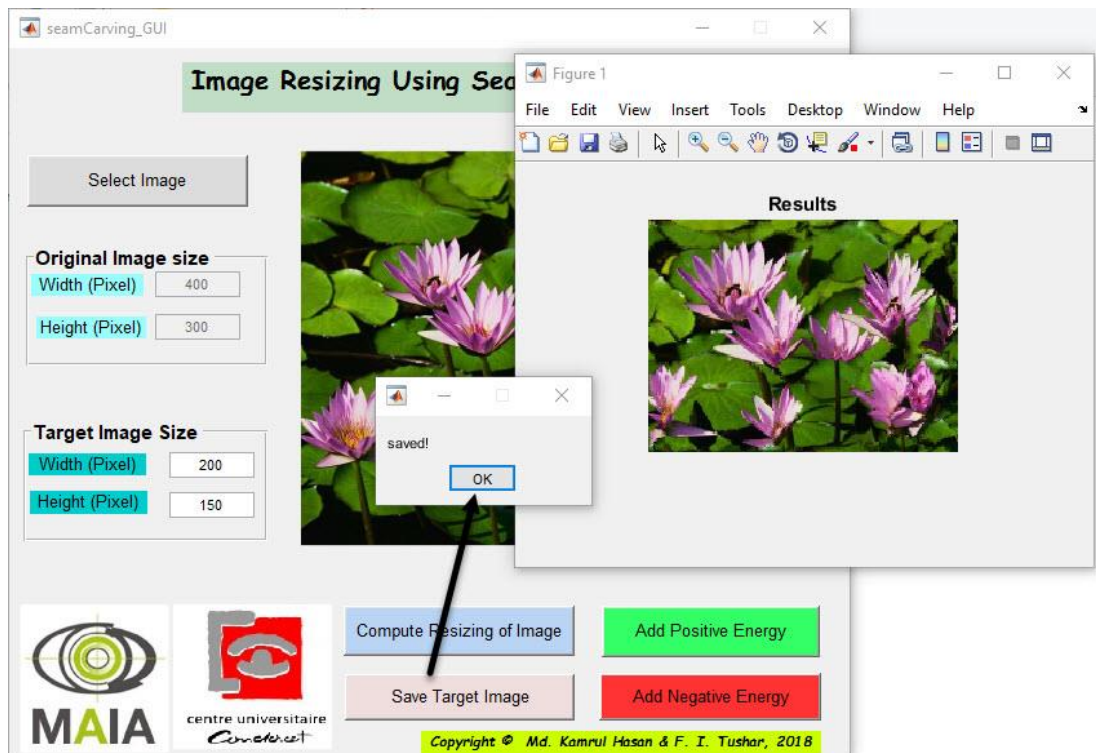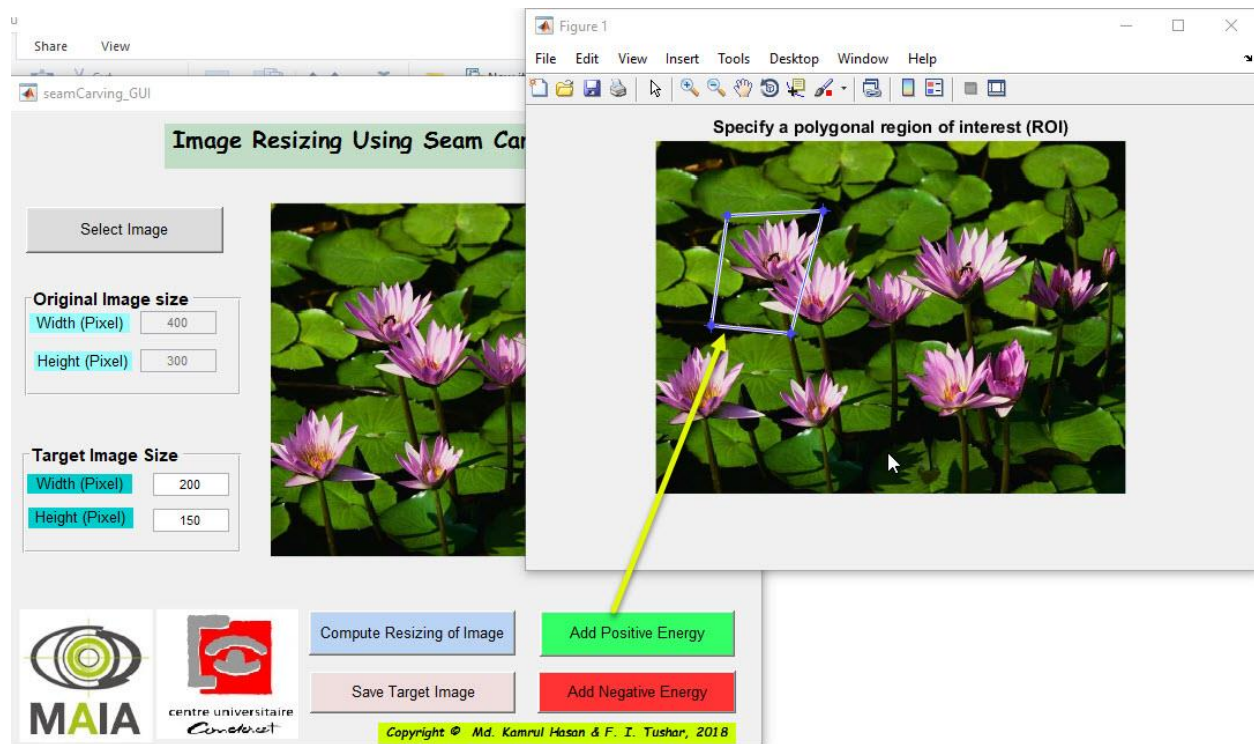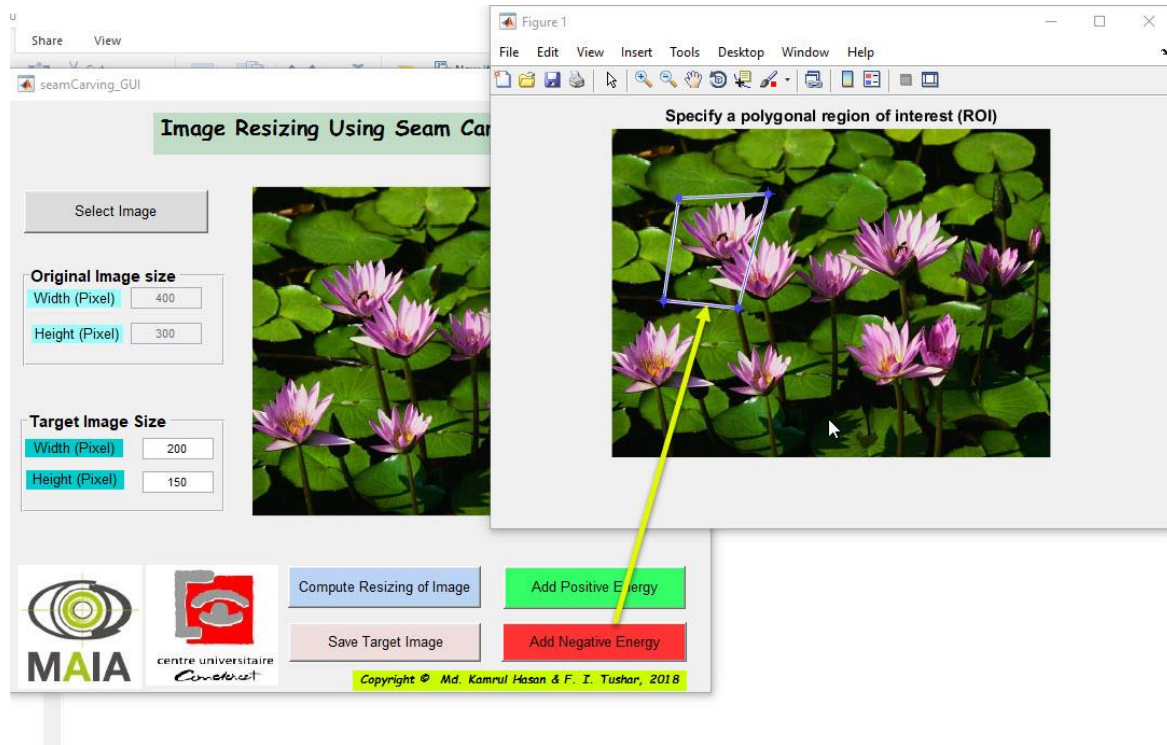
Figure 5. Saving the resized image.

(a)

(b)

Figure 6. a) Add positive energy to the ROI of the Original Image b) Add negative energy to the ROI of the Original Image

Reference

[1]. Content-Aware Image Resizing. Available at:

www.cs.utexas.edu/~jkelle/joshkelle_com/projects/contentAwareResize.html

[2]. Seam Carving for Content-Aware Image Resizing. Available at:

inst.eecs.berkeley.edu/~cs194-26/fa16/hw/proj4-seamcarving/imret.pdf