Digital Image Processing COL 783

Assignment 3: Seam Carving

Due Date: May 6, 2021

This assignment deals with Seam Carving of images as discussed in the class and extends to Object Carving. Seam Carving is a method of re-sizing an image which is in a sense context aware. The re-sizing is not just a scaling operation. The method is described in the paper by Avidan and Shamir [1]. The main idea of re-sizing is to identify a seam connecting from top to bottom (vertical seam) and/or left to right (horizontal seam) pixels with minimum energy. The energy can be defined in terms of gradient function. Finding minimum energy can be implemented using dynamic programming [2]. This method is based on the observation that one can compute the minimum-energy seams (e.g. vertical) going through all pixels in current row i by knowing the minimum-energy seams through all pixels in the previous row i-1. One can define Cumulative Minimum Energy (CME) of a path going through some pixel (i,j) as the energy at (i,j) plus the minimum of the energies at vertical and diagonal adjacent pixels i.e. at (i-1,j-1), (i-1,j), and (i-1,j+1). The cost of the globally-minimum-energy path is then just the lowest CME.
The method should then extend to remove objects. The objects are then labeled with min energy to force the seems to pass through.
The method should extend considering a Gaussian pyramid to accelerate computation through computing seems in lower reslutions and update them in the higher resolution as suggested in the paper [3].
The results should include

- Examples of reducing size of image with known number of rows and/or columns. The number of rows/columns may be given as a parameter for the implementation.
- Display of energy function of the image.
- Running of the method by displaying the progress of the seam in a different color overlayed on the image.
- Image enlargement with known number of rows/columns using seam insertion.
- Object(s) removal using an interactive specification.

Note:

- Assignment can be done in a group of maximum size of two. The group should not be different from the previous assignment(s).
- You may try your implementation on images which are used in the paper [1], in addition you may acquire images yourself and try the method.
- You are encouraged to experiment with different energy functions.

References

1. Seam Carving for Content Aware Image Resizing SIGGRAPH 2007.
2. Seam Carving in Wikipedia.
3. Fast Seam Carving Using Gaussian Pyramid