Intro to Image Understanding (CSC420)

Assignment 2

Posted: Feb 6, 2021 **Submission Deadline : Feb 16, 11.59pm, 2021**

Instructions for submission: Please write a document (either pdf, doc, etc) with your solutions (include pictures where needed). Include your code inside the document. Please submit through MarkUs. You are expected to work on the assignment **individually**.

Max points: 15

1. **[6 points]** Implement seam carving:
   (a) **[1 point]** Compute magnitude of gradients of an image
   (b) **[3 points]** Find the connected path of pixels that has the smallest sum of gradients. A path is **valid** if it is connected (the neighboring points in the path are also neighboring pixels in the image), it starts in the first row of the image and in each step continues one row down. It finishes in the last row of the image.
   (c) **[1 point]** Remove the pixels in the path from the image. This gives you a new image with one column less.
   (d) **[1 point]** Remove a few paths with the lowest sum of gradients. Create a few examples and include in your document.

   You can find more details about seam carving in this paper:

   S. Avidan and A. Shamir, *Seam Carving for Content-Aware Image Resizing*, SIGGRAPH 2007, `http://www.win.tue.nl/~wstahw/edu/2IV05/seamcarving.pdf`

2. **[4 points]** Image upscaling:
   (a) **[1 point]** Write down the mathematical form of the convolution filter that performs upscaling of a 1D signal by a factor d. You do not need to write code. Please plot this filter (you can plot it by hand).
   (b) **[3 points]** Implement a function that upscales an image to a 3x resolution. Please document your implementation. Do not use built-in functions for upscaling.

3. **[5 points]** Interest point detection:
   (a) **[4 points]** Implement a function to perform Harris corner detection. The function should take as input an image, and return corners. You can make the image grayscale.
   (b) **[1 point]** Plot your result for the attached image building.jpg, and add it to your pdf/doc file.