SYDE 671 Advanced Image Processing

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Assignment 1 - Questions Part (100 pts)

1 Instructions

- 4 questions (25 pts each).
- The answers to this document are to be submitted as a part of one Jupyter notebook file(named Questions_Your_Name_Assignment_1.ipynb), using code and markdown blocks as necessary.
- Your final submission including both question and coding parts will be ONE .zip (Your_Name_Assignment_1.zip) file with 2 directories:
  - Questions
  - Coding

  The Jupyter notebook for this portion of the assignment goes in the questions directory along with RISDance.jpg (and any other images you used for the questions part).
- Feel free to include images and equations and comment on both your code and results meticulously.

2 Questions

Q1: Explicitly desribe image convolution: the input, the transformation, and the output. Why is it useful for computer vision?

Q2: What is the difference between convolution and correlation? Construct, code and run a scenario which produces a different output between both operations.
Please use scipy.ndimage.convolve and scipy.ndimage.correlate to experiment. Use the image RISDance.jpg included in your assignment's data folder to perform any tests (feel free to resize/crop within your code if you want to).

Q3: What is the difference between a high pass and a low pass filter in how they are constructed, and what they do to the image? Please provide example kernels and output images.

Q4: How does computation time vary with between (1) convolution and correlation with (2) filter sizes from 3×3 to 15×15 (for all odd and square filter sizes including and in between those filters), and (3) with image sizes from 0.25 Megapixels to 8 Megapixels (choose your own intervals that you deem appropriate - not less than 8 intervals)?
Do the results match your expectations given the number of multiply and add operations in convolutions?
Measure using scipy.ndimage.convolve or scipy.ndimage.correlate to produce a matrix of results. A good approach is producing one 2d matrix for convolution and one for correlation. Use skimage.transform module to vary the size of the image. Use an appropriate charting function to plot your matrices of results such as Axed3D.scatter or Axes3D.plot_surface.
Use the image RISDance.jpg included in your assignment's data folder to perform these tests. Note that this image is 3840x2160 = 8,294,400 pixels i.e. 8 Megapixels.