

CS303B: Lab 4

Tutor: Yao Zhao and Jing Luo

Aim: To investigate image pyramids and re-sampling methods.

NOTE: Matlab has a built-in function *impyramid*. You should code this lab content yourself rather than just calling this function. You may compare output from your implementation with output from *impyramid*.

Subsampling

Write a method to subsample an image. The output image should be obtained by discarding every other row and every other column from the input image. (Pad the leftover pixels with zeros).

Test your new method on the lena.bmp image and the walking sequence. The result by applying the method twice should give the following.



Taken together, these copies of an image subsampled by different amounts constitute what is often known as a *pyramid representation*. They provide a multi-resolution representation that is useful for many algorithms in computer vision.

Supersampling

Now write a method to supersample an image. The output image should be obtained by repeating every row and column from the input image. Test your method by applying it to a subsampled image.

Compare the resulting image with the original. What has happened?
Now try two or three subsamples followed by two or three supersamples.

Gaussian Pyramids

Write a method that applies Gaussian smoothing and then subsampling to an image (*GaussianSubsample*). Try applying each of the following to an image sequence:

- (i) *Subsample, Subsample, Supersample, Supersample*
- (ii) *GaussianSubsample, GaussianSubsample, Supersample, Supersample*

Based on the results, which do you think yields the better low-resolution representation of the original images, Subsample x2 or GaussianSubsample x2 ?

Now write a method that applies supersampling followed by Gaussian smoothing (*GaussSupersample*). Try applying the following to the image sequence:

(i) *GaussSubsample, GaussSubsample, GaussSupersample, GaussSupersample*

Does this yield a better or a worse visualisation of the low-resolution representation than (ii)?

What kinds of edges would you expect to be able to detect at each level of the pyramid? Verify your answer using the edge detector developed in previous labs.

What kind of difference, would you expect, between the FFTs of the images at different levels of pyramid with and without Gaussian smoothing (after supersampling)? Verify your answer by showing the power spectrum using the FFT tools you developed in previous lab.

Finally...

Backup your project so that you might continue its development next week.