Assignment

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See Sections 1.2 and 2.1.3, and Exercise 2.3 in
Reinhard Klette: Concise Computer Vision
Springer-Verlag, London, 2014

`ccv.wordpress.fos.auckland.ac.nz`

Amplitudes and Phases in Frequency Space

This assignment aims at obtaining practical hands-on experience with different impacts of amplitudes and phases in frequency space on resulting filtered images, and it also addresses texture direction estimation.

You can choose to solve **the first or the second task**. The first task is to evaluate information contained in amplitude and phase of Fourier transforms of images (see Exercise 2.3 in the book). The second task is to analyse directions of image textures in the frequency domain. Both tasks will be further explained in the tutorial.

The tutor informs how to access programs for the 2D DFT and inverse 2D DFT.

Task 1

1. Select your set of gray-level images (e.g. showing human faces; you may consider examples given on `ccv.wordpress.fos.auckland.ac.nz/data/single-images/`)
2. Design and implement a program which does the following for a given pair of two images of your chosen set of test images:
   1. Transform each of the images into the frequency domain.
   2. Map the resulting complex numbers into amplitudes and phases.
   3. Create a representation of an image in frequency space by combining the amplitudes of one of the two images with the phases of the other image.
   4. Transform the resulting array of complex numbers back into the spatial domain, thus illustrating the created image in the spatial domain.
3. Which of the two contributing images (the one contributing amplitudes, or the one contributing phases) is "winning" in the created image, i.e. can you visually evaluate which of the two input images is dominant in the created image?

Task 2

1. Select your set of texture images from `ccv.wordpress.fos.auckland.ac.nz/data/textures/`
2. Design and implement a program which does the following for an image of your chosen set of test images:
    1. If a colour image, then map it into its intensity representation.
    2. Transform the given gray-level image into the frequency domain.
    3. Partition the frequency space into angular segments and calculate the total contribution of the given image to such segments in frequency space (How do you define "total contribution"?).
    4. Compare total contributions to angular segments for analysing directions in the given textures.
3. Provide examples of selected images where the shown texture is (nearly) isotropic or where the shown texture has a dominant direction.

Your Submission: Report, Sources, Input Examples

Discuss your findings in a final report (pdf) of about 2-4 pages. Start with identifying yourself and the chosen task. Write complete sentences in good English, and provide references to all the sources used in your assignment solution. Be brief and precise; use short sentences. The report should end with a section called "Conclusions" where you briefly summarise your findings when doing this assignment.

You will hand in a zip file with your report, your source code, and samples of your input images.

The marker will test your code on the images provided, but also on some other images.

The score is given based on correct performance of the provided sources (70%) and based on the quality of the provided report (30%).