

BIL 415 - Image Processing Practicum



HACETTEPE UNIVERSITY

Department of Computer Engineering

Problem Set 4

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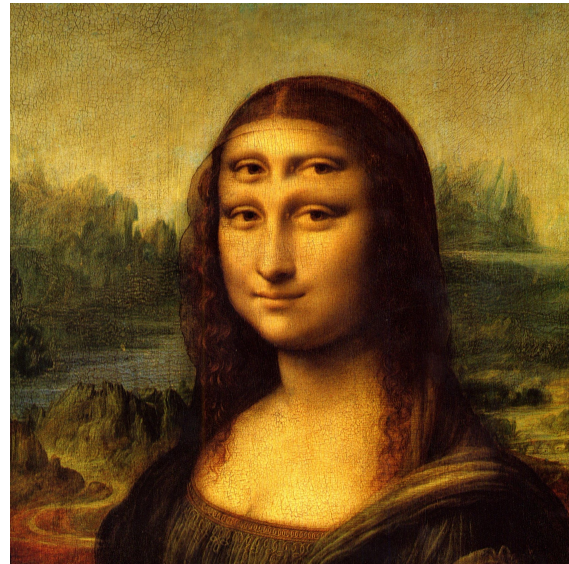
Due Date: 23:59pm on Friday, December 5th, 2014

Your 4th assignment comprise of 2 parts. First, you will use Laplacian and Gaussian pyramids for image blending. Second, you will work on Frequency domain of an image corrupted by Moire pattern to eliminate it by analyzing related frequencies.

1 Using Image Pyramid for Image Blending



a) Input



b)Result

Figure 1: Image Blending

Background

In the image editing tools such as Adobe Photoshop, GIMP, image blending is the one of most fundamental task and used for many purposes. For example you can prepare a poster for an advertisement or a film. The most important thing for image blending methods to blend images seamlessly. In other words for an successful image blending method, seams where images or image regions are stitched must be invisible.

There are many ways to blend two or more images. One such approach proposed in [1] Laplacian Pyramid. Accordingly to this approach, images are first decomposed into their Laplacian pyramids, and then these images are blended in pyramid levels so that seamless .

Overview

The goal of this assignment is to obtain a blended image like in Figure 1-b from the input images.

Details

Your program will take an image as input and a masked image region from another or same image and produce blended image. Specifically, you should carry out the following steps:

1. Build Laplacian pyramids for each image
2. Build a Gaussian pyramid for each region mask
3. Blend each level of pyramid using region mask from the same level

$$L_{12}^i = L_1^i \cdot R^i + L_2^i \cdot (1 - R^i)$$

R^i : *RegionMask*

L_1 : *Laplacian pyramid of first image*

L_2 : *Laplacian pyramid of second image*

4. Collapse the pyramid to get the final blended image.
 - You must show results of main steps in your report at least 5 different images with your comments
 - You must analyze how number of Pyramid levels affect your results so you will obtain results for different number of Pyramid levels
 - You are given a starter code to select a region for an image so that you can create image mask easily.

2 Moire Pattern Suppression[2]

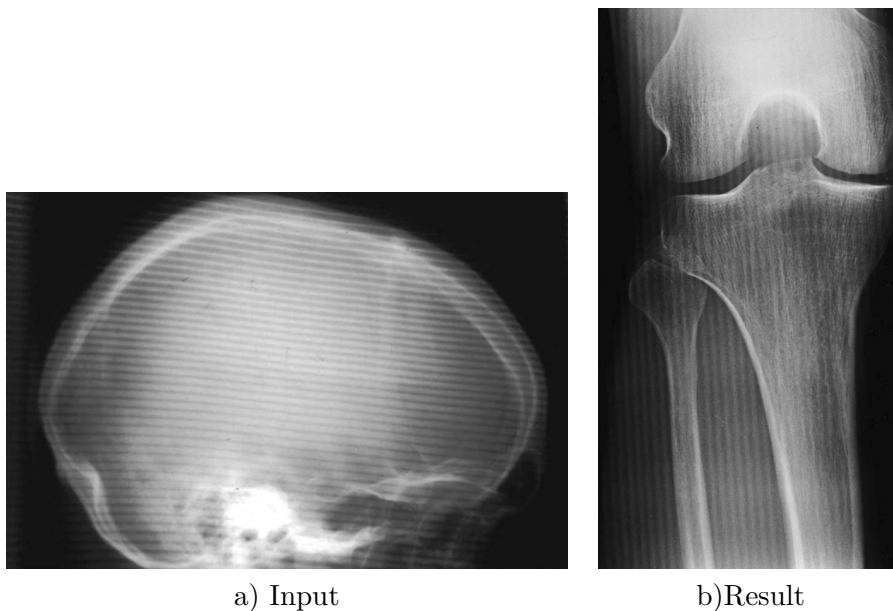


Figure 2: Images Corrupted by Moire Pattern[2]

Background

Radiographs of tissue more than 10 cm thick are typically acquired through a Bucky grid, a fine pattern of alternating lead and plastic strips that suppresses scattered radiation and thus improves the contrast of the image. Unfortunately, when the radiograph image is sampled, Moire patterns can result. This problem studies how to reduce Moire patterns while properly preserving the salient features for diagnosis. Each of these images is corrupted by a clearly visible Moire pattern as shown in Figure 2.

Overview

The goal of this part is to suppress Moire pattern in Frequency domain and show related frequency components.

Details

Your program will take an image corrupted by Moire pattern and show filtered image in frequency domain. You should carry out the following steps:

- **Label Moire Pattern in Frequency Domain**

For each image, compute its Discrete Fourier Transform (DFT) (functions: `fft2` and `fftshift`) and submit an image showing the DFT magnitude (function: `abs`). A log display may be most appropriate. Clearly identify and label the frequency components that correspond to the Moire pattern. (Hint: Repetitive noise in an image is sometimes seen as a bright peak somewhere other than the origin.)

- **Design A Notch Filter To Suppress Moire Pattern**

For each image, design a notch filter so that the frequency components for the Moire pattern are suppressed as much as possible while other frequency components are preserved. Apply your notch filter to the images DFT and submit an image showing the filtered DFT magnitude. Display the filtered image in the spatial domain.

Notch Filter: Notch filtering is an ad hoc procedure requiring a human expert to determine what frequencies need to be removed to clean up the signal. You can suppress such noise effectively by carefully erasing the peaks.

What to Hand In

You are required to submit all your report along with a short webpage in *PDF*. For that purpose, prepare a folder containing

- `README.txt` (*text file containing details about your project*)
- `code/` (*directory containing all your code*)
- `report/` (*directory containing all your documents, including your images*)
- `report/data/` (*including your data images*)
- `report/result/` (*including your result images*)
- `report/pset4.pdf` (*PDF report*)

Archive this folder as `studentid_pset4.zip` and send to `submit` system.

Your report should contain a brief overview of the problem, the details of your approach, and the results of your algorithm with your comments. Show the results of all of the main steps . If your algorithm failed to give a satisfactory result on a particular image, provide a brief explanation of the reason(s).

References

- [1] Pyramid methods in image processing,E. H. Adelson , C. H. Anderson , J. R. Bergen , P. J. Burt, J. M. Ogden,1984
- [2] <https://web.stanford.edu/class/ee368/>