Diagnostic Medical Image Processing (DMIP)
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Exercise 3: Defect Pixel Interpolation

Flat panel radiography detectors provide medical images which may contain artifacts caused by points, lines and/or clusters of inactive pixels. The goal is to eliminate such artifacts by interpolation methods.

1 Introduction

Two sets of input are given: an *observed image* $g(n)$ (of size $N \times N$) and a defect image mask $w(n)$. And therefore we can formulate a defect image as follows:

$$g(n) = f(n) \;\; w(n), \tag{1}$$

where $f(n)$ is the *ideal image* that we have to find. The simplest solution would be to divide the defect image $g(n)$ by the mask $w(n)$ in order to obtain $f(n)$. However, as one can predict a division by zero(s) is not possible, as the mask is constituted of zero values that determine the range of the defects. If the defects are not too large, they can be filled by interpolation algorithms which usually work in the spatial domain. However there is an alternative spectral domain approach.

2 Defect Pixel Interpolation by Spectral Deconvolution

Note: This exercise is based on the paper *Defect interpolation in digital radiography - how object-oriented transform coding helps* from Til Aach and Volker Metzler, Medical University of Lübeck.
Download the paper and have a look at the paper to replace the missing lines:
http://www.lfb.rwth-aachen.de/bibtexupload/pdf/AAC01a.pdf

2.1 Implementation tasks

1. Line 50: Load the defect pixel mask.
2. Line 53: Implement the multiplicative model.
3. Line 89: Call the function **f = interpdefectimage(im, g, w, maxit, pad)** with a padding size of 32.
4. Line 117 & 118: Pad the images g and w to get a better resolution in the frequency domain.
5. Line 125 & 126: Compute the Fourier Transform of g and w.

6. Line 149: Compute the maximum of **deltaE_G**.
7. Line 174: Compute the conjugate complex of **s1**: **s2** [hint: you need **halfDim(1)** for this].
8. Line 177: Compute the conjugate complex of **t1**: **t2**.
9. Line 206: Compute **FhatNext** for the special case.
10. Line 207: Compute **tval** ($= \hat{F}$). (see Eq. (9))
11. Line 274: Return the interpolated image with the same size as the input image.

Some useful matlab functions: fft2, ifft2, fftshift, ifftshift, conj, norm, mod