1 Experiments

Objectives:
◦ multiple applications of data decomposition (analysis) and composition (synthesis);
◦ the variety in data decomposition and representation;
◦ the condition number for system inversion and preconditioning;
◦ use-case studies with image data processing and analysis: spatial partition, spectral decomposition, compression and decompression, convolution modeling and/or filtering, deconvolution (direct or iterative methods: conditions/limitation and advantages)


   Reference code: demo scripts and functions under image_waterMarking

   (a) watermark an image of your choice with your own marker (not the demo ones).
   (b) detect alternations by watermark authentication.

2. Periodic convolution models & direct deconvolution methods.

   Reference code: demo scripts and functions under image_blurring_deblurring, see in particular demo_deconv_direct_circulant.

   (a) Observe and explain (in < 60 words) the difference in deconvolution with or without conditioning when the convolution/blurring system is ill-conditioned.
   (b) Find and list the advantages and application conditions (limitations) of the deconvolution via FFT diagonalization.
   (c) optional. Provide a function, and demonstrate its use, for computing the Kullback-Leibler (KL) divergence between two images of the same size. Hint: see the histograms generated by the demo codes.


   Reference code: demo scripts and functions under image_blurring_deblurring, see in particular demo_iterative_deblurring

   (a) Calculate the diagonal dominance for the convolution kernel in each demo case;
   (b) Estimate the decay rate of the Jacobi iteration for each demo case by the difference between the iterates.