Advanced Image Processing Lab.

Lab. 8 - Target Location and Object Detection: Localization Accuracy and Reliability. Image Registration

Study of accuracy and reliability of detection and localization of objects in images, of methods for image registration and of methods for detecting small targets and filtering impulse noise.

8.1 Target localization in white noise

Generate two test target images of the same energy: sharp and smooth ones. Generate test image with targets on uniform background. Write a program that adds to the test image a Gaussian noise of different variance, implements matched filters for each target, measures localization error and can be run repeatedly to measure RMS of the localization error over a set of experiments and to compute localization error histogram. Perform statistical experiment to compute distribution histogram of the localization error and to determine how RMS of the localization error depends on the SNR. Observe and explain the threshold effect in the localization reliability. Compare localization error for the two test target images.

8.2 Target localization in correlated noise

Repeat the same for correlated Gaussian noise of the same intensity. For target localization, modify appropriately matched filter to implement optimal filter. For generating correlated Gaussian noise, use results of the Lab. 6. Compare RMS of the localization error with corresponding results for white noise of the same intensity.

8.3 Image registration

Write a program for alignment, using matched filtering, images arbitrarily displaced in both co-ordinates. Use for experiments video frames or stereo images.

8.4 Detection and localization of very small objects and filtering impulse noise

8.4.1. Test detection of microcalcifications in mammograms using program **smobjdet.m** (image **mam2_256.img**). Explain the role of the low pass filter implemented in the program.

8.4.2. Generate an image corrupted by a impulse noise with probability of error 0.1 - 0.4 (images **jerus** and **text256** may be recommended). Test iterative and recursive filtering impulse noise algorithms (program **filtrimp.m**, **filtim_r.m**) for different probabilities of error and filter parameters. Observe residual noise and image distortions. Explain the role of the low pass filter implemented in the programs. Compare noise filtering parameters for different filters (program **certfimp.m**).

Submit: Experimental results, with comments, and programs