Advanced Image Processing Lab.

Lab. 7 - Image Resampling and Geometrical Transforms

Study of signal and image interpolation techniques and their applications to image geometrical transforms.

7.1. Nearest neighbour, linear, spline and discrete sinc-interpolation methods

7.1.1. Form test signals (delta-impulse, rectangular impulse and "Mexican hat impulse") and zoom them in using nearest neighbor, bilinear, bicubic interpolation (program **resize.m**). discrete sinc-interpolation (programs **sincint.m**, **sincint0.m**, **sincint1.m)**. Observe, compare interpolated signals and their spectra. Explain Gibbs's effects in discrtete sinc-interpolation. Explain difference between programs **sincint.m**, **sincint0.m**, **sincint1.m.**
7.1.2. Repeat the same for an image raw and an ECG signal (signals **ecg1.mat**, **ecg256.mat** can be used as test signals).

7.2. Image zoom

7.2.1. Compare image fragment zooming with zero-order, bilinear, and cubic (program **resize.m**) and discrete sinc- interpolation (program **interp2d.m**) methods. Compare and analyze Fourier spectra of zoomed images
7.2.2Test local image zoom using program **loczoom.m**. Observe and explain artefacts due to the boundary effects. Optional: suggest and implement a method to reduce them.

7.3. Image rotation

7.3.1Form a test image: a square inscribed into an empty frame of 256x256 pixels. Rotate the test image observe and explain aliasing effects in the process of successive rotations through angle 360°/n, n=3,4. Make the same experiment with images from the test set.
7.3.2. Test image rotation by the 3-pass algorithm and sinc-interpolation (program **myrotate.m**). Perform several successive rotations through angle 360°/**n**, ***n***=3,4,…. Compute and display error between the initial image and that rotated successively through 360° and Fourier spectra of rotation errors.

7.4. Image geometric transformations with the use of a "continuous" image model

7.4.1. Select a test image and plot image profile along an arbitrary direction with program **profile.m** using different interpolation degree. Observe interpolation effects.
7.4.2. Perform image local zoom using program **loc_zoom.m**. Compare the result with the above results obtained with program **loczoom.m**. Perform image rotation with program **rotate_s.m**. Compare results with the above results obtained with program **myrotate.m**
7.4.3. Image transformation from Cartesian to polar coordinate system with program **cart_pol.m**.
7.4.4. Write a program for arbitrary image mapping from one coordinate system to another through "continuous image model" (use image zooming programs)

Submit: obtained results, with comments, and the program.