

FrameLab

Software for framelet-based numerical analysis

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Goals The idea of this project is to develop a complete software suite for computational imaging via framelets. The code will be sorted into the following general categories:

1. Framelet expansion code

- Fast single and multilevel decomposition and reconstruction for 1D through 3D
- Signal sparsity analysis, best basis selection?
- Computing framelet coefficients

2. Numerical optimization code

- l_1 compressed sensing via ADMM/AL/DAL
- Comparison of different algorithms?
- l_0 code

3. Utilities

- Graphics and figure creation
- Shrinkage designer
- PDEs for image processing
- Forward/adjoint operators for imaging
- Classical signal processing

4. Applications

- CT
- MRI
- SPECT
- Segmentation

- Registration?
- Deblurring
- Deconvolution
- Integral equations?
- Matrix factorization?
- Matrix completion
- BM3D

1 Implementation Details

Programming languages and interfaces To do:

- GPU interface to python? pycuda? (e.g. python alternative to mex)

Data Types

2 Framelet Expansions

The first task to create/modify functions to perform framelet decomposition and reconstruction

3 Optimization Methods

4 Imaging Systems

4.1 2D Computed Tomography

4.2 3D Computed Tomography