Dictionary Learning for MRI denoising and Accelerated MRI Reconstruction

Bachelor’s Thesis

Figure 1: The atoms of a $49 \times 49$ dictionary are shown as $7 \times 7$ patches. Taken from [1].

**Objective:**
The aim of dictionary learning is to find a compact, sparse representation of basic elements (dictionaries) to represent the given input data. In this thesis, you will develop a dictionary learning method of the form

$$
\frac{1}{2} \left\| A \sum_{i=1}^{N} c_i * k_i - f \right\|_2^2 + \lambda \sum_{i=1}^{N} \| c_i \|_1
$$

where $f$ defines the input data, $A$ is the forward operator implemented for a specific task, $c_i$ are sparse representations of the input image and $k_i$ are convolution kernels (dictionary elements). The goal of this thesis is to apply this method to MRI denoising and accelerated MRI reconstruction.

**Qualifications:**
- Student of Biomedical Engineering, Information and Computer Engineering, Computer Science, Software Engineering and Management
- Basic knowledge in optimization
- Programming skills in Matlab or Python, optional: C/C++

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