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Tomographic Image Reconstruction via Tensor-Based Dictionary Learning

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In this talk, we will consider reconstruction of Xray CT images using priors in the form of a dictionary learned from training images. The reconstruction process has two stages: a) construction of a tensor dictionary prior from our training data; b) solution of the reconstruction problem by optimizing for the expansion tube fiber coefficients in that dictionary. Our approach differs from past approaches in that i) we use a third-order tensor representation for our images and ii) we recast the reconstruction problem using the tensor formulation. The dictionary learning problem is presented as a non-negative tensor factorization problem with sparsity constraints. The reconstruction problem is formulated in a convex optimization framework by looking for a solution with a sparse representation in the tensor dictionary. Numerical results show that our tensor formulation leads to very sparse representations of both the training images and the reconstructions due to the ability of representing repeated features compactly in the dictionary.