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Sparse Solving

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Imaging applications like high dynamic range compression or stitching can be done efficiently in the gradient space. While the transformation to gradient space is fast, the transformation back requires to solve a Poisson equation in order to reconstruct the resulting image. Our applied multigrid method for this purpose is based on sparse coding, where we assume that the solution of the linear system can be respresented by sparse approximation with a given dictionary consisting of small image patches. One is then able to apply the linear operator to the dictionary and use the resulting dictionary to represent the right-hand-side of the linear system sparsely. In this way no explicit solving of linear system is required. We embed the sparse approximation instead of a smoother in a multigrid method and show that the typical multigrid convergence rates can be obtained. In addition to that one does not have to store the full solution but only its sparse approximation.