REGULARIZATION BY MEANS OF DENOISING IN IMAGING

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Solving modern machine learning tasks requires the development of new methods of solving corresponding inverse problems. The majority of real-world inverse problems are ill-posed and therefore require regularization. For some digital signal processing tasks, such as image de-noising, image restoration, super-resolution, image improvement, the choice of regularization technique is nontrivial, whereas significantly influences the corresponding solution.

In our work we consider a framework for inversion of image transforms. For inverse problem $Ax = y$ we consider Bayesian approach, or maximum a posteriori probability (MAP) estimate, which finds such an x, that maximises the conditional probability $p(x|y)$. According to Bayes rule, it corresponds to maximizing the $p(y|x)p(x)$, or equivalently to minimizing over x the expression $(-\log p(y|x) - \log p(x))$, where first term is usually approximated by loss function, and second one is called regularization term.

In [1] for some given denoiser $D(x, \sigma)$ the Regularization by Denoising via Fixed-Point Projection (RED-PRO) framework applies the regularization $\rho(x) = \alpha x^T [x - D(x, \sigma)]$. It has been shown [1], that Plug-and-Play Prior (PnP) proximal gradient method considered in [2] is a special case of RED-PRO, the convergence of both frameworks to globally optimal solutions has been proven.

References

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