AMYPAD
Amyloid imaging to prevent Alzheimer´s Disease

Faster PET reconstruction with a stochastic primal-dual hybrid gradient method

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Abstract:
Image reconstruction in positron emission tomography (PET) is computationally challenging due to Poisson noise, constraints and potentially non-smooth priors-let alone the sheer size of the problem. An algorithm that can cope well with the first three of the aforementioned challenges is the primal-dual hybrid gradient algorithm (PDHG) studied by Chambolle and Pock in 2011. However, PDHG updates all variables in parallel and is therefore computationally demanding on the large problem sizes encountered with modern PET scanners where the number of dual variables easily exceeds 100 million. In this work, we numerically study the usage of SPDHG-a stochastic extension of PDHG-but is still guaranteed to converge to a solution of the deterministic optimization problem with similar rates as PDHG. Numerical results on a clinical data set show that by introducing randomization into PDHG, similar results as the deterministic algorithm can be achieved using only around 10 % of operator evaluations. Thus, making significant progress towards the feasibility of sophisticated mathematical models in a clinical setting.

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