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End-to-End Pyramid Based Method for Magnetic Resonance Imaging Reconstruction

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Abstract : Magnetic Resonance Imaging (MRI) is a lengthy medical scan that stems from a long acquisition time. Its length is mainly due to the traditional sampling theorem, which defines a lower boundary for sampling. However, it is still possible to accelerate the scan by using a different approach such as Compress Sensing (CS) or Parallel Imaging (PI). These two complementary methods can be combined to achieve a faster scan with high-fidelity imaging. To achieve that, two conditions must be satisfied: i) the signal must be sparse under a known transform domain, and ii) the sampling method must be incoherent. In addition, a nonlinear reconstruction algorithm must be applied to recover the signal. While the rapid advances in Deep Learning (DL) have had tremendous successes in various computer vision tasks, the field of MRI reconstruction is still in its early stages. In this paper, we present an end-to-end method for MRI reconstruction from k-space to image. Our method contains two parts. The first is sensitivity map estimation (SME), which is a small yet effective network that can easily be extended to a variable number of coils. The second is reconstruction, which is a top-down architecture with lateral connections developed for building high-level refinement at all scales. Our method holds the state-of-art fastMRI benchmark, which is the largest, most diverse benchmark for MRI reconstruction.

Keywords : magnetic resonance imaging, image reconstruction, pyramid network, deep learning
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