Deep Learning Techniques for Inverse Problems in Imaging

Deep learning is transforming the solution of inverse problems in imaging, such as denoising, deblurring, and medical image reconstruction. This paper provides a systematic overview and taxonomy of these methods, organized along two key dimensions: the knowledge and use of the forward measurement model, and the supervision level. We review techniques including supervised end-to-end networks, unrolled optimization, plug-and-play priors, and deep generative models. The paper analyzes critical trade-offs in sample complexity, generality, speed, discusses common failure modes and limitations, and outlines open challenges like model quantification, and nonlinear problem solving.

Keyword: Inverse Problems, Deep Learning, Generative Models, GAN, Plug-and-Play Priors

LOST_Low_rank_and_Sparse_Pre_training_for_Large_Language_Models

Large language models achieve impressive performance but require massive computational and memory resources for pre-training. While low-rank parameterization and sparsity have been explored to reduce costs, existing methods often combine these components in a suboptimal way, leading to performance degradation compared to full-rank training. This paper introduces LOST, a novel method that effectively integrates low-rank and sparse structures for efficient LLM pre-training from scratch. LOST employs SVD to initialize a low-rank component that captures the dominant subspace of the weights, while a complementary, component preserves critical information from the residual subspace. Extensive experiments on LLaMA models from 60M to 7B parameters demonstrate that LOST achieves competitive or superior performance to full-rank baselines and state-of-the-art efficient methods, while significantly reducing memory and computational overhead. The approach also generalizes well to fine-tuning tasks, validating its effectiveness and broad applicability.

Keyword: Large Language Models (LLM), Efficient Pre-training, Low-Rank Adaptation (LoRA), Structured Sparsity, Channel-wise Sparsity, Singular Value Decomposition (SVD), Memory-Efficient Optimization