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Generic Compression Ratio Adapter for End-to-End Data-Driven Image Compressive Sensing Reconstruction (EDCSR) Frameworks

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Background

Compressive sensing (CS) is a transformative sampling technique that allows sparse signals to be sampled in compressed form at a rate much lower than the Nyquist rate. In particular, end-to-end data-driven image compressive sensing reconstruction (EDCSR) frameworks achieve state-of-the-art reconstruction performance in terms of speed and accuracy. However, a major limitation of the existing EDCSR frameworks is that they can only perform reconstruction at fixed compression ratios (CRs) once deployed. For applications that desire a variable CR—which can enable adaptive usage of power, storage, and bandwidth—existing EDCSR frameworks must be trained from scratch at each CR, which is computationally costly and time-consuming.

Invention Description

Researchers at Arizona State University have developed a generic compression ratio adapter (CRA) framework that addresses the variable CR problem for EDCSR frameworks without requiring reconstruction model modification and excessive training. CRA exploits an initial reconstruction network to generate an initial estimate of reconstruction results based on a small portion of the acquired measurements. Subsequently, full measurements are approximated for the main reconstruction network by complementing the sensed measurements with the resensed initial estimate. Experiments on two public image datasets demonstrate that CRA provides an average of 13.02 dB and 5.38 dB PSNR improvement across CRs ranging from 5 to 30 over a naive zero-padding approach and the AdaptiveNN approach (a prior work), respectively.

Potential Applications

- Resource-constrained compressive sensing
- Internet-of-Things (IoT) devices

Benefits and Advantages

- Enables EDCSR frameworks to accommodate variable compression ratios

without the need for network model modification or extensive training

- Generic design allows versatile application for all EDCSR frameworks

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