

Compressed Sensing Spatial Light Modulator



AI Overview

Compressed sensing (CS) with spatial light modulators (SLMs) enables efficient optical signal acquisition and image reconstruction using fewer measurements than traditional methods. Overview Compressed sensing is a signal processing technique that exploits the sparsity of a signal to reconstruct it from fewer measurements than conventional Nyquist sampling requires. When combined with a spatial light modulator, CS can be applied in optical systems to encode spatial or spectral information onto a single-pixel detector or a photonic link, significantly reducing hardware complexity and acquisition time. Single-Pixel Imaging In single-pixel imaging, a spatial light modulator applies a series of masks (e.g., Hadamard or pseudorandom patterns) to the incoming light from a scene. A single-pixel detector measures the total transmitted or reflected light for each mask. By applying compressed sensing reconstruction algorithms, the full image can be recovered from far fewer measurements than the number of pixels in the scene. This approach is particularly useful in spectral regions where detector arrays are expensive or unavailable, and it enables applications such as depth-resolved imaging, microscopy, and Raman imaging. Optical Mixing in Photonic Links SLMs can also be used as optical mixers in photonic compressed sensing systems. Here, a sparse input signal is modulated onto a chirped optical pulse, and a pseudorandom sequence is encoded on the SLM. The optical mixing occurs in the frequency domain via frequency-to-time mapping, allowing wideband sparse signals to be acquired efficiently. The length of the pseudorandom sequence and the far-field approximation are critical factors affecting signal recovery performance. Advantages and Applications Reduced measurements: CS allows high-quality reconstruction with fewer measurements, sa...

Article Content

Analysis of compressive sensing with optical mixing using a spatial ...

Compressive sensing (CS) in a photonic link has a high potential for acquisition of wideband sparse signals. In CS it is necessary to mix the input sparse signal with a pseudorandom sequence prior to

Spatio-temporal coherent snapshot compressed imaging with time

- A compact optical imaging system of coherent snapshot compressed sensing is designed using spatial light modulator phase only.
- We demonstrate the feasibility and robustness of

Compressed sensing in the far-field of the spatial light modulator in ...

Compressed sensing in the far-field of the spatial light modulator in high noise conditions Akhil Kallepalli 1,*, John Innes2, and Miles J. Padgett1

Single-pixel imaging and compressed sensing in the far-field of the ...

Compressed sensing in the far-field of the spatial light modulator in high noise conditions Kallepalli, A., Innes, J. & Padgett, M. J., 31 Dec 2021, In: Scientific Reports.11, 8 p., 17460.

Terahertz compressive imaging with metamaterial spatial light ...

Active metamaterials have been used to realize terahertz imaging with a single-pixel detector. Compressive techniques permit high-fidelity images to be acquired at high frame rates. The

Compressed sensing for rapid IR imaging

This paper proposes a novel spinning disk approach, aiming to achieve video rate compressive imaging at infrared (IR) and terahertz (THz) frequencies. This novel disk uses a 20-cm

[2409.06577] Compressed Sensing based Detection Schemes for ...

Differential spatial modulation (DSM) exploits the time dimension to facilitate the differential modulation, which can perfectly avoid the challenge in acquiring of heavily entangled

Single Pixel Imaging and Compressive Sensing: A Practical Tutorial

Single Pixel Imaging is an emerging imaging technique that employs a bucket detector (photodiode) to sample a spatially modulated light field, rather than measuring the spatial distribution

Compressed sensing in the far-eld of the spatial light modulator in ...

In the first approach, the object can be flood (uniformly) illuminated and the backscattered light is imaged onto the plane of the spatial light modulator where the mask is applied.

Compressed sensing in the far-field of the spatial light modulator in ...

The output of the HeNe laser encounters a polarising beamsplitter that propagates the vertically polarised, reflected light in the direction of the spatial light modulator (SLM).

High-dimensional one-shot optical field compressive sensing of

Here we have proved the concept of high-dimensional one-shot optical field compressive sensing, resolving full-dimensional information of any light field.

Compressed Sensing based Detection Schemes for Differential Spatial ...

Compressed Sensing based Detection Schemes for Differential Spatial Modulation in Visible Light Communication Systems Zichun Shi*, Pu Miao*, Peng Chen‡, Lei Xue*, Li-Yang Zheng♠, Laiyuan

Compressed sensing in the far-field of the spatial light modulator in ...

Further, we successfully illustrate an implementation of compressed sensing for image reconstruction in conditions of high noise. In combination, this robust technique could be applied to any spectral region

Compressive single-pixel spectral imaging with spatial-spectral ...

By formulating the modulation of the single-pixel spectral imaging system and the sensing coherence in the differentiable matrix notation, the gradients of the modulation and the

Principles and prospects for single-pixel imaging

Camera architecture The single-pixel camera consists of two main components: the spatial light modulator (SLM) and the single-pixel detector.

Compressed sensing in the far-eld of the spatial light modulator in ...

In low SNR conditions (C, D), compressed sensing shows a better reconstruction up until 3000-4000 patterns. However, the overall image quality does reduce as a function of SNR.

Compressed sensing in the far-field of the spatial light modulator in ...

Here, we show how a phased-array modulator source can be used to create Hadamard intensity patterns in the far-field, thereby enabling single-pixel imaging. Further, we successfully illustrate an...

Compressed Sensing Spatial Light Modulator

Liquid crystal metasurface based spatial light modulator is developed for terahertz dual-color compressive imaging. Significant improvement of imaging quality and speed is demonstrated Read

Compressed sensing in the far-field of the spatial light modulator in ...

Therefore, this paper reviews the concept of compressive sensing SPI and summarizes the main measurement matrices and reconstruction algorithms in compressive sensing.

Dual-color terahertz spatial light modulator for single-pixel imaging

Liquid crystal metasurface based spatial light modulator is developed for terahertz dual-color compressive imaging. Significant improvement of imaging quality and speed is demonstrated

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