# SPUD: simultaneous phase unwrapping and denoising algorithm for phase imaging

## Abstract

Recent methods for phase unwrapping in the presence of noise include denoising algorithms to filter out noise as a preprocessing stage. However, including a denoising stage increases the overall computational complexity resulting in long execution times. In this paper, we present a noniterative simultaneous phase unwrapping and denoising algorithm for phase imaging, referred to as SPUD. The proposed method relies on the least squares discrete cosine transform (DCT) solution for phase unwrapping with an additional sparsity constraint on the DCT coefficients of the unwrapped solution. Simulation results with different levels of noise and wrapped phase fringe density reveal the suitability of the proposed method for accurate phase unwrapping and restoration. When compared to the 2D windowed Fourier transform filter, SPUD performs better in terms of phase error and execution times. The processing of experimental data from synthetic aperture radar showed the capability for processing real images, including removing phase dislocations. An implementation of the proposed algorithm can be accessed and executed through a Code Ocean compute capsule.