

# **Image Denoising with Unsupervised, Information-Theoretic, Adaptive Filtering**

*Suyash P. Awate and Ross T. Whitaker*

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School of Computing  
University of Utah  
Salt Lake City, UT 84112 USA

## ***Abstract***

The problem of denoising images is one of the most important and widely studied problems in image processing and computer vision. Various image filtering strategies based on linear systems, statistics, information theory, and variational calculus, have been effective, but invariably make strong assumptions about the properties of the signal and/or noise. Therefore, they lack the generality to be easily applied to new applications or diverse image collections. This paper describes a novel unsupervised, information-theoretic, adaptive filter (UINTA) that improves the predictability of pixel intensities from their neighborhoods by decreasing the joint entropy between them. In this way UINTA automatically discovers the statistical properties of the signal and can thereby reduce noise in a wide spectrum of images and applications. The paper describes the formulation required to minimize the joint entropy measure, presents several important practical considerations in estimating image-region statistics, and then presents a series of results and comparisons on both real and synthetic data.