

## Multispectral Image Denoising With Optimized Vector Bilateral Filter

### Abstract:

Vector bilateral filtering has been shown to provide good tradeoff between noise removal and edge degradation when applied to multispectral/hyperspectral **image** denoising. It has also been demonstrated to provide dynamic range enhancement of bands that have impaired signal to noise ratios (SNRs). Typical vector bilateral filtering described in the literature does not use parameters satisfying optimality criteria. We introduce an approach for selection of the parameters of a vector bilateral filter through an optimization procedure rather than by ad hoc means. The approach is based on posing the filtering problem as one of nonlinear estimation and minimization of the Stein's unbiased risk estimate of this nonlinear estimator. Along the way, we provide a plausibility argument through an analytical example as to why vector bilateral filtering outperforms band-wise 2D bilateral filtering in enhancing SNR. Experimental results show that the optimized vector bilateral filter provides improved denoising performance on multispectral **images** when compared with several other approaches.