

## Higher-Order Total Directional Variation

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In this talk we discuss a new higher-order and anisotropic total variation model for image processing. This new model combines higher-order total variation regularisation with possibly inhomogeneous, smooth elliptic anisotropies.

We prove some properties of this total variation model and of the associated spaces of tensors with finite variations. We show the existence of solutions to a related regularity-fidelity optimization problem and prove a decomposition formula which we will use to develop a primal-dual hybrid gradient approach for its numerical approximation.

This choice of total variation regularisation allows to preserve and enhance intrinsic anisotropic features in images. We illustrate this on various examples from different imaging applications: image denoising, wavelet-based image zooming, and reconstruction of surfaces from scattered height measurements.

This talk is based on the two papers:

Parisotto, Simone; Lellmann, Jan; Masnou, Simon; Schönlieb, Carola-Bibiane: Higher-order total directional variation: Imaging Applications. In: SIAM Journal on Imaging Sciences, 13 (4), pp. 2063-2104, 2020.

Parisotto, Simone; Masnou, Simon; Schönlieb, Carola-Bibiane: Higher-order Total Directional Variation: Analysis. In: SIAM Journal on Imaging Sciences, 13 (1), pp. 474-496, 2020.