Infimal Convolution Regularization

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The staircasing effect of the Rudin, Osher and Fatemi model for denoising images can be reduced by incorporating higher-order derivatives into the functional. One successful approach in this direction was proposed by Chambolle and Lions who suggested to use the infimal convolution of functionals with first and second-order derivatives as regularizer.

In our talk we introduce general modifications of infimal convolution regularizers in $\mathbb{R}^n$. Then we consider special settings with difference matrices. While our modifications in 1D turn out to coincide with the classical infimal convolution approach, they differ in 2D and improve the denoising results significantly. Recently, the modified infimal convolution with difference matrices was given a theoretical basis (in the continuous setting) by Bredies et al. based on tensor algebra. We generalize our results to tensor-valued images appearing, e.g., in diffusion tensor magnetic resonance imaging. Finally, we present an operator-based regularization for tensor-valued images.