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Mathematical morphology based on max-min sampling operators

In this seminar talk, we investigate a conceptual bridge between mathematical morphology and max-min sampling operators to obtain a unified perspective on continuous morphological transformations and their discrete approximations. To this end, we introduce and analyze nonlinear sampling operators based on the maximum and minimum operations of the max-min algebra. These pseudo-linear operators combine function values on a given sampling grid with a suitable kernel, which determines how neighboring samples contribute to the function approximation. We investigate the approximation properties of these operators and their convergence behavior, with particular attention to the interplay between sampling resolution, the choice of the kernel, and the regularity of the function. In this framework, we also study the associated dilation, erosion, opening, and closing operations and discuss how their characteristic morphological properties are related to the construction of the sampling operator. Finally, in the two-dimensional setting, we illustrate several applications of these operators to image processing, including upscaling, denoising, and segmentation of images.



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