Stochastic Distance Transform

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Abstract

he distance transform (DT) and its many variations are ubiquitous tools for image processing and analysis. In many imaging scenarios, the images of interest are corrupted by noise. This has a strong negative impact on the accuracy of the DT, which is highly sensitive to spurious noise points. In this study, we consider images represented as discrete random sets and observe statistics of DT computed on such representations. We, thus, define a stochastic distance transform (SDT), which has an adjustable robustness to noise. Both a stochastic Monte Carlo method and a deterministic method for computing the SDT are
proposed and compared. Through a series of empirical tests, we demonstrate that the SDT is effective not only in improving the accuracy of the computed distances in the presence of noise, but also in improving the performance of template matching and watershed segmentation of partially overlapping objects, which are examples of typical applications where DTs are utilized.

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