From Minskowski to the Euclidean Distance Transform

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In this work, the relationships between Mathematical Morphology based on Minkowski'set addition, and the distance transform are presented. First, the complexity reduction for Morphological operations by means of the distance transform is presented. For this, fast distance transform for discrete neighborhood–regular metric spaces in used to reduce the complexity of morphological operators for a family of structural elements from quadratic order to constant order. Second, the complexity reduction for the computation of the distance transform for some non regular countable metric (in particular the Euclidean metric) spaces by the use of Minkowski's subtraction is presented. In this case, the distance transform is redefined by means of Morphological erosions or dilations, reducing the complexity of the distance transform from quadratic order to linear order, whenever the structural element for the erosion operator is decomposable. Finally, some applications to mobile robotics of these results are presented. These applications include navigation and path planning optimization for auto guided vechicles in presence of obstacles.