Distance transform based on weight sequences

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Abstract

There is a continuous effort to develop the theory and methods for computing digital distance functions, and to lower the rotational dependency of distance functions. Working on the digital space, e.g., on the square grid, digital distance functions are defined by minimal cost-paths, which can be processed (back-tracked etc.) without any errors or approximations. Recently, digital distance functions defined by weight sequences, which is a concept allowing multiple types of weighted steps combined with neighborhood sequences, were developed. With appropriate weight sequences, the distance between points on the perimeter of a square and the center of the square (i.e., for squares of a given size the weight sequence can be easily computed) are exactly the Euclidean distance for these distances based on weight sequences. However, distances based on weight sequences may not fulfill the triangular inequality. In this paper, continuing the research, we provide a sufficient condition for weight sequences to provide metric distance. Further, we present an algorithm to compute the distance transform based on these distances. Optimization results are also shown for the approximation of the Euclidean distance inside the given square.

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