Single scan granulometry estimation from an asymmetric distance map

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Abstract

Granulometry, by characterizing the distribution of object sizes, is a powerful tool for the analysis of binary images. It may, for
example, extract pertinent features in the context of texture classification. The granulometry is similar to a sieving process that filters image details of increasing sizes. Its computation classically relies on morphological openings, i.e. the sequence of an erosion followed by a dilation for each ball radius. It is well known that a distance map can be described as an "erosion
transform" that summarizes the erosions with the balls of all radii. Using a Steiner formula, we show how a vector of parameters measured on an eroded contour can be extrapolated to the measures of the dilation. Instead of completing the openings from the distance map by computing a dilation for each ball size, we can estimate their cardinality from the
area, perimeter and Euler-Poincaré characteristic of each erosion. We extract these measures for all radii at once from an asymmetric distance map. The result is a fast streaming algorithm that provides an estimate of the granulometry distribution, in a single scan of the image and with very limited memory footprint.

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