Image Region Correspondence Based on Structural Similarity and Color Information

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We propose a region matching approach for solving the image correspondence problem. Regional features contain advantages over point or line features. First, regions are more robust than edges because noise tends to perturb a measurement taken over a region less than one taken over its boundaries. Second, the matching ambiguity problem should be less severe with regions, because they give rise to a richer variety of attributes than points, edges or line segments. Those attributes are size, boundary, moment, adjacency, color information, etc. Third, occlusions have a more radical effect on points and lines than on two-dimensional primitives and should thus be less detrimental to the matching performance of a region-based matching algorithm. Finally, image description in terms of regions implicitly contains region adjacency information, which can be captured in a graph representation and constitutes a powerful tool for matching and disambiguation.

In this thesis, a new region matching method based on structural similarity and color information, is presented. The stability (invariance to variations in view) of the matching primitive — the use of homogeneous regions, is emphasised. First, a region surrounding consistency is defined, based on color similarities, to drive a hierarchical region matching strategy by insuring the region relational consistency. The color information contained in an image pair is then investigated, and we implement a region-based matching algorithm through color significance selection and adjacency propagation, with explicit use of color information and structural similarity for color image correspondence. Also, a region adjacency graph description and matching approach is formulated and used to solve region matching with inconsistencies. This is done by constructing a state space based on maximum weight bipartite matching and finding the optimal matching in this state space. Several experimental results demonstrate that the approach is useful in color scene analysis.