一种面向图像拼接的改进 PCA-SIFT 算法

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摘要： 针对图像拼接中尺度不变特征变换(SIFT)算法没有充分考虑特征点的分布情况且计算复杂、耗时较长等问题，提出了一种基于改进的 PCA-SIFT 算法.该算法首先在空间极值点检测阶段引入改进的非极大值抑制法对初始特征点进行优选，得到分布更加均匀的特征点集；然后在构建描述符阶段基于圆形领域提取 64 维 SIFT 描述符，并使用主成分分析(PCA)法对描述符进一步降维，减少描述符的数据复杂度；最后在特征匹配阶段引入基于 K-D 树的 BBF 搜索策略，采用随机抽样一致性(RANSAC)算法剔除误匹配点，从而提高了匹配速度与匹配精度.在 10 组图像拼接实验中，本文算法的拼接速度是传统 SIFT 算法的 1.6~2.2 倍.实验结果表明，本文算法具有较高的精度、较好的鲁棒性，较强的实时性.

关键词： 图像拼接; 尺度不变特征变换；非极大值抑制；主成分分析；随机抽样一致性

An Improved PCA-SIFT Algorithm for Image Mosaics

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Abstract： Aiming at the problem that the SIFT algorithm does not fully consider the distribution of feature points in the image splicing and the calculation is complex and takes a long time， an improved PCA-SIFT algorithm is proposed. The algorithm firstly introduces an improved non-maximum suppression method to optimize the initial feature points so as to obtain a more even distribution of feature point sets. Then the 64-dimension SIFT descriptor is extracted based on the circular neighborhood，and the descriptor is further reduced using PCA to reduce the data complexity of the descriptor. Finally， the BBF search strategy based on K-D tree was introduced. The RANSAC was used to eliminate the false matching points， which improved the matching speed and matching accuracy. In the 10 sets of image stitching experiments， the stitching speed of this algorithm is 1.6~2.2 times that of the traditional SIFT algorithm. Experimental results show that the proposed algorithm has higher accuracy， better robustness，and stronger real-time performance.

Key words： image mosaic; seale invariant feature transform (SIFT); non-maximal inhibition; principal component analysis (PCA); random sample consensus (RANSAC)

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