

基于几何不变量的形状上下文星图配准

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Star image matching by using geometric invariants

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摘要

针对多画面天文星图的刚性配准,提出一种基于几何不变量的形状上下文配准算法。该算法首先对天文星图进行降噪预处理,并利用阈值分割与形态学算法提取天文星图中的星点及其质心坐标;然后利用星点质心间的几何不变量关系,对每个星点建立基于几何不变量的特征描述向量并由此构建了评价不同维数向量之间相似度的代价函数,以判断两个特征点之间特征描述向量的相似程度,从而得到两幅图像间的匹配星点对集合;最后,利用随机一致性鲁棒算法去除误匹配星点对,并计算得到空间变换配准参数。实验结果表明,该方法可对特征点数目、画面亮度等差异较大的两幅星图实现亚像素级精度的有效配准,性能及鲁棒性均好于传统配准方法。对于大小为 4608×3072 ,曝光时间与ISO各不相同的两组实际拍摄图像,本文方法的配准精度在0.5 pixel左右,能够成功完成配准任务。

关键词 : 天文星图, 星图配准, 几何不变量, 形状上下文

Abstract :

To match rigidly star images with multi-screens, a shape context based registration method by using geometric invariants was proposed. First, denoise methods, segmented method and morphology method were applied to star images to extract star points, so that centroid of star points could be calculated. Then, feature descriptors for every star point were calculated based on geometric invariants among all stars. Each descriptor was used to represent the relationship between this star and others. A price function to evaluate the similarity between star points was constructed to get a star match pair set between the two images. Finally, random sample consensus robust method was used to remove wrong star match pairs and calculate registration parameters for the space transform. Experimental results demonstrate that proposed method can successfully match the image with different number of feature points and different brightnesses in a sub-pixel level. For two group images with the size of 4608×3072 and different ISOs, the proposed method can offer the registration accuracy near 0.5 pixel, which meets the requirements of the registration.

Key words : astronomical image star image matching geometric invariant shape-context

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