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信息科学

基于不变特征描述符实现星点匹配

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摘要： 为了能够在星图存在旋转角度情况下,自动快速地完成星图匹配,提出了一种基于不变特征描述符的旋转不变匹配方法,将加速鲁棒特征(SURF)描述符应用于星点特征的描述和匹配。首先,对星图进行图像分割,抑制非极大值,并检测星点;然后,为计算星点分布尺度因子s,在半径为6s的圆形邻域内为每个星点计算主方向,之后将20s×20s的邻域与主方向对准,并在该邻域内为每个星点计算SURF描述符。最后,基于透视投影模型的匹配策略,提纯星点,计算匹配星图之间的变换矩阵。实验结果显示,该方法能够鲁棒地提取星点,并在图像存在旋转、平移及部分视角变化的情况下完成星图匹配,仿真实验的匹配星点的误差均在1 pixel以下,实拍星图实验的匹配星点的误差均在1.5 pixel以下,表明为每个星点建立描述符,进行匹配识别的思路是可行的。

关键词： 星点检测 星点匹配 加速鲁棒特征描述符 尺度不变特征变换描述符

Star matching based on invariant feature descriptor

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Abstract: To match automatically rotated stellar images, a rotation invariant matching method based on invariant feature descriptors was proposed, in which the Speeded Up Robust Features (SURF) was used to describe and match star features for the first time. First, a stellar image was segmented, and the non-maxima value was suppressed to extract star points in the stellar image. Then, a star distribution scale factor was calculated, the dominant orientation was obtained in a circle region with a radius of 6*s*, and the 20*s*×20*s* local region was rotated to the dominant orientation. In the local region, the SURF descriptor was calculated for each star. Finally, an automatic matching strategy based on the difference between dominant orientations was proposed. By this method, the threshold was calculated automatically and the transform matrix was given. Experimental results demonstrate that the proposed method can robustly detect star features and achieve a high precision stellar image matching between images with rotation, translation and perspective change. Obtained results show that correspondent star errors is below 1 pixel and 1.5 pixel for simulation and real image experiments, respectively. It indicates that the method to apply SURF descriptor to star matching and recognition is feasible.

Keywords: star extraction star matching Speed-up Robust Feature(SURF) descriptor Scale Invariable Feature Transformation(SIFT) descriptor

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