

高斯牛顿法图像配准的工件精确识别

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Accurate recognition of work-pieces based on Gauss-Newton image registration

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摘要

为提高机器视觉系统对工件的识别精度,提出在工件图像匹配时加入高斯牛顿图像配准算法,以使工件的识别精度达到亚像素级。首先,构建模板和目标之间的刚体变换模型,建立模板图像和目标图像的相似度残差项,利用Sobel算子对待检测图像的x方向和y方向分别进行卷积运算得到待检测图像的差分图;然后,利用该差分图计算待检测图像的雅可比矩阵,应用双线性插值法计算模板进行刚性变化后的变换矩阵;最后,运用高斯牛顿法寻找使变换矩阵和目标区域相似度残差项达到极小值点的亚像素目标位置,从而使工件目标的识别精度达到亚像素级。实验结果表明,该方法对工件的识别精度为0.1 pixel,角度均差为0.05°,满足了高精度识别工件的要求。

关键词 : 机器视觉, 图像配准, 高斯牛顿法, 工件, 精确识别

Abstract :

To improve the recognition accuracy of a machine vision system for work-pieces, the Gauss-Newton algorithm was employed to the intelligent robot's machine vision and the vision's recognition accuracy was improved by sub pixel. Firstly, a rigid transformation model between template and target was built and the residual similarity between template and target image was established. Then Sobel algorithm was used for folded operation of the images detected in the x direction and the y direction to get the directional diagram of the images. The Jacobian matrix of the images to be detected was calculated using this directional diagram, as long as the transformation matrix was calculated using BI-linear interpolation after image rigid transformation. Finally, the target location of sub pixel where the residual similarity between template and directional diagram reach the minimum was detected using Gauss-Newton algorithms, and the recognition accuracy was in sub-pixel. Experimental results show that the precision of work-piece recognition is 0.1 pixel, which satisfies the requirement of high accuracy recognition on work-pieces.

Key words : machine vision image registration Gauss-Newton algorithm work piece accuracy recognition

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