自动化学报 2009 35 (11): 1394-1402 ISSN: 0254-4156 CN: 11-2109/TP

论文与报告

融合颜色和增量形状先验的目标轮廓跟踪

周雪, 胡卫明

1. 电子科技大学自动化工程学院 成都 610054

2. 中国科学院自动化研究所模式识别国家重点实验室 北京 100190

收稿日期 2008-7-1 修回日期 2009-1-4 网络版发布日期 接受日期

摘要
基于主动轮廓的跟踪方法被广泛应用于移动摄像机下运动物体轮廓的跟踪. 针对传统方法容易受噪音、部分遮挡、背景干扰等因素影响的缺点, 提出了一个分层的基于水平集(Level sets)的跟踪框架. 该框架将颜色信息和形状先验有效地结合起来. 在框架的第一层, 初始轮廓首先根据颜色信息进化, 通过引入一个反映邻域像素之间关系的惩罚因子来改进传统的速度模型. 然后, 基于Mahalanobis距离的判别式被用来决定是否需要引入形状先验, 如果不需要, 则第一层基于颜色进化的结果就作为最终的跟踪结果; 否则, 第一层得到的轮廓需要在第二层中在形状先验的约束下继续进化. 在第二层轮廓进化中, 本文提出了一个权重形状距离因子(Weighted shape distance term, WSDT), 用来融合全局的形状信息和局部的颜色信息. 形状先验模型建立在主成分分析(Principal component analysis, PCA)子空间并通过增量学习算法在线更新. 实验结果证明了方法的有效性和鲁棒性.

关键词 跟踪 基于水平集 形状先验 移动摄像机

分类号 TP391

Object Contour Tracking with Fusion of Color and Incremental Shape Priors

ZHOU Xue, HU Wei-Ming

1. College of Automation, University of Electronic Science and Technology of China, Chengdu 610054

2. National Laboratory of Pattern Recognition, Institute of Automation, Chinese Academy of Sciences, Beijing 100190

Abstract
Active contour-based tracking has been widely used for tracking contours of objects with moving cameras. However, traditional methods are sensitive to noise, partial occlusions, background disturbance and some other factors. With respect to this point, we propose a two-layer hierarchical level set-based tracking framework in which color information and shape are fused sequentially. In the first layer, the initial contour is evolved only with the color feature. A penalty term measuring the correlations between neighboring pixels is added to improve the general region-based level set speed model. Then, the Mahalanobis distance-based discriminant criterion is adopted to determine whether the shape model is needed. If the shape model is not needed, the contours obtained in the first layer are considered as the final tracking results; otherwise, the obtained contours are evolved with the shape constraint continuously in the second layer. For the second layer, a weighted shape distance term (WSDT) is introduced to fuse the global shape information and the local color information. Principal component analysis (PCA) subspace of shape samples is trained off-line and updated using an incremental learning algorithm. The experimental results have demonstrated the effectiveness and robustness of our method.

Key words Tracking level set-based shape priors moving cameras

DOI: 10.3724/SP.J.1004.2009.01394

通讯作者 周雪 zhouxue420@gmail.com

作者个人主页 周雪; 胡卫明