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信息科学

联合梯度直方图和局部二值模式特征的人体检测

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摘要：针对采用单一梯度方向直方图(HOG)特征进行人体检测时易受竖直梯度分量干扰的缺点，提出了将分块局部二值模式(LBP)特征加入HOG特征的方法。首先，将检测窗口划分为大小为 16×16 的不重叠块，以块为单位统计LBP特征直方图，并通过大量实验获得了LBP算子的最佳参数；然后用优化过的插值方式计算HOG特征，将两者组成联合直方图。最后，用线性支持向量机(SVM)通过Bootstrapping的方式训练，得到判别模型。在INRIA人体库上的测试表明，检出率在误检率(FPPW)为 10^{-4} 时由原始的89%提高到95%，单窗口检测速度由0.625 ms提高到0.533 ms。本文将纹理特征加入原始描述轮廓的HOG特征中，排除了部分梯度干扰信息造成的误检，提高了检出率。

关键词：梯度方向直方图 分块局部二元模式 支持向量机 行人检测

HOG-LBP pedestrian detection

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Abstract: This paper proposed a method to concatenate a cell-structured Local Binary Pattern(LBP) feature into Histogram of Gradients(HOG) to solve the problem that HOG was vulnerable to the interference of vertical background gradient information in pedestrian detection. Firstly, the detection window was divided into 16×16 non-overlapping blocks, then the LBP histogram of each block was calculated and his parameters were obtained by extensive experiments. Afterwards, the HOG was computed by the optimized interpolation method, and it was combined with LBP histogram to constitute a joint histogram. Finally, a discriminative model was trained by Bootstrapped linear Support Vector Machine(SVM). Based on the test of the INRIA pedestrian dataset, it is shown that the detection rate has been increased from 89% of the HOG feature to 95% when False Positive Per Window(FPPW) is 10^{-4} , and the detection speed has been raised from 0.625 to 0.533 ms per window. It is concluded that the proposed method in this paper eliminates the false detection caused by the interference of gradient information and improves the detection rate by describing both contour and texture information.

Keywords: Histogram of Gradient(HOG) cell-structured Local Binary Pattern(LBP) Support Vector Machine (SVM) Pedestrian detection

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参考文献:

- [1]李欣, 赵亦工, 陈冰, 等.基于模糊分类的弱小目标检测方法[J].光学精密工程.2009,17(9):2311-2320. LI X, ZHAO Y G, CHENG B, et al..Approach to dim and small target detection based on fuzzy classification [J]. Opt. Precision Eng., 2009, 17 (9): 2311-2320. (in Chinese) [2]刘亚洲.基于时空分析和多粒度特征表示的人体检测方法研究[D].哈尔滨: 哈尔滨工业大学, 2009. LIU Y ZH. Spatial-temporal analysis and multi-granularity representation based human detection[D].Harbin: Harbin Institute of Technology,2009. (in Chinese) [3]LOWE D G.Distinctive image features from scale-invariant keypoints [J].International Journal of Computer Vision, 2004,60(2):91-110. [4]DALAL N, TRIGGS B. Histograms of oriented gradients for human detection[C].Computer Vision and Pattern Recognition, IEEE Computer Society Conference,2005:886-893. [5]WALK S, MAJER N, SCHINDLER K, et al..New features and insights for pedestrian detection[C].Computer Vision and Pattern Recognition,IEEE Computer Society Conference,2010:1030-1037. [6] WATANABE T, ITO S, YOKOI K.Co-occurrence histograms of oriented gradients for human detection [J].IPSN Transactions on Computer Vision and Applications,2010,2:39-47. [7]MAJI S, BERG A C, MALIK J.Classification using intersection kernel support vector machines is efficient [C].Computer Vision and Pattern Recognition, IEEE Computer Society Conference,2008:1-8. [8]FELZENSZWALB P F, GIRSHICK R B, MCALLESTER D.Cascade object detection with deformable part models [C].Computer Vision and Pattern Recognition,IEEE Computer Society Conference,2010:2241-2248. [9] WANG X Y, HAN T X, YAN SH CH.An HOG-LBP human detector with partial occlusion handling[C]. Computer Vision, IEEE International Conference,2009:32-39. [10]ZHU Q, YE H M C, CHENG K T, et al..Fast human detection using a cascade of histograms of oriented gradients [C].Computer Vision and Pattern Recognition,IEEE Computer Society Conference, 2006:1491-1498. [11]PORIKLI F.Integral histogram: a fast way to extract histograms in Cartesian spaces [C].Computer Vision and Pattern Recognition,IEEE Computer Society Conference,2005:829-836. [12]BILGIC B.Fast human detection with cascaded ensembles [D].Massachusetts:Massachusetts Institute of Technology,2010. [13]DALAL N.Finding people in images and videos[D].France:the French National Institute for Research in Computer Science and Control,2006. [14]PANG Y W, YUAN Y, LI X L, et al.. Efficient HOG human detection [J]. Signal Processing, 2011, 91: 773-

781. [15]GUO ZH H, ZHANG L,ZHANG D.A Completed modeling of local binary pattern operator for texture classification [J].IEEE Transactions on Image Processing,2010,19(6):1657-1663. [16]FAN R E,CHANG K W,HSIEH,et al.. LIBLINEAR:a library for large linear classification[J].Journal of Machine Learning Research,2008,9: 1871-1874.

本刊中的类似文章

1. 周涛 陆惠玲 陈志强 马苗.基于两阶段集成SVM的前列腺肿瘤识别[J]. 光学精密工程, 2013,21(8): 2137-2145
2. 李一芒 何昕 魏仲慧 郭敬明.采用降维技术的红外目标检测与识别[J]. 光学精密工程, 2013,21(5): 1297-1303
3. 张宇洋 刘满华 韩韬.基于MeanShift图像分割结合SVM判决的候梯人数视觉检测系统[J]. 光学精密工程, 2013,21(4): 1079-1085
4. 王卫星, 苏培垠.基于颜色、梯度矢量流活动轮廓及支持向量机实现白细胞的提取和分类[J]. 光学精密工程, 2012,20(12): 2781-2790
5. 高恒振, 万建伟, 粘永健, 王力宝, 徐湛.组合核函数支持向量机高光谱图像融合分类[J]. 光学精密工程, 2011,19(4): 878-883
6. 张仁杰, 庄松林, 臧道青.基于聚类分析与支持向量机模型的缸盖座圈图像判别[J]. 光学精密工程, 2011,19(10): 2478-2484
7. 黄吉东, 王龙山, 李国发, 张秀芝, 王家忠.基于最小二乘支持向量机的外圆磨削表面粗糙度预测系统[J]. 光学精密工程, 2010,18(11): 2407-2412
8. 刘露,刘宛予,楚春雨,吴军,周洋,张红霞.胸部CT图像中孤立性肺结节良恶性快速分类[J]. 光学精密工程, 2009,17(8): 2060-2068
9. 姚富光,钟先信,唐向阳.异物在线识别中一类支持向量机理及实现[J]. 光学精密工程, 2009,17(4): 937-942
10. 李绍成, 左洪福, 张艳彬.油液在线监测系统磨粒识别[J]. 光学精密工程, 2009,17(3): 589-595
11. 温江涛,王伯雄.应用小波包能量谱及SVM的安瓿内浮类异物识别[J]. 光学精密工程, 2009,17(11): 2794-2799
12. 林伟青,傅建中,陈子辰.基于LS-SVM与遗传算法的数控机床热误差辨识温度传感器优化策略[J]. 光学精密工程, 2008,16(9): 1682-1687
13. 赵吉文^{1,2};刘永斌²;孔凡让²;张平²;孙丙宇².基于SVM和遗传算法的新型直线电机结构参数优化[J]. 光学精密工程, 2006,14(5): 870-875
14. 赵吉文^{1,2};刘永斌²;苏亚辉²;孔凡让²;张平².新型直线电机支持向量机非线性建模研究[J]. 光学精密工程, 2006,14(3): 450-455
15. 李粉兰;徐可欣.一种应用于人脸正面图像的眼睛自动定位算法[J]. 光学精密工程, 2006,14(2): 320-326

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