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硕士学位论文

基于全局与局部特征融合的人脸检测

Fusion of Global and Local Feature for Face Detection

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摘要

人脸检测一直来就是人脸识别中最基础的一个研究热点，如今，人脸检测研究技术已取得一些成效，然而人脸检测技术的性能仍然受到一些影响因素的干扰。存在的主要干扰因素有人脸的姿态、表情、遮挡以及光照亮度等，为了降低这些因素的干扰，以改善人脸检测性能，提高准确性和鲁棒性，本文提出了基于边缘信息的人脸轮廓的全局特征和基于灰度特征的人眼模板匹配的局部特征相融合的人脸检测方法。本论文的主要工作内容有：

（1）对人脸检测技术进行了综述。说明了人脸检测研究的背景与意义、发展历史与现状以及影响因素，将检测率、漏检率以及误检率作为性能评估准则。并且从基于特征、基于可变形模型以及基于外观的方法三大类分析了不同的人脸检测方法。

（2）采用融合的肤色模型进行皮肤检测。为了减少图像背景和衣服等类肤色区域的干扰，我们首先对输入人脸彩色图像进行皮肤提取。采用高斯混合肤色模型和二维直方图肤色模型方法相融合策略，很大程度上减小人脸搜索范围与检测误差。

（3）使用基于边缘信息的人脸轮廓的全局特征人脸检测方法对图像进行人脸粗检，初步定位候选人脸区域。将 Canny 边缘检测算法用于对获得的皮肤区域二值图像进行边缘提取，并由结构开操作和闭操作去除小噪声，用形态学连通标识符方法对皮肤区域进行人脸初步检测与定位，实现人脸粗检测，初步定位候选人脸区域。

（4）采用基于灰度特征的人眼模板匹配的局部特征人脸检测方法，对候选人脸进行进一步精确检测。将所获得的皮肤区域的彩色图像进行灰度化和平滑处理，经过基于灰度特征的人眼模板匹配，通过缩放和调整模板叠加用于粗定位的候选人脸区域之后，我们计算模板和图像之间的相互关联系数，作为相似性与阈值进行比较，最终对粗定位的候选人脸区域进行取舍，排除假区域，以实现最后的人脸精确检测与定位。

通过以上工作，使图像经过皮肤提取，人脸初定位，人脸精确检测处理，构

建了基于全局和局部特征融合的人脸检测策略。本文的创新的提出了使用融合策略的皮肤检测技术，同时也利用技术融合策略实现人脸检测。经过实验测试后表明，该系统能够有效地提高人脸检测性能的正确检测概率，降低误检率，具有很好的应用前景。

关键词： 皮肤检测；人脸检测；融合策略

Abstract

Face detection has always been the most basic technology in the research of face recognition. So far, face detection has achieved some results, but the performance of face detection is still affected by a number of interfering factors, such as posture, expression, covering and illumination brightness of the faces in images. In order to reduce the interference of these factors, we proposed a fusion strategy of two face detection methods, namely the global feature face detection based on edge information of face contour and the local features face detection based on template matching of eyes. The integration of face detection methods ameliorated the performance and improved the accuracy and robustness. The follows show the main contents of this paper.

Firstly, the summary of the face detection technologies was given. We introduced the research background and significance, the development history and current situation, as well as the influencing factors of face detection. We chose the detected rate, undetected rate and false positive rate as performance evaluation criteria. The face detection was divided into three categories, including feature-based method, method based on deformable model and appearance-based one.

Secondly, a fusion skin-color model was used to detect the skin area in images. For reducing the interference of skin color-like regions including the background and clothes in images, we firstly did skin detection with a fusion skin-color model, namely, two-dimensional skin-color histogram model and Gaussian mixture skin-color model. To a large extent, the skin detection reduced the search range and the face detection error.

Thirdly, the global feature face detection based on edge information of face contour was adopted to roughly detect faces, preliminary locating candidates of face region. The Canny edge detection algorithm was used to extract edge in the binary skin-detected images. And then, we did the opening and closing operation to remove small noises. So we could achieve rough face detection with morphology operations

to initially locate face region candidates.

Lastly, the local features face detection based on template matching of eyes was using to accurately do further face detection among candidates. After the skin area detected image transformed to gray image and smoothed, we scaled and adjusted the eye template to match the face region candidates in the smoothed gray image. So we got the cross-correlation coefficient, and then compared it with the threshold value, which obtained from examinations, to locate the true faces, remove the false ones in the candidates and finally achieve accurate face detection.

Through the above work, we made the image through skin detector, preliminary face locator and finally face detector to construct an accurate face detection system based on global and local features fusion strategy. The innovation of this paper was that we use the fusion face detection strategy based on the fusion skin detection technology policy. Through experiments we found that, the system can effectively improve the detection performance including increasing the true positive rate and reducing the false positive rate. With high accuracy, the face detector we proposed has great prospects.

Key Words: Skin Detection; Face Detection; Fusion Strategy.

目录

Contents