

文章编号:1007-2780(2013)02-0273-05

基于融合图像轮廓矩和 Harris 角点方法的 遮挡人体目标识别研究

杨云, 岳柱

(, 710021, E-mail: yangyun11@163.com)

摘要:

针对遮挡条件下的人体目标识别问题, 提出了一种基于融合图像轮廓矩和 Harris 角点方法的人体目标识别方法。首先, 利用背景减法方法将人体目标从复杂背景中分离出来, 然后利用人体先验知识提取人体头部和肩部特征, 接着提取轮廓矩不变量和 Harris 角点, 最后将提取的特征融合成混合特征, 并将其输入 BP 神经网络进行识别。实验结果表明, 该方法具有更好的鲁棒性和更高的识别率。

关键词: 人体目标识别; 遮挡; Harris 角点; BP 神经网络

中图分类号: TP391.41 文献标识码: A DOI: 10.3788/YJYXS20132802.0273

Human Body Target Recognition Under Occlusion Based on Fusion of Image Contour Moment and Harris Angular Points

YANG Yun, YUE Zhu

(School of Electrical and Information Engineering of Shaanxi University of Science and Technology,
Xi'an 710021, China, E-mail: yangyun11@163.com, China)

Abstract: For the human object recognition under occlusion, the human characteristics description are vulnerably effected under occlusion, but the head and shoulder of the human body are less susceptible to the characteristics of the block, put forward a new method based on the human head and shoulder mixed contour features for human object recognition under occlusion. First, using background subtraction method to separate the human body from the complex background, and then using a priori knowledge of the human body to extract the head and shoulder parts, then the contour moment invariant and Harris angular points are extracted and fused into a mixed feature, finally put the mixed feature into BP neural network to recognize. The experiments show that the method has better robustness and higher recognition rate.

Key words: human body recognition under occlusion; moment invariants; Harris angular points; BP neural network

收稿日期: 2012-08-14; 修订日期: 2012-09-08

基金项目: (No. 2010JK419)

作者简介: (1965—), 男, 陕西渭南人, 硕士, 讲师, 主要从事图像处理、模式识别方面的研究。

(
),
[1]
Harris
[2]
[3]
Harris
Harris
Harris

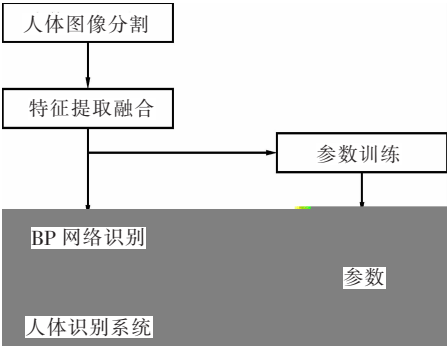
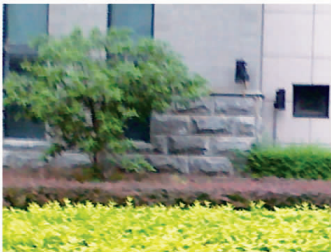


Fig. 1 Flow chart of human recognition system

2.1 人体头肩部位提取

$$d = \max(C_r - B_r, C_g - B_g, C_b - B_b) \quad (1)$$


2
Fig. 2 Background image



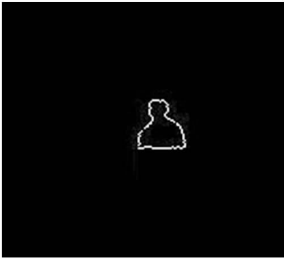
3

Fig. 3 Current image



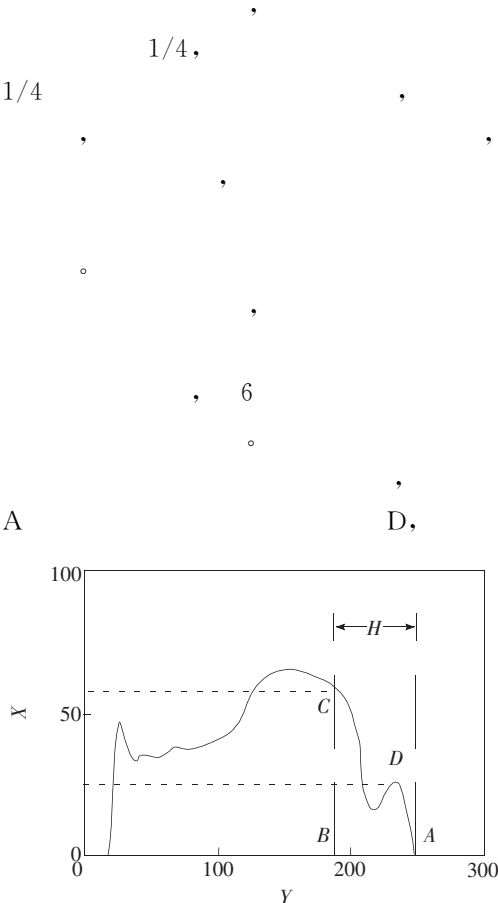
4

Fig. 4 Differential binary image



5

Fig. 5 Head and shoulder area contour



6

Fig. 6 Body vertical projection histogram

, ,
2.5~3 ,
2.5 , A B
H。

,
:

- (1)
(2) ,
255 ,

- (3) h , h_n
 C_n h_{n-1} h_{n+1}
 C_{n-1} C_{n+1} ,
 $C_n > C_{n-1}$ (2)
 $C_n > C_{n-1}$ (3)
 $C_n > \sigma$ (4)
 C_n 。 (4) σ

- ,
1 ,
2 , 1 ,
2 ,
。
(4) C_n ,
 $2.5 \times C_n$ 。 $2.5 \times$
 $C_n > h$,

2.2 轮廓矩

Hu , ,
 ,
Hu
 , ,
 , :
:

$m_{pq} = \int_C x^p y^q ds$ $p, q = 0, 1, 2, \dots$ (5)

$\int_C$ C :

$$\mathrm{d}s=\sqrt{(\mathrm{d}x)^2+(\mathrm{d}y)^2}\tag{6}$$

$$\mu_{\mathrm{pq}}=\iint_{\mathcal{C}}(x-\overline{x})^p(y-\overline{y})^q\mathrm{d}s\tag{7}$$

$$\overline{x}=\frac{m_{10}}{m_{00}},\overline{y}=\frac{m_{01}}{m_{00}},\tag{8}$$

$$\varphi_1=\mu_{20}+\mu_{02}\tag{9}$$

$$\varphi_2=(\mu_{20}-\mu_{02})^2+4\mu_{11}\tag{10}$$

$$\varphi_3=(\mu_{30}-3\mu_{12})^2+(3\mu_{12}-\mu_{03})^2\tag{11}$$

$$\varphi_4=(\mu_{30}+\mu_{12})^2+(\mu_{21}+\mu_{03})^2\tag{12}$$

$$\varphi_5=(\mu_{30}-3\mu_{12})(\mu_{30}+\mu_{12})\times$$
$$[(\mu_{30}+\mu_{12})^2-3(\mu_{21}+\mu_{03})]+(3\mu_{21}-\mu_{21})\times$$
$$(\mu_{21}+\mu_{03})[3(\mu_{30}+\mu_{12})^2-(\mu_{21}+\mu_{03})^2]\tag{13}$$

$$\varphi_6=(\mu_{20}-\mu_{02})[(\mu_{30}+\mu_{12})^2-(\mu_{21}+\mu_{03})^2]+$$
$$4\mu_{11}(\mu_{30}+\mu_{12})(\mu_{21}+\mu_{03})\tag{14}$$

2.3 Harris 角点

Harris

$$E_{x,y}=\sum_{u,v}[xI_x+yI_y+O(x^2+y^2)]^2\approx$$
$$(x,y)M(x,y)^T\tag{15}$$
$$I_x=I\oplus(-1,0,1)\quad I_y=$$
$$I\oplus(-1,0,1)。$$

M

$$\boldsymbol{M}=\boldsymbol{W}\oplus\begin{bmatrix}I_x^2&I_xI_y\\I_xI_y&I_y^2\end{bmatrix}\tag{16}$$

W

$\oplus$

Harris Stephen

$\text{Det}(\boldsymbol{M})\quad\text{Tr}(\boldsymbol{M})$

R :

$$R=\text{Det}(\boldsymbol{M})-\kappa\text{Tr}^2(\boldsymbol{M})\tag{17}$$

$\kappa=0.04$ (Harris)。

2.4 特征融合

$$\Omega,\quad A\quad B$$
$$\xi\in\Omega。$$
$$A\quad\beta\in B,\quad\gamma=\{\alpha,\beta\}。$$

3 BP 神经网络的人体识别

BP

[7], BP

$$F=[k\mid s(1)\mid,k\mid s(2)\mid,\cdots,k\mid s(p)\mid,\varphi1,\varphi2,\varphi3,\varphi4,\varphi5,\varphi6,\varphi7]\tag{18}$$

， $|s(1)| \cdots |s(p)|$ 为 Harris 角点， k 为 Harris 角点的个数， $\varphi_1 \cdots \varphi_7$ 为 Harris 角点的方位角， $[8]$ 。

7。k。k 2，k

，k：

$$k \sum_{i=1}^m |s^i(1)| = \sum_{i=1}^m (|\varphi_1^i| + |\varphi_2^i| + |\varphi_3^i| + |\varphi_4^i| + |\varphi_5^i| + |\varphi_6^i| + |\varphi_7^i|)$$

(19)

，k， $s^i(1)$ 为 Harris 角点的方位角， i 为 Harris 角点的个数， m 为 Harris 角点的个数， $|\varphi_1^i| \cdots |\varphi_7^i|$ 为 Harris 角点的方位角， i 为 Harris 角点的个数， k 为 Harris 角点的个数。

4 实验结果

，2 (，300，150)，150。1~3。86.8%，Harris 85.5%，92.9%。

表 1 单独采用轮廓矩时的识别率

Table 1 Recognition rate of using contour moment

/ %
87.5
86

表 2 采用 Harris 角点时候的识别率

Table 2 Recognition rate of using Harris angular points

/ %
86
85

表 3 采用混合特征时候的识别率

Table 3 Recognition rate of using mixed feature

/ %
93.7
92

5 结 论

，BP，Harris，BP，。

参 考 文 献：

[1] Zhou J P, Hoang J. Real time robust human detection and tracking system [C]. *Proc. of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, San Diego, USA:IEEE,2005:149-156.

[2] ， ， ， . [J]. ， 2009,(16):443-444.

[3] . [J]. ， 2012,(20):168-170.

[4] . [D]. ： ， 2010.

[5] ， ， . [J]. ， 2011,4(28):103-106.

[6] Schmid C, Mohr R, Bauckhage C. Evaluation of interest point detectors [J]. *International Journal of Computer Vision*, 2000,37(2):151-172.

[7] ， ， . [J]. ， 2011,26(6):836-840.

[8] Yu S W, Zhu K J, Fengqin Diao. A dynamic all parameters adaptive BP neural networks model and its application on oil reservoir prediction [J]. *Applied Mathematics and Computation*, 2008,195(1):66-75.