The Study of Face Detection Based on Wavelet and Support Vector Machines Algorithm

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ABSTRACT

Successful face detection is closely related to the tasks of subsequent face recognition. Hence, the high detection rate plays an important role on the success of face recognition. This study first proposes an algorithm of face detection based on knowledge and feature method (also called method ONE) to overcome the difficulties of elliptical labeling method. Then, another algorithm of face detection based on support vector machine (SVM) method (also called method TWO) is also proposed to solve the problem of skin color segmentation due to large illumination variation. The method ONE uses the facial features, such as eyes, nose, and mouth so on, to extract and locate the facial region from their background of an image. With the aid of the method ONE, the proposed elliptical labeling method can quickly and accurately locate (or detect) the possible facial regions in an image. However, the use of the triangular labeling method, which is based on the geometry formed by the two eyes and mouth of the possible face candidate, can further reduce the false detection rate by the elliptical labeling method. The method TWO utilizes a SVM learning machine to train a great variety of samples, including skin color and non-skin color images, to form a useful skin color model based on multicolor space, which can be used to predict the skin color regions in a tested image. The tested image is first divided into several blocks with fixed size. The block can then be considered as a skin color region when the number of skin-tone pixels in a block predicted by the SVM method is greater than a certain threshold, say, 50%. The results show that this method can completely solve the problem of skin color segmentation due to the large variation of illumination. Furthermore, the face features can be further extracted from the possible blocks with skin color by a gray level face model, which is also trained by the SVM method. With the aid of both skin color model and gray level face model, the efforts to compare the frame in a tested image with the gray level face model can be greatly reduced, but the possibility of false detection should be further reduced.

Keywords : Face detection ; Skin color segmentation ; support vector machine

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REFERENCES

[1] M. H. Yang," Detecting Faces in Images: A Survey," IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), vol. 24, no. 1, pp. 34-58,2002.

[2] Yang, G. and T. S. Huang Human face detection in complex background. Pattern Recognition, 27(1),53-63. 1994 [3] Hsu, R. L., M. Abdel-Mottaleb and A. K. Jain Face detection in color images, IEEE Trans. Pattern Analysis and Machine Intelligence, 24(5), 696-706. 2002 [4] Sandeep, K. and A. N. Rajagopalan Human Face Detection in Cluttered Color Image Using Skin Color and Edge Information, Indian Conference on Computer Vision, Graphics and Image Processing, Ahmedabad, India. 2002 [5] Terrillon, J. C., M. David and S. Akamatsu Detection of Human Faces in Complex Scene Images by Use of a Skin Color Model and Invariant Fourier-Mellin Moments, International Conference on Pattern Recognition, Brisbane, Australia, 1350-1355. 1998 [6] Yullie, P. Hallinan and D. Cohen Feature exaction from faces using deformable templates. International Journal of Computing Vision, 8(2), 99-111. 1992 [7] M. Soriano, B. Martinkauppi, S. Huovinen, and M. Laaksonen, " Skin color modeling under varying illumination conditions using the skin locus for selecting training pixels," Proceedings of IEEE Nordic Signal Processing Symposium, pp. 383-386, 2000.

[8] M. Soriano, M. Martinkauppi, S. Huovinen, and M. Laaksonen, " Skin detection in video under changing illumination conditions," Proceedings of the 15th International Conference on Pattern Recognition, Vol. 1, pp. 839-842, 3-7 Sept. 2000.

[9] A. Hadid, M. Pietikainen, and B. Martinkauppi, " Color-based face detection using skin locus model and hierarchical filtering," Proceedings of the 16th International Conference on Pattern Recognition, Vol. 4, pp. 196-200, 2002.

[10] Yullie, P. Hallinan and D. Cohen Feature exaction from faces using deformable templates. International Journal of Computing Vision, 8(2), 99-111. 1992 [11] Jain, K., Y. Zhong and M-P Jolly Deformable template models: A review. Signal Processing, 71(2), 109-129. 1998 [12] Bruneli, R. and T. Poggio Face recognition: Features versus templates, IEEE Transactions on pattern analysis and machine intelligence, 15(10), 1042-1052. 1993 [13] Turk, M. and A. Pentland Eigenfaces for recognition. Journal of cognitive neuroscience, 3(1), 71-86. (1991) [14] Rowley, H. A., S. Baluja and T. Kanade Neural Network-Based Face Detection, IEEE Computer Society Conference on Computer Vision and Pattern Recognition, San Francisco, California, 203-208. (1996) [15] H. A. Rowley, S. Baluja and T. Kanade, " Rotation Invariant Neural Network-Based Face Detection, " IEEE Computer Society Conference on Computer Vision and Pattern Recognition, Santa, Barbara, California, 38-44, 1998.

[16] M. Turk, and A. Pentland, " Eigenfaces for recognition," Journal of Cognitive Neuroscience, Vol. 3, No. 1, pp. 71-86, 1991.

[17] S. Y. Lee, Y. K. Ham, and R. H. Park, " Recognition of human front faces using knowledge-based feature extraction and neuro-fuzzy algorithm," Pattern Recognition, Vol.29, No.11, pp. 1863-1867, 1996.

[18] E. Osuna , R. Freund , and F. Girosi," Training Support Vector Machines: An Application to Face Detection," Proc. IEEE Conf. Computer Vision and Pattern Recognition, pp.130-136,1997.

[19] Oren, M. Papageorgiou, C. Sinha, P. Osuna, E. Poggio, T. " Pedestrian Detection Using Wavelet Templates" Proceedings of 1997 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 17-19 June, pp.193-199, 1997 [20] P. Papageorgiou and M. Oren," A General Framework for Object Detection " Center for Biological and Computational Learning Artificial Intelligence Laboratory.

[21] Constantine. Papageorgiou, Tomaso. Poggio, " A Trainable System for Object Detection" International Journal of Computer Vision 38(1), 15– 33, 2000 [22] Elena. Casiraghi, Raffaella. Lanzarotti, Giuseppe. Lipori, " A face detection system based on color and support vector machines" Dipartimento di Scienze dell' Informazione Universit`a degli Studi di Milano Via Comelico, 39/41 20135 Milano, Italy [23] Junwei Han, George M. Award, Alistair Sutherland, and Hai Wu, Automatic Skin Segmentation for Gesture Recognition Combining Region and Support Vector Machine Active Learning* School of Computing, Dublin City University, Ireland [24] Haizhou ,Ai. Luhong. Liang. and Guangyou, Xu. Face detection based on template matching and support vector machines. IEEE International Conference on Image Processing, Volume 1, pp.1006 - 1009, 7-10 Oct, 2001 [25] C.C. Chang, C.J.Lin, " LIBSVM:A Library for Support Vector Machine", http//www.csie.ntu.edu.tw/~cjlin/libsvm/index.html, 2003 [26] V. Vapnik , S. Golowich , and A. Smola," Support Vector method for function approximation regression estimation and signal processing ," In M. Mozer   M. Jordan, and T. Petsche, editors, Advances in Neural Information Processing Systems 9, pages 281-287, Cambridge, MA   1997.MIT Press.

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