

人臉偵測與追蹤之實作

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摘要

本論文中，提出一個基於特徵點追蹤之人臉追蹤技術。本論文提出之人臉追蹤技術主要由兩個部份所組成：人臉偵測和人臉追蹤。首先，人臉偵測部分，使用Haar-Like特徵結合多分類器演算法的人臉偵測器，找出人臉的所在區域，為了移除偵測錯誤的人臉區域，人眼資訊也被採用。完成人臉偵測後，本論文透過特徵擷取與特徵追蹤達成人臉追蹤。為了評估所提出的方法，藉由網路攝影機擷取各種不同的臉部動態影像。實驗結果顯示，本論文提出之人臉追蹤系統中，人臉偵測正確檢測率高於96%，人臉追蹤正確檢測率高於91%，效果良好。實驗結果證明，在自然且具有雜訊環境下，本論文提出的方法可以有效地達成人臉追蹤。

關鍵詞：人臉追蹤、人臉偵測、特徵追蹤、KLT追蹤、人眼偵測

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參考文獻

- [1]P. Viola and M. Jones, "Robust real-time face detection," *International Journal of Computer Vision*, vol. 57, no. 2, pp. 137-154, 2004.
- [2]G. S. Lin, M. K. Chang, and Y. J. Chang, "Gender recognition based on multi-model information fusion," *APSIPA ASC 2011*.
- [3]Y. Andreu and R. A. Mollineda, "The role of face parts in gender recognition," in *Proc. LNCS Int ' I Conf. on Image Analysis and Recognition*, vol.5112, pp. 945-954, 2008.
- [4]H. Fukai, H. Takimoto, Y. Mitsukura and M. Fukumi, "Age and Gender Estimation System based on Human Perception," *Proc. of 18th IEEE International Symposium on Robot and Human Interactive Communication*, pp. 1143-1148, 2009.
- [5]Olugbenga Ayinde, and Yee-Hong Yang, "Region-Based Face Detection," *Pattern Recognition*, Vol. 35, pp. 2095-2017, 2002.
- [6]S. Hayashi, and O. Hasegawa, "A Detection Technique for Degraded Face Images," *Conference on Computer Vision and Pattern Recognition*, IEEE Computer Society, Vol. 2, pp. 1516-1512, 2006.
- [7]L. Zhao, X. Sun, and X. Xu, "Face detection based on facial features," *Proceedings of the International Conference on Signal Processing*, Vol. 3, Nov, pp. 16-20, 2006.
- [8]M. Turkan, M. Pardes, and A.E. Cetin, "Edge Projections for eye localization," *Optical Engineering*, Vol. 47, pp. 047007-1 – 047007-6, 2008.
- [9]J. -S. Jang, and J. -H. Kim, "Fast and robust face detection using evolutionary pruning," *IEEE Transactions on Evolutionary Computation*, Vol. 12, No. 5, pp. 562-571, 2008.
- [10]P. S. Hiremath, and A. Danti, "Detection of Multiple Faces in an Image Using Skin Color Information and Lines-of-Separability Face Model," *International Journal of Pattern Recognition and artificial Intelligence*, Vol. 20, No. 1, pp. 39-61, 2006.
- [11]Chin-Chung Han, Hong-Yuan Mark Liao, Kuo-Chung Yu, and Liang-Hua Chen, "Fast Face Detection Via Morphology-based Pre-Processing," *Pattern Recognition*, Vol. 33, pp. 1701-1712, 2000.
- [12]L. Goldmann, U. J. Monich, and T. Sikora, "Components and Their Topology for Detection in the Presence of Partial Occlusions," *IEEE Transactions on Information Forensics and Security*, Vol. 2, No. 3, Sep, pp. 559 – 569, 2007.
- [13]S. Bircheld, "Elliptical head tracking using intensity gradients and color histograms," *IEEE Conf. Computer Vision and Pattern Recognition*, pp. 232 – 237, 1998.
- [14]V. Kruger, R. Herpers, K. Daniilidis, and G. Sommer, "Teleconferencing using an attentive camera system," *Int. Conf. on Audio- and*

Video-based Biometric Person Authentication, pp. 142 – 147, 1999.

- [15]Y. Raja, J. McKenna, and S. Gong, “ Tracking and segmenting people in varying lighting conditions using color, ” Int. Conf. on Automatic Face- and Gesture- Recognition, pp. 228 – 233, 1998.
- [16]Y. Zheng and Y. meng, “ A swarm-intelligence based algorithm for face tracking, ” Int. J. Intelligent Systems Technologies and Applications, vol. 7, no. 3, pp.266 – 281, 2009.
- [17]Jeremiah R. Barr, Kevin W. Bowyer, and Patrick J. Flynn, “ Detecting Questionable Observers Using Face Track Clustering, ” 2011 IEEE Workshop on Applications of Computer Vision (WACV), pp. 182-189, 2011.
- [18]Hao Ji, Fei Su, and Geng Du, “ Multiple faces tracking based on joint kernel density estimation and robust feature descriptors, ” 2009. IC-NIDC 2009. IEEE International Conference on Network Infrastructure and Digital Content, pp. 680-685, 2009.
- [19]Thanh Duc Ngo, Duy-Dinh Le, Shin ' ichi Satoh, and Duc Anh Duong, “ Robust Face Track Finding in Video Using Tracked Points, ” 2008. SITIS '08. IEEE International Conference on Signal Image Technology and Internet Based Systems, pp. 59-64, 2008.
- [20]C.-Y. Yu, Y.-C. Ouyang, C.-M. Wang, and C.-I Chang, “ Adaptive inverse hyperbolic tangent algorithm for dynamic contrast adjustment in displaying scenes, ” EURASIP Journal on Advanced in Signal Processing, vol. 2010, pp. 1-20, 2010.
- [21]Z. Wang, A. C. Bovik, H. R. Sheikh and E. P. Simoncelli, “ Image quality assessment: from error visibility to structural similarity, ” IEEE Transactions on Image Processing, vol. 13, pp. 600-612, 2004.
- [22]T. Ojala, M. Pietikainen, and T. Maenpaa, “ Multiresolution gray-scale and rotation invariant texture classification with local binary patterns ” , IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 24, pp. 971-987, 2002.
- [23]V. Vapnik, The Nature of Statisical Learning Theory, Springer-Verlag, New York, 1995.
- [24]J. Shi, and C. Tomasi, “ Good Feature to Track, ” IEEE Conf. Computer Vision and Pattern Recognition, pp. 593-600, June 1994.
- [25]T. Tommasini, A. Fueiello, and E. Trucco etal. , “ Making good features track better, ” Int ' I Conf. Computer Vision and Pattern Recognition, pp. 178-183, 1998.
- [26]Stan Birchfield, “ Derivation of Kanade-Lucas-Tomasi Tracking Equation, ” Unpublished, May 1996.
- [27]C. Tomasi and T. Kanade, “ Detection and Tracking of Point Features, ” Carnegie Mellon University Technical Report CMU-CS-91-132, April 1991.
- [28]C. Garcia and G. Tziritas, “ Face Detection Using Quantized Skin Color Regions Merging and Wavelet Packet Analysis, ” IEEE Transactions on Multimedia, vol. 1, pp. 264-277, 1999.