

{tag}

{/tag}

International Journal of Computer Applications  
© 2011 by IJCA Journal

Number 4 - Article 8

Year of Publication: 2011

Authors:

Mohammed Alhanjouri

Hana Hejazi

10.5120/2269-2923

{bibtex}pxc3872923.bib{/bibtex}

**Abstract**

This paper identifies two novel techniques for face features extraction based on two different multi-resolution analysis tools; the first called curvelet transform while the second is waveatom transform. The resultant features are trained and tested via three improved hidden Markov Model (HMM) classifiers, such as: Structural HMM (SHMM), Deviance Information

Criterion-Inverse Weighted Average K-mean-SHMM (DIC-IWAK-SHMM), and Enclosed Model Selection Criterion (EMC) coupled with DIC-IWAK-SHMM as the proposed methods for face recognition.

A comparative studies for DIC-IWAK-SHMM approach to recognize the face were achieved by using two type of features; one method using Waveatom features and the other method uses 2-level Curvelet features, these two methods compared with a six methods that used in previous researches.

The goal of the paper is twofold; using Deviance information criterion and IWAK-means clustering algorithm based on SHMM.

### Reference

- Mandal T. and Wu Q., 2008. Face Recognition using Curvelet Based PCA, 19th International Conference on Pattern Recognition (ICPR).
- Waveatom: <http://www.waveatom.org>
- Rabiner L., 1989. A tutorial on hidden markov models and selected applications in speech recognition", IEEE Proc., vol. 77, no. 2, pp: 257–286.
- Nefian A., Hayes M., 2000. Maximum likelihood training of the embedded HMM for face detection and recognition, Proc. Of the IEEE International Conference on Image Processing, ICIP, Vol. 1, 10-13 September 2000, Vancouver, BC, Canada, pp. 33-36.
- Bai L., Shen L., 2003. Combining Wavelets with HMM for Face Recognition, 23rd International Conference on Innovative Techniques and Applications of Artificial Intelligence (SGAI '03), Cambridge, UK, 13-15 December, pp. 227-234.
- Nefian A., 2002. Embedded Bayesian networks for face recognition, Proc. of the IEEE International Conference on Multimedia and Expo, Vol. 2, , Lusanne, Switzerland, 26-29 August 2002, pp. 133-136.
- Le H., Li H., 2004. Recognizing frontal face images using hidden Markov models with one training image per person, ICPR, vol. 1, p: 318–321.
- Bouchaffra D., Tan J., 2006. Introduction to structural hidden markov models: application to handwritten numeral recognition, Intelligent Data Analysis Journal, Vol. 10, No.1.
- Mandal T., Majumdar A., Wu Q., 2007. Face Recognition by Curvelet Based Feature Extraction, Proc of ICIAR, Montreal, Canada, vol. 4633, 22-24 August 2007, pp 806-817.
- Mandal T., Wu Q., 2008. Face Recognition using Curvelet Based PCA, Pattern Recognition, ICPR, 19th international conference, Tampa, Florida, USA.
- Majumdar A., Bhattacharya A., 2007. Face Recognition by Multiresolution Curvelet Transform on Bit Quantized Facial Images, International Conference on Computational Intelligence and Multimedia Applications, vol. 2, 13.
- Majumdar A., Ward R., 2008. Single image per person face recognition with images synthesized by non-linear approximation, 15th IEEE International Conference on Image Processing, ICIP 2008, P: 2740–2743.
- Majumdar A., Ward R., 2008. Multiresolution Methods in Face Recognition. Delac K., Grgic M., Bartlett M.: Recent Advances in Face Recognition, InTech, Publisher, p: 79-96
- Rziza M., El Aroussi M., et al, 2009. Local Curvelet Based Classification Using Linear Discriminant Analysis for Face Recognition, International Journal of Computer Science, Vol. 4, No. 1, pp. 72
- Xie J., 2009. Face Recognition Based on Curvelet Transform and LS-SVM, Proceedings

of the International Symposium on Information Processing (ISIP'09), Huangshan, China, 21-23 August 2009, p: 140-143.

- Aggarwal V., Patterh M., 2009. ECG Compression using Wavelet Packet, Cosine Packet and Wave Atom Transforms, International Journal of Electronic Engineering Research, Vol. 1, No. 3, p: 259–268.
- Candes E., Demanet L., et al., 2006. Fast Discrete Curvelet Transforms, Technical Report, Cal Tech, March.
- Curvelets: A surprisingly effective non-adaptive representation for objects with edges: <http://www.Curvelet.org/papers/Curve99.pdf>
- Demanety L., Ying L., 2007. Wave atoms and sparsely of oscillatory patterns, Appl. Comput. Harm. Anal. , February, 2007.
- Young S., et al., The HTK Tools and Reference Manuals, version 3.4, Cambridge University Engineering Department, 2009.
- Bouchaffra D., Tan J., 2006. Introduction to structural hidden markov models: application to handwritten numeral recognition, Intell. Data Anal. J., Vol. 10, Number 1, 2006.
- Bouchaffra D., Amira A., 2008. Structural hidden Markov models for biometrics: fusion of face and fingerprint, Pattern Recognition, Vol. 41, p: 852– 867.
- Han J., Kamber M., Data mining: concepts and techniques, 2nd edition, Elesvier, 2006.
- Rama A., Tarrés F., Rurainsky J., Eisert P., 2008. 2D-3D Mixed Face Recognition Schemes, Delac K., Grgic M., Bartlett M.: Recent Advances in Face Recognition, In\_Tech publisher, p: 125-148.
- Face images database: <http://www.cl.cam.ac.uk/Research/DTG/attarchive>
- Description of the Collection of Facial Images: <http://cswww.essex.ac.uk/mv/allfaces/grimace.zip>
- Yale face database: <http://cvc.yale.edu>
- Mandal T., Wu Q., Yuan Y., 2008. Curvelet based face recognition via dimension reduction, Signal Processing. Vol. 89, No. 12, pp. 2345-2353.

### Index Terms

Computer Science

Pattern Recognition

### Key words

HMM

Curvelet

Waveatom

Face

Recognition

Structural HMM

