

## **BIBLIOGRAPHY**

- 1. Aizawa, K., Harashima, H., and Saito, T., "Model-Based Analysis Synthesis Image Coding System for a Person's Face," *Signal Processing: Image Communication 1*, pp. 139-152, 1989.
- 2. Anandan, P., "A Computational Framework and an Algorithm for the Measurement of Visual Motion," *International Journal of Computing Vision*, Vol. 2, pp. 283-310, 1989.
- 3. Barron. J.L., Fleet, D.J., and Beauchemin, S.S., "Systems and Experiment Performance of Optical Flow Techniques," *International Journal of Computer Vision*, Vol. 12, No. 1, pp. 43-77, 1994.
- 4. Bartlett, M.S., Viola, P.A., Sejnowski, T.J., Golomb, B.A., Larsen, J., Hager, J.C., and Ekman, P., "Classifying Facial Action," *Advances in Neural Information Processing Systems* 8, pp. 823-829, MIT Press, Cambridge, MA, 1996.
- 5. Bassili, J.N., "Emotion Recognition: The Role of Facial Movement and the Relative Importance of Upper and Lower Areas of the Face," *Journal of Personality and Social Psychology*, Vol. 37, pp. 2049-2059, 1979.
- 6. Baum, L.E., Petrie, T., Soules, G., and Weiss, N., "A Maximization Technique Occurring in the Statistical Analysis of Probabilistic Functions of Markov Chains," *Annals of Mathematical Statistics*, Vol. 41, No. 1, pp. 164-171, 1970.
- 7. Belhumeur, P.N., Hespanha, J.P., and Kriegman, D.J., "Eigenfaces vs. Fisherfaces: Recognition Using Class Specific Linear Projection," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 19, No. 7, pp. 711-720, 1997.
- 8. Bergen, J.R., Anandan, P., Hanna, K.J., and Hingorani, R., "Hierarchical Model-Based Motion Estimation," *Proc. of Second European Conference on Computer Vision*, pp. 237-252, Springer-Verlag, May 1992.
- 9. Beymer, D., "Face Recognition Under Varying Pose," *MIT Artificial Intelligence Laboratory*, A.I. Memo No. 1461, December 1993.
- 10. Beymer, D., "Vectorizing Face Images by Interleaving Shape and Texture Computations," *MIT Artificial Intelligence Laboratory*, A.I. Memo No. 1537, September 1995.

- 11. Black, M.J., and Anandan, P., "A Framework for the Robust Estimation of Optical Flow," *In Proc. International Conference on Computer Vision*, pp. 231-236, Berlin, Germany, May 1993.
- 12. Black, M.J., and Yacoob, Y., "Tracking and Recognizing Facial Expressions in Image Sequences, Using Local Parameterized Models of Image Motion," *University of Maryland*, Technical Report CS-TR-3401, January 1995.
- 13. Black, M.J., Yacoob, Y., Jepson, A.D., and Fleet, D.J., "Learning Parameterized Models of Image Motion," *IEEE Conference on Computer Vision and Pattern Recognition*, pp. 561-567, Puerto Rico, June 1997.
- 14. Blake, A., Isard, M., and Reynard, D., "Learning to Track the Visual Motion of Contours," *In J. Artifical Intelligence*, 1995.
- 15. Bregler, C., and Konig, Y., "Eigenlips for Robust Speech Recognition," *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, pp. 669-672, Adelaide, 1994.
- 16. Bruce, V., *Recognizing Faces*, Lawrence Erlbaum Associates, London, 1988.
- 17. Brunelli, R., and Poggio, T., "Face Recognition: Features versus Templates," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 15, No. 10, pp. 1042-1052, October 1993.
- 18. Cai, W., and Wang, J., "Adaptive Multiresolution Collocation Methods for Initial Boundary Value Problems of Nonlinear PDEs," *Society for Industrial and Applied Mathematics*, Numer. Anal., Vol. 33, No. 3, pp. 937-970, June 1996.
- 19. Canny, J., "A Computational Approach to Edge Detection," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 8, No. 6, pp. 679-698, 1986.
- Chellappa, R., Sirohey, S., Wilson, C.L., and Barnes, C.S., "Human and Machine Recognition of Faces: A Survey," *University of Maryland*, Technical Report CS-TR-3339, August 1994.
- 21. Choi, C.S., Harashima, H., and Takebe, T., "Analysis and Synthesis of Facial Expressions in Knowledge-Based Coding of Facial Image Sequences," *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, pp. 2737-2740, Toronto, Canada, May 1991.
- 22. Chui, C.K., An Introduction to Wavelets, Academic Press, 1992.

- 23. Cohn J.F., and Elmore, M., "Effect of Contingent Changes in Mothers' Affective Expression on the Organization of Behavior in 3-Month-Old Infants," *Infant Behavior and Development*, Vol. 11, pp. 493-505, 1988.
- 24. Cohn, J.F., Zlochower, A.J., Lien, J.J., Wu, Y.T., and Kanade, T., "Facial Expression Analysis: Preliminary Results of a New Image-Processing Based Method," *Proceedings of the 9th Conference of the International Society for Research on Emotions*, pp. 329-333, Toronto, Canada, August 1996.
- 25. Cohn, J.F., Zlochower, A.J., Lien, J.J., Wu, Y.T., and Kanade, T., "Facial Expression Can Be Measured by Image Processing of Video Sequences," *Biennial Meeting of the Society for Research in Child Development*, pp. 98, Washington, D.C., April 1997.
- Cohn, J.F., Zlochower, A.J., Lien, J.J., Wu, Y.T., and Kanade, T., "Automated Face Coding: A Computer-Vision Based Method of Facial Expression Analysis," 7th European Conference on Facial Expression, Measurement, and Meaning, Salzburg, Austria, July 1997.
- 27. Cohn, J.F., Zlochower, A.J., Lien, J.J., and Kanade, T., "Feature-Point Tracking by Optical Flow Discriminates Subtle Differences in Facial Expression," *Third IEEE International Conference on Automatic Face and Gesture Recognition*, pp. 396-401, Nara, Japan, April 1998.
- 28. Cohn, J.F., Zlochower, A.J., Lien, J.J., and Kanade, T., "Automated Face Coding: A Computer-Vision Based Method of Facial Expression Analysis," *Journal of Psychophysiology*, In Press.
- 29. Cootes, T.F., Taylor, C.J., Cooper, D.H., and Graham, J., "Active Shape Models Their Training and Application," *Computer Vision and Image Understanding*, Vol. 61, No. 1, pp. 38-59, January 1995.
- 30. Cottrell, G.W., and Metcalfe, J., "EMPATH: Face, Gender and Emotion Recognition Using Holons," *Advances in Neural Information Processing Systems 3*, pp. 564-571, San Mateo, CA, 1991.
- 31. Craw, I., and Cameron, P., "Face Recognition by Computer," *Proceedings of the British Machine Vision Conference*, pp. 487-507, 1992.
- 32. Darwin, C., *The Expression of Emotions in Man and Animals*, John Murray, 1872, reprinted by University of Chicago press, 1965.

- 33. Ding, J., Shimamura, M., Kobayashi, H., and Nakamura, T., "Neural Network Structures for Expression Recognition," *Proceedings of International Joint Conference on Neural Network*, pp. 1420-1423, 1993.
- 34. Ekman, P., and Friesen, W.V., *The Facial Action Coding System*, Consulting Psychologists Press Inc., San Francisco, CA, 1978.
- 35. Ekman, P., "Facial Expression and Emotion," *American Psychologist*, Vol. 48, pp. 384-392, 1993.
- 36. Essa, I.A., "Analysis, Interpretation and Synthesis of Facial Expressions," *MIT Media Laboratory*, Perceptual Computing Technical Report 303, Ph.D. dissertation, February 1995.
- 37. Forney, G.D., "The Vitervi Algorithm," *Proceedings of the IEEE*, Vol. 61, No. 3, pp. 268-278, March 1973.
- 38. Fridlund, A.J., *Human Facial Expression: An Evolutionary View*, Academic Press, San Diego, CA, 1994.
- 39. Golomb, B., Lawrence, D., and Sejnowski, T., "SEXnet: A Neural Network Identifies Sex From Human Faces," *Advances in Neural Information Processing System 3*, pp. 572-577, San Mateo, CA, 1991.
- 40. Gray, R.M., "Vector Quantization," *IEEE ASSP Magazine*, pp. 4-29, April 1984.
- 41. Hager, J., and Ekman, P., "The Essential Behavioral Science of the Face and Gesture that Computer Scientists Need to Know," *Proceedings of the International Workshop on Automatic Face- and Gesture-Recognition*, pp. 7-11, Zurich, Switzerland, June 1995.
- 42. Hancock, P.J.B., Burton, A.M., and Bruce, V., "Face Processing: Human Perception and Principal Components Analysis," *Memory and Cognition* 24, pp. 26-40, 1996.
- 43. Haralick, R.M., and Shapiro, L.G., *Computer and Robot Vision Volume I*, Addison-Wesley, 1992.
- 44. Hashiyama, T., and Furuhashi T., Uchikawa, Y., and Kato, H., "A Face Graph Method Using a Fuzzy Neural Network for Expressing Conditions of Complex Systems."
- 45. Heeger, D.J., "Optical Flow Using Spatiotemporal Filters," *International Journal of Computer Vision*, Vol. 1, pp. 279-302, 1988.

- 46. Himer, W., Schneider, F., Kost, G., and Heimann, H., "Computer-Based Analysis of Facial Action: A New Approach," *Journal of Psychophysiology*, Vol. 5, No. 2, pp. 189-195, 1991.
- 47. Horn, B.K.P., and Schunk, B.G., "Determining Optical Flow," *Artificial Intelligence*, Vol. 17, pp. 185-203, 1981.
- 48. Kaiser, S., and Wherle, T., "Automated Coding of Facial Behavior in Human-Computer Interactions with FACS," *Journal of Nonverbal Behavior*, Vol. 16, No. 2, pp. 65-140, 1992.
- 49. Kanade, T., *Computer Recognition of Human Faces*, Basel & Stuttgart, Birkhauser Verlag, 1977.
- 50. Kass, M., Witkin, A., and Terzopoulos, D., "Snakes: Active Contour Models," *International Journal of Computer Vision*, pp. 321-331, 1988.
- 51. Kaucic, R., Dalton, B., and Blake, A., "Real-Time Lip Tracking for Audio-Visual Speech Recognition Applications," In Proc. European Conference Computer Vision, pp. 376-387, Cambridge, UK, 1996.
- 52. Kim, H.J., and Li, C.C., "A Non-Orthogonal Wavelet Edge Detector with Four Filter-Coefficients," *Mathematical Imaging: Wavelet Applications in Signal and Image Processing*, SPIE, Vol. 2034, San Diego, CA, 1993.
- 53. Kimura, S., and Yachida, M., "Facial Expression Recognition and its Degree Estimation," *IEEE Computer Vision and Pattern Recognition*, pp. 295-300, 1997.
- 54. Kirby, M., and Sirovich, L., "Application of the Karhuneh-Loeve Procedure for the Characterization of Human Faces," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 12, No. 1, pp. 103-108, January 1990.
- 55. Kobayashi, H., and Hara, F., "The Recognition of Basic Facial Expressions by Neural Network," *Proceedings of International Joint Conference on Neural Network*, pp. 460-466, 1991.
- 56. Kobayashi, H., and Hara, F., "Recognition of Six Basic Facial Expressions and their Strength by Neural Network," *IEEE International Workshop on Robot and Human Communication*, pp. 381-386, September 1992.

- 57. Kobayashi, H., and Hara, F., "Recognition of Mixed Facial Expressions by Neural Network," *IEEE International Workshop on Robot and Human Communication*, pp. 387-391, September 1992.
- 58. Lanitis, A., Taylor, C.J., and Cootes, T.F., "Automatic Interpretation and Coding of Face Images Using Flexible Models," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 19, No. 7, pp. 743-756, 1997.
- 59. Lee, K-F, "Large-Vocabulary Speaker-Independent Continuous Speech Recognition: The SPHINX System," *Carnegie Mellon University*, Computer Science Department, Ph.D. dissertation, April 1988.
- Li, H., Roivainen, P., and Forchheimer, R., "3-D Motion Estimation in Model-Based Facial Image Coding," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 15, No. 6, pp. 545-555, June 1993.
- 61. Li, Y., and Kobatake, H., "Extraction of Facial Sketch Images and Expression Transformation Based on FACS," *IEEE*, pp. 520-523.
- 62. Lien, J.J., Kanade, T., Zlochower, A.J., Cohn, J.F., and Li, C.C., "Automatically Recognizing Facial Expressions in the Spatio-Temporal Domain," *Workshop on Perceptual User Interfaces*, pp. 94-97, Banff, Alberta, Canada, October 19-21, 1997. Also available at http://www.cs.cmu.edu/~jilien
- 63. Lien, J.J., Kanade, T., Cohn, J.F., and Li, C.C., "Automated Facial Expression Recognition Based on FACS Action Units," *Third IEEE International Conference on Automatic Face and Gesture Recognition*, pp. 390-395, Nara, Japan, April 14-16, 1998. Also available at http://www.cs.cmu.edu/~jjlien
- 64. Lien, J.J., Kanade, T., Cohn, J.F., and Li, C.C., "Subtly Different Facial Expression Recognition and Expression Intensity Estimation," *IEEE Conference on Computer Vision and Pattern Recognition, Santa Barbara*, CA, June 23-25, 1998. Also available at http://www.cs.cmu.edu/~jjlien
- 65. Linde, Y., Buzo, A., and Gray, R., "An Algorithm for Vector Quantizer Design," *IEEE Transaction on Communications*, Vol. COM-28, NO. 1, pp. 84-95, January 1980.
- Lucas, B.D., "Generalized Image Matching by the Method of Differences," Carnegie Mellon University, Technical Report CMU-CS-85-160, Ph.D. dissertation, July 1984.

- 67. Mase, K., and Pentland, A., "Automatic Lip-reading by Optical-Flow Analysis," *Systems and Computers in Japan*, Vol. 22, No. 6, pp. 67-76, 1991.
- 68. Mase, K., "Recognition of Facial Expression from Optical Flow," *Institute of Electronics, Information and Communication Engineers Transactions*, Vol. E74, pp. 3474-3483, 1991.
- 69. Matsuno, K., Lee, C-W, Kimura, S., and Tsuji, S., "Automatic Recognition of Human Facial Expressions," *International Conference on Computer Vision*, pp. 352-359, 1995.
- 70. McNeil, D., "So You Think Gestures Are Nonverbal?" *Psychological Review*, 92, pp. 350-371, 1985.
- 71. Morimoto, C., Yacoob, Y., and Davis, L., "Recognition of Head Gestures Using Hidden Markov Models," *International Conference on Pattern Recognition*, pp. 461-465, Austria, 1996.
- 72. Moses, Y., Reynard, D., and Blake, A., "Determining Facial Expressions in Real Time," *International Workshop on Automatic Face- and Gesture-Recognition*, pp. 332-337, Zurich, Switzerland, June 1995.
- 73. Murase, H., and Nayar, S.K., "Visual Learning and Recognition of 3-D Objects from Appearance," *International Journal of Computer Vision*, Vol. 14, No. 1, pp. 5-24, 1995.
- 74. O'Toole, A.J., and Edelman, S., "Structural Aspects of Face Recognition and the other Race Effect," *Memory and Cognition*, 22, pp. 208-224, 1994.
- 75. Padgett, C., and Cottrell, G., "Representing Face Images for Emotion Classification," *Advances in Neural Information Processing Systems 9*, pp. 894-900, Cambridge, MA, 1997.
- 76. Paul, D.B., "Speech Recognition Using Hidden Markov Models," *The Lincoln Laboratory Journal*, Vol. 3, No. 1, pp. 41-62, 1990.
- 77. Poelman, C.J., "The Paraperspective and Projective Factorization Methods for Recovering Shape and Motion," *Carnegie Mellon University*, Technical Report CMU-CS-95-173, Ph.D. dissertation, July 1995.
- 78. Press, W.H., Teukolsky, S.A., Vetterling, W.T., and Flannery, B.P., *Numerical Recipes in C, The Art of Scientific Computing*, 2nd Edition, Cambridge University Press, 1992.

- 79. Rabiner, L.R., "A Tutorial on Hidden Markov Models and Selected Applications in Speech Recognition," *Proceedings of The IEEE*, Vol. 77, No. 2, pp. 257-285, February 1989.
- 80. Ralescu, A., and Hartani, R., "Some Issues in Fuzzy and Linguistic Modeling," *IEEE Proc. of International Conference on Fuzzy Systems*, 1995.
- 81. Rinn, W.E., "The Neuropsychology of Facial Expression: A Review of the Neurological and Psychological Mechanisms for Producing Facial Expressions," *Psychological Bulletin*, 95, pp. 52-77, 1984.
- 82. Rosenblum, M., Yacoob, Y., and Davis, L.S., "Human Emotion Recognition from Motion Using a Radial Basis Function Network Architecture," *University of Maryland*, Technical Report CS-TR-3304, June 1994.
- 83. Samal, A., and Iyengar, P.A., "Automatic Recognition and Analysis of Human Faces and Facial Expression: A Survey," *Pattern Recognition*, Vol. 25, No. 1, pp. 65-77, 1992.
- 84. Samaria, F., and Young, S., "HMM-Based Architecture for Face Identification," *Image and Vision Computing*, Vol. 12, No. 8, pp. 537-543, October 1994.
- 85. Sato, T., Yamaguchi, T., "Generation of Facial Expression Using Chaotic Retrieval," *IEEE Symposium on Emerging Technologies & Factory Automation*, 1994.
- 86. Scherer, K.R., and Ekman, P., (Eds.), *Approaches to Emotion*, Lawrence Erlbaum Associates, 1984.
- 87. Starner. T., and Pentland, A., "Visual Recognition of American Sign Language Using Hidden Markov Models", *Proceedings of the International Workshop on Automatic Face- and Gesture-Recognition*, pp. 189-194, Zurich, Switzerland, June 1995.
- 88. Stork, D.G., and Hennecke, M.E., "Speechreading: An Overview of Image Processing, Feature Extraction, Sensory Integration and Pattern Recognition Techniques," *Proceedings of the Second International Conference on Automatic Face and Gesture Recognition*, Killington, Vermont, pp. xvi-xxvi, October 1996.
- 89. Suwa, M., Sugie, N., and Fujimura, K., "A Preliminary Note on Pattern Recognition of Human Emotional Expression," pp. 408-410.

- 90. Szeliski, R. and Coughlan, J. "Spline-Based Image Registration," *International Journal of Computer Vision*, Vol. 22, No. 3, pp. 199-218, 1997.
- 91. Terzopoulos, D., and Waters, K., "Analysis and Synthesis of Facial Image Sequences Using Physical and Anatomical Models," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 15, No. 6, pp. 569-579, June 1993.
- 92. Tomasi, C., "Shape and Motion from Image Streams: A Factorization Method," *Carnegie Mellon University*, Technical Report CMU-CS-91-172, Ph.D. dissertation, September 1991.
- 93. Turk, M., and Pentland, A., "Eigenfaces for Recognition," *Journal of Cognitive Neuroscience*, Vol. 3, No. 1, pp. 71-86, 1991.
- 94. Ushida, H., Takagi, T., and Yamaguchi, T., "Recognition of Facial Expressions Using Conceptual Fuzzy Sets," *Proc. of the 2nd IEEE International Conference on Fuzzy Systems*, pp. 594-599, 1993.
- 95. Valentin, D., Abdi, H., O'Toole, A.J., and Cottrell, G.W., "Connectionist Models of Face Processing: A Survey," *Pattern Recognition*, Vol. 27, No. 9, pp. 1209-1230, 1994.
- 96. Vanger, P., Honlinger, R., and Haken, H., "Applications of Synergetics in Decoding Facial Expressions of Emotion," *Proceedings of the International Workshop on Automatic Face- and Gesture-Recognition*, pp. 24-29, Zurich, Switzerland, June 1995.
- 97. Vetter, T., and Poggio, T. "Linear Object Classes and Image Synthesis from a Single Example Image," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Vol. 19, No. 7, pp. 733-741, 1997.
- 98. Viterbi, A.J., "Error Bounds for Convolutional Codes and an Asymptotically Optimal Decoding Algorithm," *IEEE Transactions on Information Theory*, Vol. 13, pp. 260-269, April 1967.
- 99. Wallbott, H., "Effects of Distortion of Spatial and Temporal Resolution of Video Stimuli on Emotion Attributions," *Journal of Nonverbal Behavior*, Vol. 16, No. 1, pp. 5-20, 1992.
- 100. Waters, K., "A Physical Model of Facial Tissue and Muscle Articulation Derived from Computer Tomography Data," *SPIE Visualization in Biomedical Computing*, 1808, pp. 574-583, 1992.

- 101. Wu, Y.T., Kanade, T., Cohn, J.F., and Li, C.C., "Optical Flow Estimation Using Wavelet Motion Model," *IEEE International Conference on Computer Vision*, pp. 992-998, Bombay, India, January 1998.
- 102. Xiong, Y., "High Precision Image Matching and Shape Recovery," *Carnegie Mellon University*, Ph.D. dissertation, 1995.
- 103. Yacoob, Y., and Davis, L., "Recognizing Human Facial Expression," *University of Maryland*, Technical Report CS-TR-3265, May 1994.
- 104. Yamato, J., Ohya, J., and ISHII, K., "Recognizing Human Action in Time-Sequential Images Using Hidden Markov Model," *IEEE International Conference on Computer Vision*, pp. 379-385, 1992.
- 105. Yang, J., "Hidden Markov Model for Human Performance Modeling," *University of Akron*, Ph.D. dissertation, August 1994.
- 106. Yuille, A.L., Cohen, D.S., and Hallinan, P.W., "Feature Extraction from Faces Using Deformable Templates," *International Journal of Computer Vision*, Vol. 8, pp. 104-109, 1992.
- 107. Zlochower, A.J., Cohn, J.F., Lien, J.J., and Kanade, T., "Automated Face Coding: A Computer Vision Based Method of Facial Expression Analysis in Parent-Infant Interaction," *International Conference on Infant Studies*, Atlanta, Georgia, April 1998.