Pattern Recognition

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Bayesian face recognition

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Abstract

We propose a new technique for direct visual matching of images for the purposes of face recognition and image retrieval, using a *probabilistic* measure of similarity, based primarily on a Bayesian (MAP) analysis of image differences. The performance advantage of this probabilistic matching technique over standard Euclidean nearest-neighbor eigenface matching was demonstrated using results from DARPA's 1996 â€œFERETâ€ face recognition competition, in which this Bayesian matching alogrithm was found to be the top performer. In addition, we derive a simple method of replacing costly computation of *nonlinear* (on-line) Bayesian similarity measures by inexpensive *linear* (off-line) subspace projections and simple Euclidean norms, thus resulting in a significant computational speed-up for implementation with very large databases.

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Keywords

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Face Recognition; Density estimation; Bayesian analysis; MAP/ML classification; Principal component analysis; Eigenfaces

About the Authorâ€"BABACK MOGHADDAM is a Research Scientist at Mitsubishi Electric Research Laboratory in Cambridge MA, USA. He received the B.S. (Magna Cum Laude) and M.S. (Honors) degrees in Electrical & Computer Engineering from George Mason University in 1989 and 1992, respectively, and his Ph.D. degree from the Department of Electrical Engineering and Computer Science at the Massachusettes Institute of Technology in 1997. During his doctoral studies he was a Research Assistant in the Vision & Modeling group at the MIT Media Laboratory, where he developed an automatic face recognition system that was the top competitor ion ARPA's â€œFERETâ€ face recognition competition. His research interests include computer vision, image processing, computational learning theory and statistical pattern recognition. He is a member of Eta Kappa Nu, IEEE and ACM.

About the Authorâ€"TONY JEBARA received his BEng in honours electrical engineering from McGill University, Canada in 1996. He also worked at the McGill Center for Intelligent Machines from 1994â€“1996 on computer vision and 3D face recognition research. In 1996, he joined the MIT Media Laboratory to work at the Vision and Modeling â€" Perceptual Computing Group. In 1998, he obtained his M.Sc. degree in Media Arts and Sciences for research in real-time 3D tracking and visual interactive behavior modeling. He is currently pursuing a Ph.D. degree at the MIT Media Laboratory

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About the Authorâ€”ALEX PENTLAND is the Academic Head of the M.I.T. Media Laboratory. He is also the Toshiba Professor of Media Arts and Sciences, and endowed chair last held by Marvin Minsky. He received his Ph.D. from the Massachusetts Institute of Technology in 1982. He then worked at SRI's AI Center and as a Lecturer at Stanford University, winning the Distinguished Lecturer award in 1986. In 1987 he returned to M.I.T. to found the Perceptual Computing Section of the Media Laboratory, a group that now includes over 50 researches in computer vision, graphics, speech, music, and humanâ€“machine interaction. He has done reseach in humanâ€“machine interface, computer graphics, artifical intelligence, machine and human vision, and has published more than 180 scientific articles in these areas. His most recent research focus is understanding human behavior in video, including face, expression, gesture, and intention recognition, as described in the April 1996 issue of Scientific American. He has won awards from the AAAI for his research into fractals; the IEEE for his research into face recognition; and from Ars Electronica for his work in computer vision interfaces to virtual environments.

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