Ain Shams University - Faculty of Engineering
Computer and Systems Engineering Department

Machine Vision Image Understanding Applied to Human Face Location and Identification

A Thesis

Submitted in Partial Fulfillement for the Requirements of the Degree of the Master of Science in Electrical Engineering (Computer and Systems Engineering)

Submitted by

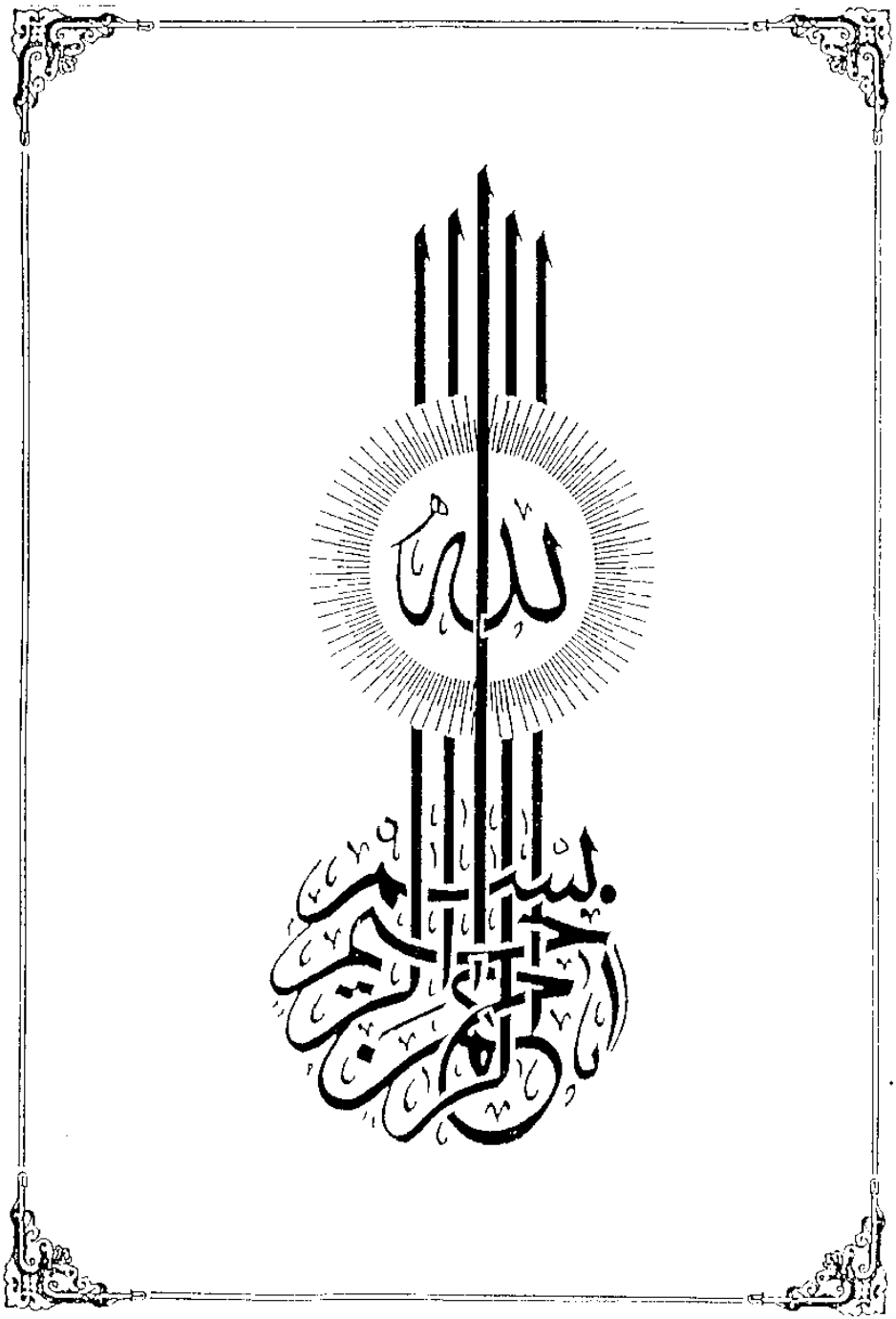
Mohamed Nabil MOUSTAFA

B.Sc. Electrical Engineering
(Computer and Control Section)
Ain Shams University, 1993

Supervised By

Prof. Dr. M. Adeeb R. GHONAIMY

Cairo-1997



بسم الله الرحمن الرحيم

﴿ و يسألونك عن الروح قل الروح من أمر ربي و ما أوتيتم من العلم إلا قليلا ﴾

صدق الله العظيم

(الإسراء ٨٥)

Abstract

Mohamed Nabil Moustafa: Machine Vision Image Understanding Applied to Human Face Location and Identification, Ain Shams University, 1997

This thesis considers segmentation and identification of human faces from images with clutter. The segmentation developed uses a novel technique based on genetic algorithms (GAs) and principal component analysis (PCA). The later method is used to encode the statistical features of the face during the learning phase by projecting the training face image set on the eigenvectors of the covariance matrix. These eigenvectors constitutes the axes of the face space.

During the testing phase, the GA searches in the cluttered input image for the closest region, in euclidean means, to the face space built a priori. The GA chromosome encodes the coordinates of the rectangle framing the face, while the fitness function is inversely proportional to the distance from the face space.

The geometrical face features are then located using the same technique but referring to the features spaces which are the eyes, nose and mouth spaces. The recognition phase takes place to identify the located face image and its geometrical features.

The whole system components were implemented and integrated. The sensitivity analysis of the integrated system was tested on some common face databases with encouraging results.

Keywords

Computer vision, Pattern Recognition, Image Understanding, Principal Component Analysis, Genetic Algorithms, Face Recognition.

Summary

The aim of this work is to introduce a novel technique for face location in an input cluttered image. First, the thesis surveys relevant literature in the field of face segmentation and recognition. Second, it presents the work done in face recognition using Principal Component Analysis (PCA) method using either statistical or connectionist models. The PCA method is used to encode the statistical features of the face during the learning phase by projecting the training face image set on the eigenvectors of the covariance matrix. These eigenvectors constitutes the axes of the face space. A more comprehensive description follows by a set of experiments.

After a brief definition of a genetic algorithm, Chapter 3 introduces the proposed genetic algorithms for face location (GAFL) which searches in the cluttered input image for the closest region, in euclidean means, to the face space built a priori. The proposed GAFL architecture and its motivation are then described. Finally, results are presented through a series of detailed experiments on some common face databases with encouraging results

Some investigations done on the PCA approach are then described. These investigations tried to determine some necessary system parameters in an fully automated way. These parameters are the number of eigenfaces, the threshold of the distance from face space value and the threshold of the distance from face class value. A comparison between the GAFL and the distance from face space map method is held. The integration between the proposed GAFL (for face location) and the eigenfaces (for recognition) is intorduced. The sensitivity of this approach is then studied against variation in size, illumination and rotation. The experimental results of the system sensitivity are presented.

Finally, Chapter 6 concludes the thesis, by summarizing the results obtained and indicating the future directions of face recognition.

Acknowledgments

I would like to express my sincere appreciation to Prof. Adeeb R. Ghonaimy for his valuable help and profound encouragement. I have enjoyed being his student.

I would like also to thank the professors and staff members of my department who helped me.

Special thanks to my wife for her valuable advice in preparing the manuscript and for being understanding and selfless.

Finally, I would like to thank my parents and my sister for their strong support during all my life.

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