FINAL ORAL EXAMINATION

OF

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B.S., UNIVERSITY OF CENTRAL FLORIDA, 2007
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FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY
(COMPUTER ENGINEERING)

Tuesday, March 11, 2014, 9:00 A.M.
CREOL, Room 102

DISSERTATION COMMITTEE
Professor Mubarak Shah, Chairman
Professor Rahul Sukthankar
Professor Niels da Vitoria Lobo
Professor Xin Li
Professor Jun Wang
OUTLINE OF GRADUATE STUDIES

Major: Computer Engineering

Courses: Computer Vision Tappen
Advanced Computer Vision Shah
Computer Vision Systems Shah
3D Computer Vision Foroosh
Image Processing Foroosh
Mathematical Methods on Image Analysis Li

SELECTED PUBLICATIONS, TALKS AND PATENTS


Face Recognition for Web-Scale Datasets, E.G. Ortiz and B.C. Becker, ELSEVIER Computer Vision and Image Understanding (CVIU), 2014.

Face Recognition in Movie Trailers via Mean Sequence Sparse Representation-based Classification, E.G. Ortiz, A. Wright, and M. Shah, IEEE International Conference on Computer Vision and Pattern Recognition (CVPR), 2013.


Evaluation of Face Recognition Techniques for Application to Facebook, B.C. Becker and E.G. Ortiz, IEEE Conference on Automatic Face and Gesture Recognition (FG), 2008. (Oral)

With the increasing pervasiveness of digital cameras, the Internet, and social networking, there is a growing need to catalog and analyze large collections of photos and videos. In this dissertation, we explore unconstrained still-image and video-based face recognition in real-world scenarios, e.g. social photo sharing and movie trailers, where people of interest are recognized and all others are ignored. In such a scenario, we must obtain high precision in recognizing the known identities, while accurately rejecting those of no interest.

Recent advancements in face recognition research has seen Sparse Representation-based Classification (SRC) advance to the forefront of competing methods. However, its drawbacks, slow speed and sensitivity to variations in pose, illumination, and occlusion, have hindered its wide-spread applicability. The contributions of this dissertation are three-fold:

1. For still-image data, we propose a novel Linearly Approximated Sparse Representation-based Classification (LASRC) algorithm that uses linear regression to perform sample selection for $l_1$-minimization, thus harnessing the speed of least-squares and the robustness of SRC. On our large dataset collected from Facebook, LASRC performs equally to standard SRC with a speedup of 100-250x.

2. For video, applying the popular $l_1$-minimization for face recognition on a frame-by-frame basis is prohibitively expensive computationally, so we propose a new algorithm Mean Sequence SRC (MSSRC) that performs video face recognition using a joint optimization leveraging all of the available video data and employing the knowledge that the face track frames belong to the same individual. Employing MSSRC results in a speedup of 5x on average over SRC on a frame-by-frame basis.

3. Finally, we make the observation that MSSRC sometimes assigns inconsistent identities to the same individual in a scene that could be corrected based on their visual similarity. Therefore, we construct a probabilistic affinity graph combining appearance and co-occurrence similarities to model the relationship between face tracks in a video. Using this relationship graph, we employ random walk analysis to propagate strong class predictions among similar face tracks, while dampening weak predictions. Our method results in a performance gain of 15.8% in average precision over using MSSRC alone.
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1984 Born in Baton Rouge, LA
2003-07 B.S., University of Central Florida, Orlando, FL
2005-06 Robotics Programmer, University of Central Florida, Orlando, FL
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2007-14 Ph.D., University of Central Florida, Orlando, FL
2014 Computer Vision Scientist, Sighthound, Orlando, FL

SELECTED HONORS

2007-10 NSF Graduate Research Fellowship $171,000
2007-14 FEF McKnight Doctoral Fellowship $68,000