



**UNIVERSITY OF CENTRAL FLORIDA**  
**CENTER FOR RESEARCH IN COMPUTER VISION**

**FINAL ORAL EXAMINATION**

*OF*

ENRIQUE GABRIEL ORTIZ  
B.S., UNIVERSITY OF CENTRAL FLORIDA, 2007  
M.S., UNIVERSITY OF CENTRAL FLORIDA, 2009

*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

<b>Courses:</b> 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

**Open-Universe Face Recognition in Movie Trailers via Sparse Representation and Affinity-based Propagation**, E.G. Ortiz and M. Shah, *International Journal of Computer Vision (IJCV)*, 2014. (Under Review)

**Who Do I Look Like? Determining Parent-Offspring Resemblance via Genetic Features**, A. Dehghan, E.G. Ortiz, R. Villegas, and M. Shah, *IEEE International Conference on Computer Vision and Pattern Recognition (CVPR)*, 2014.

**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.

**Video Action Recognition with a Handful of Labeled Examples**, E.G. Ortiz, R. Sukthankar, and M. Shah, *AAAI Symposium on Weakly Supervised Learning from Multimedia*, 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)

**Video Face Recognition**, E.G. Ortiz, A. Wright, and M. Shah, US Patent 61/857,957 (Pending).

# DISSERTATION

## TAMING WILD FACES: WEB-SCALE, OPEN-UNIVERSE FACE IDENTIFICATION IN STILL AND VIDEO IMAGERY

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.



## **ENRIQUE GABRIEL ORTIZ**

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
2006-07	Undergraduate Research Assistant, Machine Learning Lab, University of Central Florida, Orlando, FL
2006	Undergraduate Research Assistant, Automation Sciences Lab, University of California-Berkeley, Berkeley, CA
2007-09	M.S., University of Central Florida, Orlando, FL
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