Bi-Annual Report | 2010 & 2011

University of Central Florida

Computer VISION

A Coherent Framework for Photo-Quality Assessment and Enhancement based on Visual Aesthetics

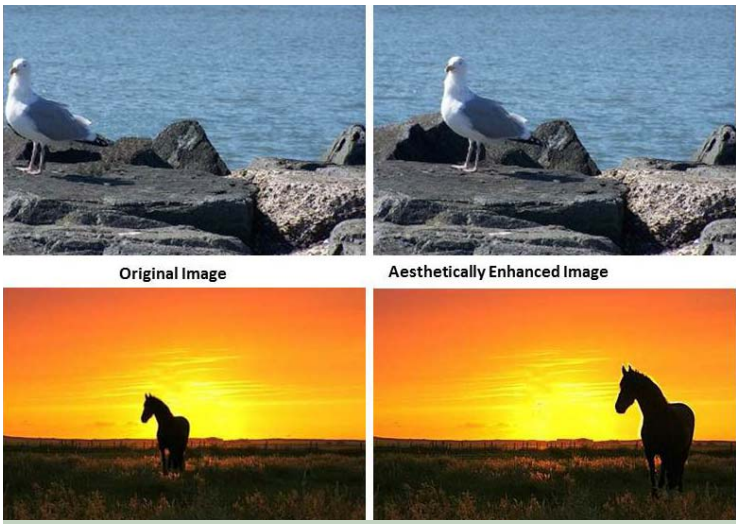
ACM MM Best Paper Award Nomination

Subh Bhattacharya
Ph.D. Student

Subhabrata (Subh) Bhattacharya's paper titled "*A Coherent Framework for Photo-Quality Assessment and Enhancement based on Visual Aesthetics*" was nominated for the best paper award in a top tier conference in multimedia, ACM MM 2010, held in Florence, Italy. In this paper, he introduced a semi-automatic method to enhance the appeal of a natural photograph using high-level aesthetic cues. The best paper nominee talk is available in video lectures at: http://videolectures.net/acmmm2010_bhattacharya_cfp/

The project was also presented at Intel *Research's Labs 2010 Technology Open house* event (http://www.youtube.com/watch?v=uDltOliN3Hg), where Subh was collaborating with one of his co-authors of the paper Dr. Rahul Sukthankar, as a summer intern.

An extension of the paper was published in ACM transactions on multimedia computing, communication and applications (TOMCCAP), Volume 75, Issue 1, October 2011.



Results

Visual Crowd Surveillance through a Hydrodynamics Lens

An article summarizing our work in the area of visual analysis of dense crowds was highlighted on the cover page of the *Communications of the ACM* Magazine in Volume 54, Issue 12, December 2011. The article is co-authored by Brian Moore, Saad Ali, Ramin Mehran and Mubarak Shah.

Dr. Mubarak Shah delivered a keynote talk on the same topic at 2010 ACM Multimedia Conference held in October 2010 at Florence, Italy. The talk is available in video lectures at: http://videolectures.net/acmmm2010_shah_vcs/

Computer Vision Lab
University of Central Florida

Dr. Mubarak Shah
Agere Chair Professor
Director, Computer Vision Lab

Ms. Cherry Place
Laboratory Manager

Research Associates

Dr. Imran Saleemi, Ph.D.

Ph.D. Students

Subhabrata Bhattacharya
Afshin Dehghan
Soumyabrata Dey
Md. Ahsan Habib
Haroon Idrees
Hamid Izadinia
Salman Khokhar
Wenhui Li
Baoyuan Liu
Ramin Mehran
Shayan Modiri Assari
Oliver Nina
Omar Oreifej
Enrique Ortiz
Ryan Patrick
Kishore Reddy
Vladimir Reilly
Amir Roshan Zamir
Guang Shu
Berkan Solmaz
Khurram Soomro
Nasim Souly
Waqas Sultani
Yicong Tian
Gonzalo Vaca
Guanxiong Yang
Yang Yang
Dong Zhang

M.S. Students

Jonathan Poock

H.S. Students

Tommy Goris
Megan Herrera

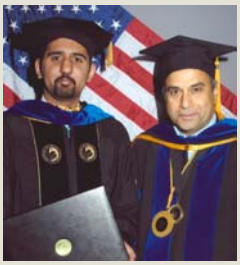
Group Picture

Top Row: Amir Roshan Zamir, Nasim Souly, Khurram Soomro, Kishore Reddy, Bryant Liu, Dong Zhang, Md. Ahsan Habib, Waqas Sultani, Jonathan Poock, Pau Agusti Ballester, Ramin Mehran, Ryan Patrick, Oliver Nina, Dr. Mubarak Shah, Hamid Izadinia, Vladimir Reilly, Dr. Eraldo Ribeiro, Grayson Yang, Jianwei Luo, Afshin Dehghan
Bottom Row: Shayan Modiri Assari, Enrique Ortiz, Yang Yang, Yicong Tian, Soumyabrata Dey, Guang Shu, Salman Khokhar, Subh Bhattacharya, Dr. Imran Saleemi, Wenhui Li, Gonzalo Vaca, Berkan Solmaz, Haroon Idrees

Computer Vision Lab Graduates

Dr. Mikel Rodriguez

Thesis: *Spatio Temporal Maximum Average Correlation Height Templates in Action Recognition and Video Summarization*
Graduation Term: Summer 2010
Current Affiliation: MITRE



Dr. Imran Saleemi

Thesis: *Pattern of Motion: Discovery and Generalized Representation*
Graduation Term: Spring 2011
Current Affiliation: Post-Doc, Computer Vision Lab, UCF

Dr. Ramin Mehran

Thesis: *Crowd Motion Analysis*
Graduation Term: Fall 2011
Current Affiliation: Microsoft

Meet our New Fall 2011 Ph.D. Students

Afshin Dehghan

University of Tehran

Md. Ahsan Habib

University of Dhaka

Wenhui Li

University of Electronic Science and Technology of China

Shayan Modiri Assari

Sharif University of Technology

Oliver Nina

Brigham Young University

Khurram Soomro

Lahore University of Management Sciences

Nasim Souly

Iran University of Science and Technology

Waqas Sultani

Seoul National University

Yicong Tian

Beijing University of Posts and Telecommunications

Dong Zhang

Zhejiang University

Visiting Scholars

Sergio Alvarez

Ph.D. Student
(Feb-Aug '11)
University of Alcalá

Jesper Bækdahl

Ph.D. Student
(Nov '11-June '12)
Aalborg University

Xiali Wang

Assoc. Professor
(Jan '10-Jan'11)
Chang'an University

Markus Quaritsch

Sr. Researcher
(Jan-March '10)
Klagenfurt University

Jacob Buhl

Ph.D. Student
(Nov '10-Dec '11)
Aalborg University

Eraldo Ribeiro

Assoc. Professor
(July-Dec '11)
Florida Institute of Technology

Jianwei Luo

Ph.D. Student
(Nov '10-Nov '12)
Beihang University

Pau Agusti-Ballester

Ph.D. Student
(Sep-Dec '11)
University Jaume I

Pingkun Yan

Professor
(Sep-Nov '11)
Chinese Academy of Sciences

Krishnan Rangarajan

Professor
(June-July '11)
Dayanada Sagar College of Engineering

SoTL Award

Dr. Mubarak Shah won the 2010-2011 UCF *Scholarship of Teaching and Learning* Award (SoTL) for his outstanding contributions.

The criteria for evaluating applicants' for this award include the following four major categories:

1. Value or impact of SoTL efforts both within the discipline and to the teaching and learning community.
2. Peer recognition of research and creative efforts.
3. Publication of research and creative efforts.
4. External grant and contract support for SoTL activities appropriate to the applicant's discipline.

CECS Advisory Board Award

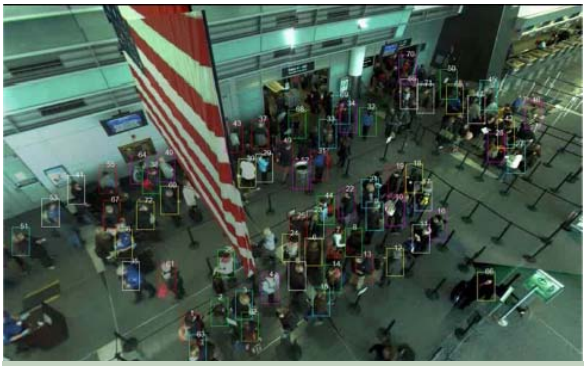
Dr. Mubarak Shah was recommended unanimously for this important award by the Board's Awards Committee and was selected to receive the 2011 College of Electrical Engineering & Computer Science (CECS) Advisory Board Award for Faculty Excellence.

The CECS Advisory Board Award for Faculty Excellence recognizes one CECS faculty member each year who has demonstrated outstanding performance during the three to five previous academic years. Consideration is given to meritorious recognition by peers at the national level, outstanding accomplishments in research and/or education, or superb administrative performance.

Computer Vision Lab Research

Pacific Northwest National Lab (PNNL)

UCF was awarded $340,298 in relation to the Evaluation of Tracking Algorithms on **ISIS** (*Imaging System for Immersive Surveillance)* Video Data for the Wide Area Surveillance Project. The project is a part of the Wide-Area Surveillance (WAS) project being implemented by the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T). This project targets the development and evaluation of desirable crowd tracking algorithm to be used in the (ISIS) context. ISIS is a camera system developed by *Massachusetts Institute of Technology/Lincoln Laboratories* (MIT/LL) and managed by the *Pacific Northwest National Laboratory* (PNNL). The ISIS consists of a 100 Mpixel sensor (an array of image servers and associated hard drive storage array). While the ISIS camera can collect a large volume of video data for a wide area monitored, it demands an effective crowd tracking algorithm to be integrated with the ISIS software system supporting video viewing and analysis.



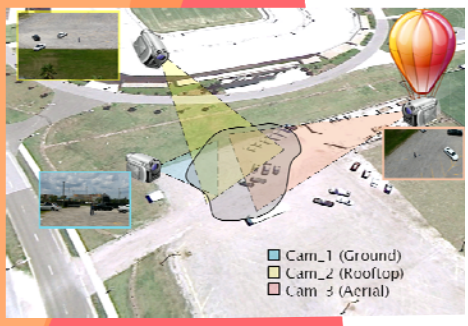
Example of tracking by NONA System

UCF has developed the **NONA** system for automatic detection and tracking of humans in ISIS video. The latest version of the NONA system implements several unique capabilities allowing close to real time tracking of a large number of humans visible in a static camera scenario. In addition to inclusion of a new probabilistic human detector, the NONA system employs a part based appearance model, and explicit handling of partial occlusions to enable reliable and robust detection and tracking of a target across frames. The framework is general and is readily applicable to a variety of human tracking data sets, where it has shown very encouraging results.

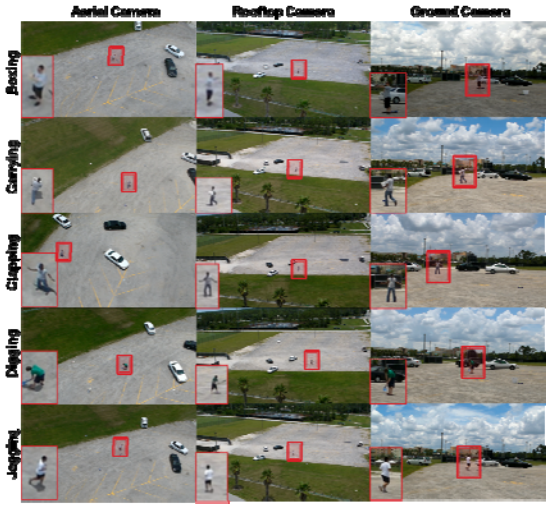
Harris

The UCF Computer Vision Lab has received continued support from the *Harris Corporation* during several past years. In 2011, Harris awarded a $100,000 grant for UCF to extend the state of the art in action and activity recognition in visual data. In particular, UCF will employ sparse representation and minimization techniques to attempt to learn action models using the fewest number of training examples or videos. The goal of the research to be conducted during this effort is to develop new ideas in activity recognition, which are novel in a number of ways, in order to create a deployable solution that can be used in the field to greatly reduce video analysts' workload without sacrificing reliability or detection or recognition accuracy.

UCF-ARG Dataset



The UCF-ARG (University of Central Florida-Aerial, Rooftop and Ground camera) Dataset is a Multiview Human Action dataset. UCF-ARG consists of 10 actions performed by 12 actors recorded from a ground camera, a rooftop camera at a height of 100 feet, and an aerial camera mounted onto the payload platform of a 13' Kingfisher Aerostat helium balloon as illustrated in the figure.



The 10 actions are Boxing, Carrying, Clapping, Digging, Jogging, Open-Close Trunk, Running, Throwing, Walking and Waving. Except for Open-Close Trunk, all the other actions are performed 4 times by each actor in different directions. Open-Close Trunk is performed only 3 times, i.e. on 3 cars parked in different directions. The actions are captured using a high-definition camcorder 1920 X 1080 at 60fps (frames per second).

UCF-ARG Evaluation Set: The evaluation set has approximately 3 minutes of video captured using the aerial, rooftop and ground cameras. At any given instance the number of actors in the camera view can vary from 4 to 8 and the actors are free to perform any of the 10 actions and can change the action being performed at any time. The sequences from the aerial camera are annotated using the VIPER format for evaluation.

The dataset is available at:
http://vision.eecs.ucf.edu/data/UCF-ARG.html

Undergraduate Research

2011 GAUSS Group (from left to right): Edward Romero, Eric Niederman, David Perlaza, Casey Van Buren, Michael Bird, Toby Boas, Matthew Suttinger, Deveron Crawford, Dr. Mubarak Shah, Dr. Bob Muise, Dr. Alvero Islas, Katie Mercier, Dr. Piotr Mikusinski, Dr. Niels Lobo, Dr. Connie Schober, Dr. Brian Moore, Aritra Dutta, Dr. Xin Li

NSF CSUMS

www.math.ucf.edu/csums/

Computational Science Training for Undergraduates in Mathematical Sciences

(Co-PIs: Drs. X. Li; C. Schober; P. Mikusinski & N. Lobo)

- Michael Bird
- Toby Boas
- Deveron Crawford
- Zachary Medina
- Katie Mercier
- Eric Niederman
- David Perlaza
- Brandon Reeves
- Edward Romero
- Matthew Russo
- Matthew Suttinger
- Casey Van Buren

NSF Research Experience for Undergraduates(REU)

vision.eecs.ucf.edu/reu-web/reu.html

(Co-PIs: Drs. N. Lobo & M. Tappen)

- Alexander Darino—University of Central Florida
- Emily Hand—University of Nevada, Reno
- Jeffrey Loppert—University of Central Florida
- Corey Pittman—University of Central Florida
- Taylor Rassmann—University of Central Florida
- Sahil Shah—University of Maryland
- Thomas Swift—University of Rochester
- Nancy Zanaty—University of Central Florida

NSF Research Experience for Teachers

- Charles Lynch—Hagerty High School
- Francisco Chaparro-Torress—Olympia High School

2011 REU Group (from left to right): Tommy Goris, Charles Lynch, Megan Herrera, Francisco Chaparro-Torress, Alex Darino, Dr. Niels Lobo, Dr. Mubarak Shah, Thomas Swift, Corey Pittman, Emily Hand, Taylor Rassmann, Amy Ko, Nancy Zanaty, Berkan Solmaz, Sahil Shah, Jeffrey Loppert

Army Research Office (ARO) HSAP

Tommy Goris
Cypress Creek HS

UCF received a High School Apprenticeship Program supplement from the Army Research Office to its project on ***Taming Crowded Visual Scenes***. The High School Apprenticeship Program (**HSAP**) is a commuter program for high school juniors and seniors who demonstrate an interest in science, technology, engineering, or mathematics (STEM) to work as an apprentice in an Army funded university research laboratory. HSAP/URAP is designed so that students can apprentice in fields of their choice with experienced scientists and engineers full-time during the summer or part-time during the school year.

Tommy Goris of Cypress Creek High School and Megan Herrera of Timber Creek High School were selected to apprentice during the summer of 2011. Tommy worked on extraction of ground truth locations for about 8,000 images taken in Pittsburgh, PA using Google Street View. Megan investigated the behavior of the new Google image search engine which searches based on visual characteristic of an image instead of text.

Megan Herrera
Timber Creek HS

2010 & 2011 Publications & Invited Talks

BOOK CHAPTER

Subhabrata Bhattacharya, Haroon Idrees, Imran Saleemi, Saad Ali, and Mubarak Shah, ***Moving Object Detection and Tracking in Infra-red Aerial Imagery***, Machine Vision Beyond Visible Spectrum, Augmented Vision and Reality, Volume 1, 2011 Springer series, DOI: 10.1007/978-3-642-11568-4.

CONFERENCES

Shandong Wu, Brian Moore, and Mubarak Shah, ***Chaotic Invariants of Lagrangian Particle Trajectories for Anomaly Detection in Crowded Scenes***, IEEE Conference on Computer Vision and Pattern Recognition 2010, San Francisco, CA.

Imran Saleemi, Lance Hartung, and Mubarak Shah, ***Scene Understanding by Statistical Modeling of Motion Patterns***, IEEE Conference on Computer Vision and Pattern Recognition 2010, San Francisco, CA

Mikel Rodriguez, ***CRAM: Compact Representation of Actions in Movies***, IEEE Conference on Computer Vision and Pattern Recognition 2010, San Francisco, CA.

Omar Oreifej, Ramin Mehran, and Mubarak Shah, ***Human Identity Recognition in Aerial Images***, IEEE Conference on Computer Vision and Pattern Recognition 2010, San Francisco, CA.

Vladimir Reilly, Haroon Idrees, Mubarak Shah, ***Detection and Tracking of Large Number of Targets in Wide Area Surveillance***, European Conference on Computer Vision (ECCV), Crete, Greece, 2010.

Vladimir Reilly, Berkan Solmaz, Mubarak Shah, ***Geometric Constraints for Human Detection in Aerial Imagery***, European Conference on Computer Vision (ECCV), Crete, Greece, 2010.

Amir Roshan Zamir and Mubarak Shah, ***Accurate Image Localization Based on Google Maps Street View***, European Conference on Computer Vision (ECCV), Crete, Greece, 2010. (Received ECCV travel grant for this paper).

Ramin Mehran, Brian Moore, Mubarak Shah, ***A Streakline Representation of Flow in Crowded Scenes***, European Conference on Computer Vision (ECCV), Crete, Greece, 2010.

Subhabrata Bhattacharya, Rahul Sukthankar, and Mubarak Shah, ***A Coherent Framework for Photo-Quality Assessment and Enhancement based on Visual Aesthetics***, full paper in ACM Multimedia International conference, Florence 2010. (Winner of Travel grant, Nominated for best paper award).

Subhabrata Bhattacharya, Rahul Sukthankar, Rong Jin, and Mubarak Shah, ***A Probabilistic Representation for Efficient Large Scale Visual Recognition Tasks***, IEEE Conference on Computer Vision and Pattern Recognition, Colorado Springs, CO, USA, June 21-25, 2011.

Omar Oreifej, Guang Shu, Teresa Pace, and Mubarak Shah, ***A Two-Stage Reconstruction Approach for Seeing Through Water***, IEEE Conference on Computer Vision and Pattern Recognition, Colorado Springs, CO, USA, June 21-25, 2011.

Jingen Liu, Mubarak Shah, Benjamin Kuipers, and Silvio Savarese, ***Cross-View Action Recognition via View Knowledge Transfer,*** IEEE Conference on Computer Vision and Pattern Recognition 2011, Colorado Springs, CO, USA, June 21-25, 2011. (Oral).

Sangmin Oh, Anthony Hoogs, Amitha Perera, Naresh Cuntoor, Chia-Chih Chen, Jong Taek Lee, Saurajit Mukherjee, J. K. Aggarwal, Hyungtae Lee, Larry Davis, Eran Swears, Xioyang Wang, Qiang Ji, Kishore Reddy, Mubarak Shah, Carl Vondrick, Hamed Pirsiavash, Deva Ramanan, Jenny Yuen, Antonio Torralba, Bi Song, Anesco Fong, Amit Roy-Chowdhury, and Mita Desai, ***A Large-scale Benchmark Dataset for Event Recognition in Surveillance Video***, IEEE Conference on Computer Vision and Pattern Recognition 2011, Colorado Springs, CO, USA, June 21-25, 2011.

Salman Khokhar, Imran Saleemi, and Mubarak Shah, ***Statistical Event Representation and Similarity Invariant Classification by KL Divergence Minimization***, International Conference on Computer Vision, November 2011, Barcelona, Spain.

Shandong Wu, Omar Oreifej, and Mubarak Shah, ***Action Recognition in Videos Acquired by a Moving Camera Using Motion Decomposition of Lagrangian Particle Trajectories***", International Conference on Computer Vision, November 2011, Barcelona, Spain.

JOURNALS

Saad Ali and Mubarak Shah, ***Human Action Recognition in Videos Using Kinematic Features and Multiple Instance Learning,*** IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI), Volume 32, Issue 2, Pages: 288-303, February 2010.

Subhabrata Bhattacharya, Rahul Sukthankar and Mubarak Shah, ***A holistic approach to aesthetic enhancement of photographs***, ACM Transactions on Multimedia Computing, Communications, and Applications (TOMCCAP), Volume 75, Issue 1, October 2011.

Brian E. Moore, Saad Ali, Ramin Mehran, and Mubarak Shah, ***Visual Crowd Surveillance through a Hydrodynamic Lens***, Communications of ACM, December 2011, vol. 54, no. 12, pp 64-73.

INVITED TALKS (by Prof. Shah)

Human Action Recognition and Key Motion Pattern Detection, Department of Statistics, UCLA, February 23, 2010.

Detecting Key Motion Patterns, IEEE Local chapter, Princeton, NJ, April 23, 2010.

Human Action Recognition: Chaotic Invariants, Diffusion Maps and Feature Trees, ECE Department, Columbia University, NY, April 26, 2010.

Human Action Recognition: Chaotic Invariants, Diffusion Maps and Feature Trees, IBM TJ Watson Distinguished Speaker Series, Hawthorne, NY, April 27, 2010.

Visual Analysis of Crowded Scenes, NVSED, U.S. Army, Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA, May 12, 2010.

Human Action Recognition: Trajectories, Bag of Video Words, and Spatio-temporal Interest Points, invited talk, First International Workshop on Computer Vision for Computer Games, June 14th 2010, San Francisco, CA.

Detecting Motion Patterns, ACM MM Conference 2010 meta reviewer workshop, University of Amsterdam, June 24, 2010.

Detecting Motion Patterns, University of Houston, July 2, 2010.

Human Action Recognition: Trajectories, Bag of Video Words, and Spatio-temporal Interest Points, Google, July 9, 2010.

Semantic Video Retrieval using High-level Context, Invited Talk, Large-Scale Multi-Media Workshop, ICPR, Istanbul, Turkey, August 22, 2010.

***Airborne Video Surveillance*, AVSS, Plenary Lecture**, August 30, 2010, Boston, MA.

Visual Crowd Surveillance is Like Hydrodynamics, Keynote Talk, ACM Conference on Multimedia, Florence, Italy, October 28, 2010.

UAV Video Analysis, Invited Talk, ACIVS 2010, Sydney, Australia, December 13, 2010.

Visual Crowd Analysis, University of Technology, Sydney, Australia, December 14, 2010.

UAV Video Analysis, Monash University, Churchill Australia, December 16, 2010.

Human Action Recognition, Distinguished Lecture, UAE University, Al Ain, UAE, December 19, 2010.

Human Action Recognition: Trajectories, Bag of words, Feature Tree, ACM Distinguished Speaker Program Lecture, Iqra University, Karachi, Pakistan, December 23, 2011.

Recognizing Human Actions, IBA Sukkur, Sukkur, Pakistan, December 27, 2010.

Airborne Video Surveillance, Keynote Talk, ICMV 2010 : 2nd International Conference on Machine Vision, Islamabad, Pakistan, December 29, 2010.

Human Action Recognition: Trajectories, Bag of words, Feature Tree, ACM Distinguished Speaker Program Lecture, Paris Tech, Paris, France, January 4, 2011.

Scalable Image Matching, invited talk at USPTO Workshop on Image Search and Analysis, April 4, 2011.

Video Analytics and Activity Recognition, SPIE "Biometric Technology for Human Identification VIII" Conference, Orlando, April 25, 2011. Keynote talk.

***Crowd Analysis*, Short Spring School on Surveillance**, May 17-19, 2011, Modena, Italy. (Half Day Course).

Visual Recognition of Human Action, Computer Science, University of Warwick, Coventry, UK, May 23, 2011.

***Airborne Video* Surveillance**, Ningbo Institute of Material Technology & Engineering—Chinese Academy of Sciences, Ningbo, China, August 11, 2011.

Visual Crowd Surveillance, 3rd Sino-USA Summer School in Vision, Learning and Pattern Recognition, August 7-14, 2011, Chengdu, China. (Short Course).

Patterns of Motion: Discovery and Generalized Representation, ICIG 2011, August 12-15, 2011, Hefei, China. (Keynote Speech).

Visual Recognition of Human Action, Chinese Academy of Sciences, Xi'an, China, August 17, 2011.

Video Surveillance Systems, ICVS 2011, September 20-22, 2011, Sophia Antipolis, France. (Keynote Speech).

***Human Actions*, ARO/DARPA Workshop on Exploitation of Full Motion Video Sequences,** October 20-21, 2011, College Park, MD.

***Visual Tracking*,** DHS S&T Video Analytics Symposium, MIT Lincoln Lab, November 2, 2011.

Patterns of Motion: Discovery and Generalized Representation, Escuela Politecnica Universidad de Alcal, Madrid ESPAA (SPAIN), November11, 2011.

Guest Speakers

http://www.eecs.ucf.edu/index.php?id=research/seminars

Fernando De la Torre Carnegie Mellon University	Learning Components for Human Sensing	March 4, 2010
Jiangjian Xiao Sarnoff Corporation	Aerial Video Processing for Scene Understanding and Object Tracking	April 8, 2010
Ramesh Jain University of California, Irvine	Contenxt: Bridging the Semantic Gap	April 9, 2010
Antonio Torralba Massachusetts Institute of Technology	Scene and Object Recognition in Context	August 2, 2010
Jake Aggarwal University of Texas at Austin	Computer Recognition of Human Activities and Objects	August 5, 2010
Justin Romberg Georgia Institute of Technology	An Introduction to Compressed Sensing	August 6, 2010
Nuno Vasconcelos University of California, San Diego	Understanding Video of Crowded Environments	October 18, 2010
John Kender Columbia University	Video Genetics: A Case Study from YouTube	November 8, 2010
Ioannis Kakadiaris University of Houston	3D-Aided Face Recognition	November 18, 2010
Yaser Sheikh Carnegie Mellon University	The Adventures in Reconstructing Dynamic Scenes in Three-Dimensions	November 29, 2010
Roland Kwitt University of Salzburg	Joint Probabilistic Model for Wavelet Coefficients with Application to Image Retrieval and Classification	January 18, 2011
Rudolf Mester Goethe University	Learning Multi-View Correspondences from Temporal Coincidences	January 21, 2011
Katsushi Ikeuchi University of Tokyo	e-Heritage Projects in Italy, Cambodia, and Japan: Les-son Learned	October 17, 2011
Lawrence Carin Duke University	Exploiting Low-Dimensional Structure in Image and Video Analysis	October 27, 2011
Takeo Kanade Carnegie Mellon University	First Person Vision	November 17, 2011

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