Prithviraj Banerjee

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RESEARCH INTERESTS

Computer Vision, Machine Learning, Pattern Recognition, Statistical inference and Optimization Probabilistic dynamical models for activity classification and detection.

EDUCATION

University of Southern California, Los Angeles, California, USA

Doctor of Philosophy, Computer Science   August 2008 – August 2014

- Thesis Topic: Incorporating Aggregate Feature Statistics in Structured Dynamical Models for Human Activity Recognition
- Advisor: Professor Ram Nevatia

M.S., Computer Science   August 2008 – May 2011
- GPA: 4.0 out of 4.0
- Advisor: Professor Ram Nevatia

Indian Institute of Technology (IIT), Kharagpur, West Bengal, India

M.Tech. & B.Tech., Electronics and Electrical Communication   August 2003 – May 2008
- GPA: 9.25 out of 10.00
- Master's Degree Specialization: Visual information and Embedded Systems
- Thesis Topic: Framework for Human Tracking and Model Generation
- Advisor: Professor Somnath Sengupta

HONOURS AND AWARDS

Provost Fellowship, University of Southern California, 2008-2010. Awarded to the top 100 Ph.D. students across all disciplines.

Keshab Parhi Award for the best demonstrable Master's thesis project of practical interest, Indian Institute of Technology, Kharagpur, 2008

PUBLICATIONS

P. Banerjee and R. Nevatia, "Multi-State Discriminative Video Segment Selection for Complex Event Classification," *Asian Conference on Computer Vision (ACCV)* , 2014

P. Banerjee and R. Nevatia, "Pose Filter based Hidden-CRF models for Activity Detection," *European Conference on Computer Vision (ECCV)* , 2014

P. Banerjee and R. Nevatia, "Pose Based Activity Recognition using Multiple Kernel Learning," *IAPR International Conference on Pattern Recognition (ICPR)* , 2012, Japan.

P. Banerjee and R. Nevatia, "Learning Neighborhood Co-occurrence Statistics of Sparse Features for Human Activity Recognition," *IEEE Advanced Video and Signal-Based Surveillance (AVSS)* , 2011, Austria.

P. Banerjee and R. Nevatia, "Dynamics based Trajectory Segmentation for UAV videos," *IEEE Advanced Video and Signal-Based Surveillance (AVSS)* , 2010, Boston, USA.

P. Natarajan, P. Banerjee and R. Nevatia, " Accurate Person Tracking Through Changing Poses for Multi-view Action Recognition," *ICVGIP*, 2010, India.

P. Natarajan, P. Banerjee, F. Khan and R. Nevatia, "Graphical Framework for Action Recognition using Temporally Dense STIPs," *IEEE WMVC*, 2009, Utah, USA.

P. Banerjee, A. Pinz and S. Sengupta, "Model generation for robust object tracking based on Temporally Stable Regions," *IEEE WMVC*, 2008, Colorado, USA.

P. Banerjee and S. Sengupta, "Human Motion Detection and Tracking for Video Surveillance," *National Conference for Communication*, 2008, Bombay, India.

Amazon.com, Seattle, Washington USA

Software Development Engineer   August 2014 – March 2016

Research Scientist   March 2016 – current

- *Amazon Go Grocery Store:* Developed machine learning and computer vision algroithms to build a grocery store where customers can shop without requiring manual checkout at a cashiers register. Worked on prototyping and developing customer tracking and identifiaction algorithms via analysis of video data.

University of Southern California, Los Angeles, California USA

Graduate Student   August 2008 – August 2014

- *Multi-State Video Segment Selection:* Recognize long range complex human events by pooling features from discriminative video segments. Developed provably faster linear time algorithm for single state segment selection problem. Developed fractional linear programming based multi-state video segment selection algorithm for dynamic feature pooling.
- *MindsEye:* (1) Developed activity recognition algorithms for modeling pairwise local neighborhood relationships of spatio-temporal features using Hidden-CRF models. (2) Developed techniques for pooling discriminative structured observation features, like inferred human pose distributions from pictorial structure models. (3) Developed Latent-SVM based HCRF algorithms for detecting activities in a continuous video stream, containing a sequence of complex key-pose transitions and involving interactions with hard to detect objects and other humans.
- *VIRAT:* Worked on event recognition in vehicular trajectories from Unmanned Aerial Vehicle videos. Developed a dynamic programming based trajectory smoothing and segmentation algorithm using second order Auto-Regressive models. Analyzed noise tolerance of hierarchical graphical models for recognizing complex human activities in aerial videos.

Indian Institute of Technology (IIT), Kharagpur, India

Undergraduate Student   August 2003 – May 2008

- *Human Detection and Tracking System for Video Surveillance.* The work involved the tracking of objects in motion and classifying them as Human or Non-Human entities using a Histogram of Oriented Gradients based human detector.
- *Model generation for Robust Object Tracking (Master's thesis).* A Temporally Stable Region (TSR) based object tracking system was developed with focus on tracking objects through partial and complete occlusion (received the Keshab Parhi best demonstrable Master's thesis award).

Institute of Electrical Measurement and Measurement Signal Processing, TU Graz, Austria

Internship   May 2007 – July 2007

Developed a new approach to tracking objects was implemented through the generation of Temporally Stable Regions and graph based matching.

Software R&D Group - Ricoh Company, Tokyo, Japan

Internship   May 2006 – July 2006

The work involved temporally segmenting the video of a factory worker assembling a product into key steps of the assembly operation and automatically extracting the various characteristic traits of the worker (Patent Application No.: 2007-151895 filed).

Division for Robotics & Remote Handling, Bhabha Atomic Research Centre (BARC), India

Internship   May 2005 – July 2005

The project involved setting up a Serial Communication interface between a remote robot and the base station, primarily for picture and range data transmission, creating GUI's for the Sensor Data Acquisition model and documenting existing codes for future reference of the lab.

Teaching assistant at USC for "Computer Vision" CSCI-574, Fall 2010

Teaching assistant at IIT Kharagpur for "Neural Networks", Spring 2008