Ninad Thakoor
3460 Florida St
Riverside, California, 92507
Email: ninadt@ucr.edu
Ph. 682-472-7685

Research Interests:
Computer Vision, Pattern Recognition, Real time systems, Image Processing

Education:
- **Ph.D.**   University of Texas at Arlington,
Electrical Engineering, December 2009.
"Dynamic Scene Interpretation and Understanding from Two Views"
Segmenting a dynamic scene based on structure and motion, visual object recognition

- **MS**   University of Texas at Arlington,
Electrical Engineering, 2004.
"Automatic Articulated Object Extraction and Classification from Video with Moving Camera"

- **BE**   University of Mumbai, India,
Electronics, and Telecommunications Engineering, 2001

Publications:
Patents:
1. Passenger Vehicle Make and Model Recognition System (UC Case No. 2012-863-1), Provisional patent application submitted
2. Method and System for Vehicle Classification (WO/2012/125687), Patent filed and published online, absorbed following provisional patents.
    a. A Structural Signature Based Passenger Vehicle Classification and Measurement System
    b. A Vehicle Ground Clearance Measurement System
    c. A Video Based Hierarchical Vehicle Classification

Book Chapters:
1. **N. S. Thakoor**, A. C. Cruz and B. Bhanu, "Video Bioinformatics Databases and Software" in Video Bioinformatics. Springer.
2. A. C. Cruz, B. Bhanu and **N. S. Thakoor**, "Understanding of the Biological Process of Non-Verbal Communication: Facial Emotion and Expression Recognition" in Video Bioinformatics. Springer.

Journal Articles:
1. A. L. Tambo, B. Bhanu, N. Ung, **N. Thakoor**, N. Luo, Z. Yang, "Understanding pollen tube growth dynamics using the Unscented Kalman Filter," Pattern Recognition Letters, Available online.
2. Suresh Kumar, Bir Bhanu, **N. S. Thakoor,** Subir Ghosh, "Modeling uncertainties in performance of object recognition," The Mathematical Scientist, 40 (1) , Jun. 2015
3. **N. S. Thakoor**, L. An, B. Bhanu, S. Sunderrajan, B.S. Manjunath, "People Tracking in Camera Networks: Three Open Questions," IEEE Computer, 48 (3), Mar. 2015, pp. 78-86

4. A. Cruz, B. Bhanu and **N. S. Thakoor**, "Background suppressing Gabor energy filtering," Pattern Recognition Letters, vol. 52, Jan. 2015, pp. 40–47

5. A. Cruz, B. Bhanu and **N. S. Thakoor**, "Vision and attention theory based sampling for continuous facial emotion recognition," IEEE Trans. Affective Computing, 5(4), Oct. 2014, pp. 418-431.

6. **N. Thakoor**, B. Bhanu, "Structural Signatures for Passenger Vehicle Classification in Video," IEEE Transactions on Intelligent Transportation Systems, 14(4), December 2013, pp. 1796-1805

7. S. Nair, B. Bhanu, S. Ghosh, **N. Thakoor**, "Predictive Models for Multibiometric Systems," Pattern Recognition, 47 (12), December 2014, pp. 3779–3792.

8. R. Wang, B. Bhanu, **N. Thakoor**, "Learning Small Gallery Size for Prediction of Recognition Performance on Large Populations," Pattern Recognition, 46(12), December 2013, pp. 3533-3547

9. **N. Thakoor**, J. Gao, "Branch-and-Bound for Model Selection and its Computational Complexity," IEEE Transactions on Knowledge & Data Engineering, 23(5), May 2011, pp. 655-668

10. **N. Thakoor**, J. Gao, V. Devarajan, "Multibody Structure-and-Motion Segmentation by Branch-and-bound Model Selection," IEEE Transactions on Image Processing, 19(6), June 2010, p. 1393-1402

11. **N. Thakoor**, J. Gao, S. Jung, "Embedded planar surface segmentation system for stereo images," Machine Vision and Applications, 21(2), Feb. 2010, p. 189-199

12. **N. Thakoor**, J. Gao, V. Devarajan, "Multi-stage Branch and Bound Merging for Planar Surface Segmentation in Disparity Space," IEEE Transactions on Image Processing, 17(11), Nov. 2008, p. 2217-2226

13. **N. Thakoor**, J. Gao, V. Devarajan, "Multi-hypothesis Prior for Segmentation of Stereo Disparity," IEEE Signal Processing Letters, 15, 2008, p. 613-616

14. **N. Thakoor**, J. Gao, "Automatic Video Object Extraction with Camera in Motion," International Journal of Image and Graphics, 8 (4), Oct. 2008, p. 573-600

15. S. Gopinath, Q. Wen, **N. Thakoor**, K. Luby-Phelps, J. Gao, "A statistical approach for intensity loss compensation of confocal microscopy images," Journal of Microscopy, 230 (1), April 2008, p. 143-159

16. **N. Thakoor**, J. Gao, S. Jung, "Hidden Markov Model-Based Weighted Likelihood Discriminant for 2-D Shape Classification," IEEE Transactions on Image Processing, 16 (11), Nov. 2007, p. 2707 - 2719

Conference Publications:

1. **N. Thakoor** and B. Bhanu, "Efficient Alignment for Vehicle Make and Model Recognition," IEEE International Conference on Image Processing (ICIP 2014). Rated in top 10% of accepted papers.

2. A. Cruz, B. Bhanu and **N. S. Thakoor,** "One shot emotion scores for facial emotion recognition," IEEE International Conference on Image Processing (ICIP 2014).

3. **N. Thakoor** and B. Bhanu, "Context-aware Reinforcement Learning for Re-identification in a Camera Network," ACM/IEEE International Conference on Distributed Smart Cameras (ICDSC 2013).

4. A. Cruz, B. Bhanu, **N. Thakoor,** "Facial Emotion Recognition with Anisotropic Inhibited Gabor Energy Histograms," IEEE International Conference on Image Processing (ICIP 2013).

5. G. Harlow, A.Cruz, L. Shuo, **N. Thakoor**, A. Bianchi, J. Chen, B. Bhanu, Z. Yang, "Automated Spatial Analysis of ARK2: Putative Link Between ROP Signaling and Microtubules," International Symposium on Biomedical Imaging (ISBI 2013)

6. B. X. Guan, B. Bhanu, **N. Thakoor**, P. Talbot, S. Lin, "Automatic Cell Region Detection by K-Means with Weighted Entropy," International Symposium on Biomedical Imaging (ISBI 2013)

7. S. Yang, L. An, B. Bhanu, **N. Thakoor**, "Improving Action Units Recognition Using Dense Flow-based Face Registration in Video," IEEE International Conference on Automatic Face and Gesture Recognition (FG 2013)

8. **N. Thakoor** and B. Bhanu, "Structural Signatures for Passenger Vehicle Classification in Video," International Conference on Pattern Recognition (ICPR 2012), Oral presentation

9. A. Cruz, B. Bhanu, **N. Thakoor**, "Facial Emotion Recognition in Continuous Video," International Conference on Pattern Recognition (ICPR 2012)
10. A. Cruz, B. Bhanu, **N. Thakoor**, "Facial Emotion Recognition with Expression Energy," 2nd International Audio/Visual Emotion Challenge and Workshop (AVEC 2012)
11. L. An, **N. Thakoor**, B. Bhanu, "Vehicle Logo Super-resolution by Canonical Correlation," International Conference on Image Processing (ICIP 2012)
12. S. R. Nair, B. Bhanu, S. Ghosh, **N. Thakoor**, "Prediction and Validation of Indexing Performance for Biometrics," International Joint Conference on Biometrics (IJCB 2011)
13. J. Yu, B. Bhanu, **N. Thakoor**, "Face Recognition in Video with Closed-Loop Super-resolution," IEEE Computer Society and IEEE Biometrics Council Workshop on Biometrics in association with CVPR 2011
14. B. X. Guan, B. Bhanu, **N. Thakoor**, P. Talbot, S. Lin, "Human Embryonic Stem Cell Detection by Spatial Information and Mixture of Gaussians," First IEEE Conference on Healthcare Informatics, Imaging, and Systems Biology (HISB 2011)
15. **N. Thakoor**, J. Gao, V. Devarajan, "Computation Complexity of Branch-and-bound Model Selection," IEEE International Conference on Computer Vision (IEEE ICCV2009)
16. **N. Thakoor**, J. Gao, V. Devarajan, "Multi-stage Branch-and-Bound for Maximum Variance Disparity Clustering", IAPR International Conference on Pattern Recognition (IAPR ICPR2008)
17. **N. Thakoor**, J. Gao, "Branch-and-bound Hypothesis Selection for Two-view Multiple Structure and Motion Segmentation", IEEE CS Conference on Computer Vision and Pattern Recognition (IEEE CS CVPR2008)
18. S. Gopinath, **N. Thakoor**, J. Gao, K. Luby-Phelps, "A Statistical Approach for Intensity Loss Compensation of Confocal Microscopy Images", IEEE International Conference on Image Processing (IEEE ICIP2007)
19. **N. Thakoor**, J. Gao, S. Jung, "Real-time Planar Surface Segmentation in Disparity Space", IEEE Workshop on Embedded Computer Vision (IEEE ECVW2007), in conjunction with IEEE CS CVPR 2007
20. **N. Thakoor**, J. Gao, S. Jung, "Detecting occlusion for hidden Markov modeled shapes", IEEE International Conference on Image Processing (IEEE ICIP2006)
21. **N. Thakoor**, J. Gao, Q. Wen, S. Jung, "Occlusion Resistant Shape Classifier based on Warped Optimal Path Matching", International Conference on Pattern Recognition (IEEE ICPR2006), Oral presentation
22. **N. Thakoor**, J. Gao, "Shape Classifier based on Generalized Probabilistic Descent Method with Hidden Markov Descriptor", IEEE International Conference on Computer Vision (IEEE ICCV2005).
23. **N. Thakoor**, J. Gao, "Automatic Extraction and Localization of Multiple Moving Objects with Stereo Camera in Motion", IEEE International Conference on Systems, Man and Cybernetics (IEEE SMC 2005)
24. **N. Thakoor**, J. Gao, "Hidden Markov Model based 2D Shape Classification", Advanced Concepts for Intelligent Vision Systems (ACIVS 2005), Published as Lecture notes in Computer Science (LNCS), Volume 3708/2005
25. **N. Thakoor**, J. Gao, "Automatic Video Object Shape Extraction and its Classification with Camera in Motion", IEEE International Conference on Image Processing (IEEE ICIP2005)
26. **N. Thakoor**, J. Gao, S. Jung, "Hidden Markov Model based Weighted Likelihood Discriminant for Minimum Error Shape Classification," IEEE International Conference on Multimedia and Expo (IEEE ICME2005)
27. **N. Thakoor**, J. Gao, S. Jung, "A Motion Field Reconstruction Scheme for Smooth Boundary Video Object Segmentation," IEEE International Conference on Image Processing (IEEE ICIP2004)
28. **N. Thakoor**, J. Gao, and H. Chen, "Automatic Object Detection in Video Sequences with Camera in Motion," Advanced Concepts for Intelligent Vision Systems (IEEE ACIVS 2004)
29. **N. Thakoor**, J. Gao, "Articulated Video Object Extraction by the Combination of Spatial and Temporal Segmentation," The 4th IASTED International Conference on Visualization, Imaging, and Image Processing, (IASTED VIIP 2004)

Research Experience:

Project Scientist	University of California, Riverside, Center for Research in Intelligent Systems, May January 2015-Present

- **Context-aware computer vision:** Development reinforcement learning methods for continuous learning for context-aware reidentification
- **Make and model recognition:** Fine grain recognition of vehicles from videos
- **Cyber physical systems:** Using cyber physical system in disaster scenarios for releif

Post-Doctoral Scholar	University of California, Riverside, Center for Research in Intelligent Systems, May 2010-January 2015

- **Context aware learning**: Developed reinforcement learning methods for continuous learning for reidentification and tracking.
- **Vehicle recognition**: Developed a system to detect and recognize make and model of civilian vehicles, implemented a real-time prototype in C++/OpenCV for vehicle classification.
- **Performance prediction for biometrics systems:** Developed statistical model for indexing performance
- **Facial emotion recognition:** Recognition of facial expression in videos, face super-resolution from videos
- **Human embryonic stem cell analysis:** Detection, segmentation and classification of stem cells
- **Symmetry analysis:** Hierarchical symmetry, symmetry detection, symmetry integrated computer vision

Post-Doctoral Researcher	University of Texas at Arlington, Electrical Engineering Department, January 2010-May 2010

- **Infrared imaging:** Explored applications of infrared imaging in Electrical, Biomedical, Material and Civil engineering

Research Assistant	University of Texas at Arlington, Biocomputing and Vision lab, Department of Computer science and Engineering, April 2003-December 2009

- **Stereo segmentation:** Developed a framework to extract unknown number of planes from stereo disparity
- **Structure-and-motion segmentation:** Developed an algorithm to detect unknown number of moving object from a scene
- **Visual object recognition:** Improved bag-of-features approach to incorporate feature location relevance
- **Real time stereo segmentation:** Implemented a proof-of-concept computer vision system on a TI TMS320DM642 DSP, involved stereo calibration, rectification, disparity computation, connected component analysis, clustering which operated at ~5 frames per second
- **2D shape classification:** Developed hidden Markov model based approaches to classify 2D shapes and extended the technique for occluded shapes
- **Motion segmentation:** Developed frame difference and optical flow based method to extract moving object

- **Image compensation:** Developed a simple expectation maximization based technique to compensate for intensity decay for fluorescent microscopy

Teaching Experience:

Instructor	University of Texas at Arlington, Department of Electrical Engineering, January 2009-May 2010. Taught Electronics, Circuit analysis laboratory and Circuit analysis laboratory for non-electrical engineering majors
Teaching Associate	University of Texas at Arlington, Department of Electrical Engineering, August 2004- December 2008. Assisted in Circuit analysis theory and laboratory, Neural networks, Microprocessors, Electronics, Fundamental of telecommunication systems, Digital circuits design theory and laboratory, VHDL.

Other:

Lab administrator	University of Texas at Arlington, Biocomputing and Vision lab, Department of Computer science and Engineering, April 2003- December 2009 Managed Windows and Linux systems and network; Deployed and maintained PDC, NIS, NFS, DFS, SAMBA, backup solution, VPN solution, Apache web server; Made purchase recommendations for software, hardware as well as computer vision systems.
Lab administrator	Vivekananda Education Society's Institute of Technology, Mumbai, India, December 2001- July 2002 Developed course software and experiments with Texas Instruments starter kit for undergraduate level digital signal processing course

Achievements and Awards:
- Travel award from PAMI-TC for IEEE CS Conference on Computer Vision and Pattern Recognition, 2008
- Rudolf Hermann's graduate fellowship for outstanding PhD students, 2004
- Computer Vision and Pattern Recognition Scholarship by Computer Science and Engineering Department, 2003

Professional Service:
- Conference Committee member: ICDSC 2013: Finance and local chair, WACV 2015: Finance and Local chair
- Journal Reviewer: IEEE transactions on Image Processing, Pattern Recognition, Computer Vision and Image Understanding, Machine Vision and Applications, PLOS ONE, International Journal of Pattern Recognition and Artificial Intelligence
- Conference Reviewer: ICPR 2012, ECVW 2007, ISBI 2014, ICPR 2014, ISBI 2015, WACV 2015
- Other: Judge for poster awards ICDSC 2013.

Professional Affiliations:
- Member of the Engineering honor society, Tau Beta Pi
- IEEE member since 2003