# Changjiang Yang

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## Research Interests

Computer Vision, Pattern Recognition, Machine Learning, Robotics, and Scientific Computing.

My primary focus has been on: efficient algorithms for large-scale problems, real-time object tracking, robust similarity measures, camera calibration, autonomous navigation systems, and probabilistic analysis of Hough transform.

## Education

- Ph.D. in Computer Science, (expected) May 2005
  University of Maryland, College Park, Maryland, USA
  Thesis: Efficient Algorithms with Applications in Vision and Learning
  Advisors: Professor Larry Davis and Professor Ramani Duraiswami
- M.S. in Pattern Recognition and Artificial Intelligence, June 1999
  Institute of Automation, Chinese Academy of Sciences, Beijing, China
  Thesis: Camera calibration and Self-Calibration
- B.E. in Automatic Control, June 1996
  University of Science and Technology of China, Hefei, China
  Thesis: Investigations on Some Important Aspects of the Hough Transform
  GPA ranks second in the Department of Automation

## Research Experience

- 08/2000 – present, University of Maryland, College Park, Maryland
  Research Assistant, Computer Vision Laboratory
  - Efficient algorithms for computer vision and machine learning.
  - Visual tracking and surveillance.

- Study on robust and efficient similarity measures.
- Image registration, superresolution and regularization.

- 08/1999 – 08/2000, Michigan State University, East Lansing, Michigan
  Research Assistant, Pattern Recognition and Image Processing Laboratory
  - Automatic detection of image orientation.
  - Visual motion based behavior learning using hierarchical discriminant regression.
  - Develop microchip drivers for robot navigation system.

- 01/1996 – 08/1999, Chinese Academy of Sciences, Beijing, China
  Research Assistant, National Laboratory of Pattern Recognition
  - Camera calibration and self-calibration, 3D Reconstruction.
  - Probabilistic analysis of Hough transform for geometric primitive detection.
  - Active vision based mobile robot navigation system.

# Publications

## Refereed Journal Publications

1. A. Vailaya, H. Zhang, C. Yang, Feng-I Liu, and A.K. Jain. Automatic image orientation detection. *IEEE Trans. Image Processing*, 11(7):746 – 755, July 2002.
2. C. Yang and J. Weng. Vision-based behavior learning using hierarchical discriminant regression. *Pattern Recognition Letters*, 23:1031 – 1038, 2002.
3. C. Yang, F. Sun, and Z. Hu. Self-calibration of rotating cameras using conic correspondences. *Acta Automatica Sinica*, 27(3):310 – 317, 2001 (in Chinese).
4. C. Yang, F. Sun, and Z. Hu. Planar conic based camera calibration. *Chinese Journal of Computers*, 23(5):541 – 547, 2000 (in Chinese).
5. Z. Hu, C. Yang, Y. Yang, and S. Ma. An inherent probabilistic aspect of the Hough transform. *Journal of Computer Science and Technology*, 14(1):44 – 48, 1999.
6. Z. Hu, C. Yang, W. Wang, and S. Ma. The optimal design of line parameterization. *Acta Automatica Sinica*, 24(3):307 –314, 1998 (in Chinese).

## Refereed Conference Publications

1. C. Yang, R. Duraiswami, and L. Davis. Efficient spatial-feature tracking via the mean-shift and a new similarity measure. To Appear in *Proc. IEEE Conf. Comp. Vision Pattern Recognition*, San Diego, CA, June 2005.
2. C. Yang, R. Duraiswami, and L. Davis. Efficient kernel machines using the improved fast Gauss transform. In *Advances in Neural Information Processing Systems*, Vancouver, Canada, December 2004 (Spotlight presentation, 8% acceptance rate).
3. C. Yang, R. Duraiswami, N. Gumerov, and L. Davis. Improved fast Gauss transform and efficient kernel density estimation. In *Proc. Int'l Conf. Computer Vision*, pages 464 – 471, Nice, France, October 2003.

4. C. Yang, R. Duraiswami, D. DeMenthon, and L. Davis. Mean-shift analysis using quasi-newton methods. In *Proc. Int'l Conf. Image Processing*, volume 3, pages 447 – 450, 2003.

5. C. Yang, R. Duraiswami, and L. Davis. Superresolution using preconditioned conjugate gradient method. In *IEEE International Conference on Image and Graphics*, 2002.

6. C. Yang, R. Duraiswami, and L. Davis. Near-optimal regularization parameters for applications in computer vision. In *Proc. Int'l Conf. Pattern Recognition*, volume 2, pages 569 – 573, 2002.

7. C. Yang and Z. Hu. Planar conic based camera calibration. In *Proc. Int'l Conf. Pattern Recognition*, volume 1, pages 1555 – 1558, 2000.

8. J. Weng, W.S. Hwang, Y. Zhang, C. Yang, and R. Smith. Developmental humanoids: humanoids that develop skills automatically. In *The First IEEE-RAS International Conference on Humanoid Robots*, Boston, MA, September 2000.

9. C. Yang and Z. Hu. An intrinsic parameters self-calibration technique for active vision system. In *Proc. Int'l Conf. Pattern Recognition*, volume 1, pages 67 – 69, 1998 (Oral presentation).

10. C. Yang, X. Meng, and Z. Hu. Energy based randomized Hough transform. In *International Conference on Signal Processing*, volume 2, pages 1117 – 1120, 1998.

11. Z. Hu, W. Wang, C. Yang, and S. Ma. A framework for the design of new line parameterizations. In *International Conference on Signal Processing*, volume 2, pages 863 – 866, 1996.

### Technical Reports and Submissions

1. C. Yang, R. Duraiswami, and L. Davis. Mean shift tracking under the general motion models. Submitted to ICCV, 2005.

2. C. Yang, R. Duraiswami, and L. Davis. Fast multiple object tracking via a hierarchical particle filter. Submitted to ICCV, 2005.

3. B. Han, C. Yang, R. Duraiswami, and L. Davis. Bayesian filtering and integral image for visual tracking. Invited to special session of *Real-Time Object Tracking: Algorithms and Evaluation in Workshop on Image Analysis for Multimedia Interactive Services (WIAMIS)*, Montreux, Switzerland, 2005.

4. C. Yang, R. Duraiswami, A. Elgammal, and L. Davis. On-line kernel-based tracking in joint feature-spatial spaces. In *Proc. IEEE Conf. Comp. Vision Pattern Recognition*, Washington, DC, 2004 (DEMO).

5. C. Yang, R. Duraiswami, A. Elgammal, and L. Davis. Real-time kernel-based tracking in joint feature-spatial spaces. Technical Report CS-TR-4567, Dept. of Computer Science, University of Maryland, College Park, MD, 2004.

6. C. Yang, R. Duraiswami, and N. Gumerov. Improved fast Gauss transform. Technical Report CS-TR-4495, Dept. of Computer Science, University of Maryland, College Park, MD, also submitted *SIAM Sci. Comput.* for publication, 2003.

## Software Package

1. C. Yang, R. Duraiswami, N. Gumerov and L. Davis. *Fast Improved Gauss Transform Evaluation Engine (FIG TREE) version 1.0*. University of Maryland Invention Disclosure *IS-2004-051*, 2004.

## Demonstration

1. C. Yang, R. Duraiswami, A. Elgammal and L. Davis. On-Line Kernel-Based Tracking in Joint Feature-Spatial Spaces. In *IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, 2004.

## Talks and Lectures

1. 03/30/2005, *Fast Kernel-Based Image Registration and Molecular Docking*, Computer-Aided Drug Design Center, School of Pharmacy, University of Maryland, Baltimore, MD.
2. 03/03/2005, *Fast Kernel-Based Methods with Applications to Visual Tracking and Learning*, Computational Interaction and Robotics Group, the Johns Hopkins University, Baltimore, MD.
3. 12/17/2004, *NIPS 2004 Workshop: Fast N-Body Learning*, Panel Discussion, Canada.
4. 12/10/2004, *Efficient Kernel Machines for Learning via the Fast Gauss Transform*, Center for Automation Research (CfAR) seminar, University of Maryland, College Park.
5. 10/11/2004, *Fast Gauss Transform*, Guest lecture for graduate course CMSC878R: Fast Multipole Methods: Fundamentals and Applications, University of Maryland, College Park.
6. 09/26/2003, *An Improved Fast Gauss Transform and Applications to Kernel Methods*. Center for Automation Research (CfAR) seminar, University of Maryland, College Park.
7. 05/10/2002, *Normalized Cuts and Image Segmentation: Review and Extensions*. Center for Automation Research (CfAR) seminar, University of Maryland, College Park.
8. 02/02/2001, *Review of Literature on Super-Resolution and Mosaicking*. Center for Automation Research (CfAR) seminar, University of Maryland, College Park (with Ali Zandifar).

## Programming Skills

- Programming Languages: C/C++, Java, FORTRAN, Basic, Matlab, MCS Assembly.
- Programming SDK: MS DirectX, Intel Streaming SIMD Extensions, Intel MKL.
- Vision and Graphics Libraries: OpenGL, OpenCV, MS VisSDK.
- Operating systems: Windows 2000/XP, Solaris, Linux.

## Hardware Skills

- Embedded system development, Microchip programming, PCB design, RS232 communication programming. Robot navigation system development.

## Honors and Awards

- Computer Science Department Fellowship, University of Maryland, College Park, 2000 - 2002.
- President's Award, Chinese Academy of Sciences, 1999.
- Hua Wei Award, Chinese Academy of Sciences, 1998.
- Tung Chee Hwa Orient Award, Chinese Academy of Sciences, 1997.
- Legend Award, University of Science and Technology of China, 1994.

## Memberships in Professional Societies

- Institute of Electrical and Electronics Engineers (*IEEE*)
- Society for Industrial and Applied Mathematics (*SIAM*)
- American Mathematical Society (*AMS*)
- American Association for the Advancement of Science (*AAAS*)
- American Statistical Association (*ASA*)

## References

1. Prof. Larry S. Davis, Chair of the Computer Science Department
   Department of Computer Science, University of Maryland, College Park, MD 20742
   (301)405-2662, lsd@cs.umd.edu, http://cvl.umiacs.umd.edu/users/lsd
2. Prof. Ramani Duraiswami, Director of the Perceptual Interfaces and Reality Laboratory
   Department of Computer Science, University of Maryland, College Park, MD 20742
   (301)405-6710, ramani@umiacs.umd.edu, http://www.umiacs.umd.edu/˜ramani
3. Prof. Dianne P. O'Leary
   Department of Computer Science, University of Maryland, College Park, MD 20742
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4. Prof. David Jacobs
   Department of Computer Science, University of Maryland, College Park, MD 20742
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