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Education

- Aug 2004** *Ph.D. in Computer Science*
University of Maryland, College Park.
Dissertation: The compositional character of visual correspondence.
Advisor: Professor Yiannis Aloimonos
- Dec 2001** *M.S. in Computer Science*
University of Maryland, College Park.
Grade Point Average (GPA): 4.0/4.0
- May 2000** *M.S. in Physics*
University of Maryland, College Park.
- Jun 1997** *B.Sc. in Physics*
University of Pune, India.
Awarded first rank.

Positions

- Oct 2006 – present Member of Technical Staff,
Computer Vision and Graphics,
Google Inc.
- Sep 2004 – Sep 2006 Research Associate, CfAR,
Institute for Advanced Computer Studies,
University of Maryland
- Dec 2000 – Aug 2004 Graduate Research Assistant,
Department of Computer Science,
University of Maryland
- Aug 1998 – May 2000 Graduate Fellow,
Department of Physics,
University of Maryland.

Research Summary**Primary Research Area: Computer Vision**

- Surface recovery and segmentation (Stereo vision, Optical flow, Occlusions, Shape estimation, Motion estimation).
- 2D/3D motion analysis, video stabilization, motion segmentation and applications (navigation, localization, compression, video analysis), sensor fusion (visual + non-visual).
- Language models (Grammars) for Human Action Recognition (video parsing, annotation & search, surveillance, character animation, motion capture, robotics). Linking vision to natural language and AI.
- People detection in images. Learning and object detection/classification problems in vision.
- Omni-directional vision, systems design.
- Mobile robots and Humanoid robots, Active vision, Sensor networks.

Contributed to the following research projects

ARDA Video Analysis and Content Exploitation (VACE), DARPA Video Verification of Identity (VIVID), NSF project in Human and Social Dynamics (HSD).

Professional activities

- Served on the video analysis panel at the National Science Foundation (NSF). Also served as a NSF reviewer.
- Reviewer for computer vision journals (IEEE PAMI, CVIU, KAIS, IJPRAI, The Visual Computer).
- Reviewer for several computer vision conferences (ICCV, CVPR, ECCV, ICPR, IROS, ICIP).

Previous academic highlights

- *Awarded the Graduate School Fellowship*, University of Maryland, College Park, 1998-2000. Also offered admission to graduate schools at MIT and Cornell with full graduate assistantships.
- *1st rank* in the B.Sc. (Physics) examination, 1997, conducted by the University of Pune, India and several affiliated institutions.
- *IIT Joint Entrance Exam (JEE), All India Rank 249.*
- *4th rank* among nearly a million students in the Higher Secondary School examination in the Maharashtra State Board (Pune), India, in 1994.
- *15th rank* among nearly a million students in the Secondary School examination in the Maharashtra State Board (Pune), India, in 1992.
- *Awarded the National Talent Search (NTS) Scholarship* in 1992, which is awarded only to 750 students in India after a three-stage nationwide selection process involving millions of students.

Teaching Summary

Computer Science Department, Univ. of Maryland

- *Co-instructor*, CMSC 828F, **Perceptual Robotics**, Spring 2006.
- *Substitute instructor* for CMSC733 (Computer Vision) and CMSC426 (Image Processing).

Physics Department, Univ. of Maryland

- *Teaching Assistant* for PHYS161, PHYS405, PHYS262A. Student reviews at <http://www.cs.umd.edu/users/ogale> under 'Teaching'.

Research Experience

Postdoctoral Work

- **OpenVis3D** (open-source 3D vision library)
 - Released an open-source 3D computer vision library on Google Code. See <http://code.google.com/p/openvis3d>, <http://google-code-updates.blogspot.com/2006/10/announcing-openvis3d.html>
 - The library includes routines for dense stereo matching, optical flow (motion) estimation, occlusion detection, and egomotion (3D self-motion) estimation.
 - My university code download page, which links to the library, has measured >20,000 unique downloads. See <http://www.cs.umd.edu/users/ogale/download/code.html>
 - Top-ranked download page in Google search results for “download stereo code” or “download optical flow”.
- **Human action understanding using language models**
 - Modeling human activity using generative language models such as grammars for recognizing and parsing activity in a manner similar to speech recognition. The goal is to develop visual, motor and natural language descriptions of actions for detection, classification, recognition, imitation and generation. See paper 12.
 - Human activity models from sensor networks: Creation of hierarchical grammatical models of human activity using sensor networks with various sensing capabilities. Collaboration with Andreas Savvides (Yale U.).
- **Segmentation and surface representation**
 - Creation of compositional approaches and algorithms for unification of various low-level visual cues, using novel representations of segmentation, which permit information exchange among multiple cues (such as stereo, motion, color and texture). Handling phenomenon such as transparency, illusory contours and surface curvature.

Doctoral Research

Dissertation: The compositional character of visual correspondence.

- **Image correspondence** (stereo matching and optical flow), **Segmentation, Oclusions and Shape estimation.**
 - Identified the effects of surface slant (shape) on image correspondence, and proposed new constraints and algorithms to correctly compute correspondence and oclusions in the presence of slant. Extended the state-of-the-art in stereo vision to correctly handle untextured slanted surfaces. See papers 4, 5, 8, 9.
 - Created stereo algorithms which perform contrast invariant matching by solving a global correspondence-segmentation problem using diffusion and biologically inspired local matching with Gabor filters. See papers 5, 11.
- **3D motion analysis**
 - Created novel algorithms for 3D motion segmentation (finding independently moving objects) using a moving camera. For the first time, oclusions were used to identify independent movement. See papers 3, 7.
 - Created a new algorithm for computing ordinal depth relations from video (i.e., region A is in front of region B) using oclusions. Ordinal depth permits detection of a hitherto

unknown but commonly encountered class of moving objects. See paper 3.

- **Omnidirectional vision systems**

- Programmed a *single PC mobile video capture-to-disk system* with 9 synchronized hi-res cameras. Called the Argus Eye, it is an omnidirectional system inspired by the insect eye, which simplifies and stabilizes 3D motion (egomotion) estimation. See papers 6, 2.

Master’s Research, Department of Physics, University of Maryland

- Worked on a variety of problems including simulation of pattern formation in fluids, and pattern formation and magnetism in oxides. One of my papers has received more than 150 citations.

List of Publications

(PDF copies at <http://www.cs.umd.edu/users/ogale/publist.htm>)

Book Chapters

1. *Detecting independent 3D movement*, A. S. Ogale, C. Fermüller, and Y. Aloimonos, in Handbook of Geometric Computing Applications in Pattern Recognition, Computer Vision, Neural computing, and Robotics, E. Bayro-Corrochano, Ed., Springer Verlag, March 2005.

Journals

2. *The Argus-eye: a new tool for robotics*, P. Baker, A. S. Ogale, and C. Fermüller, IEEE Robotics and Automation Magazine: Special Issue on Panoramic Robots, vol. 11, no. 4, 31-38, December 2004.
3. *Motion segmentation using oclusions*, A. S. Ogale, C. Fermüller, and Y. Aloimonos, IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 27, no. 6, 988-992, June 2005.
4. *Shape and the stereo correspondence problem*, A. S. Ogale and Y. Aloimonos, International Journal of Computer Vision, vol. 65, no. 3, 147-162, Dec 2005.
5. *A roadmap to the integration of early visual modules*, A. S. Ogale and Y. Aloimonos, International Journal of Computer Vision: Special Issue on Early Cognitive Vision, vol. 72, no. 1, 9-25, Apr 2007.

Conferences and Workshops

6. *New eyes for robotics*, P. Baker, A. S. Ogale, C. Fermüller, and Y. Aloimonos, in Proc. IEEE Conf. on Intelligent Robots and Systems (IROS), vol. 1, 1018-1023, October 2003
7. *Oclusions in motion processing*, A. S. Ogale, C. Fermüller, and Y. Aloimonos, in Proc. BMVA symposium on Spatiotemporal Image Processing, March 2004.
8. *Stereo correspondence with slanted surfaces: critical implications of horizontal slant*, A. S. Ogale and Y. Aloimonos, in Proc. IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), vol. 1, 568-573, June 2004. Oral presentation (5% acceptance for oral presentations).
9. *The influence of shape on image correspondence*, A. S. Ogale and Y. Aloimonos, in Proc. Second Intl. Symposium on 3D Data Processing, Visualization and Transmission (3DPVT), vol. 1, 945-952, September 2004.
10. *The motion segmentation hierarchy*, A. S. Ogale, C. Fermüller, and Y. Aloimonos, in Proc. Fifth Workshop on Dynamic Perception, 201-210, November 2004.

11. *Robust contrast invariant stereo correspondence*, A. S. Ogale and Y. Aloimonos, in Proc. IEEE Conf. on Robotics and Automation (ICRA), April 2005, **ICRA BEST VISION PAPER FINALIST**.
12. *View-invariant modeling and recognition of human actions using grammars*, A. S. Ogale, A. Karapurkar, Y. Aloimonos, International Conference on Computer Vision, Workshop on Dynamical Vision (ICCV-WDM), October 2005.
13. *A sensory grammar for inferring behaviors in sensor networks*, D. Lymberopoulos, A. S. Ogale, A. Savvides, Y. Aloimonos, Information Processing in Sensor Networks (IPSN'06), 251-259, April 2006.

Patents

- 2 patents pending.

Publications in Physics (Journals)

- A. *Octahedral cation site disorder effects on magnetization in double-perovskite Sr_2FeMoO_6 : Monte Carlo simulation study*, A. S. Ogale, S. B. Ogale, R. Ramesh, T. Venkatesan, Applied Physics Letters, vol. 75, no. 4, 537-539, July 1999. **Number of citations received: 152.**
- B. *Self-organized pattern formation in the oxidation of supported iron thin films - II. A simulation study*, A. S. Ogale, Physical Review B, vol. 64, Art. No. 035409, 2001.
- C. *Viscous fingering of miscible fluids in an anisotropic radial Hele-Shaw cell*, B. G. Banpurkar, A. S. Ogale, A. V. Limaye, S. B. Ogale, Physical Review E, vol. 59, no. 2, 2188-2191, February 1999.
- D. *Self-organized pattern formation in the oxidation of supported iron thin films. I. An experimental study*, S. R. Shinde, A. S. Ogale, S. B. Ogale, S. Aggarwal, V. Novikov, E. D. Williams, R. Ramesh, Physical Review B, vol. 64, Art. No. 035408, 2001.
- E. *Influence of near-surface nonstoichiometry on the surface magnetization of mixed-valent manganite: A computer simulation study*, U. P. Wad, A. S. Ogale, S. B. Ogale, T. Venkatesan, Applied Physics Letters, vol. 81, 3422-3424, 2002.
- F. *Role of 90° domains in lead zirconate titanate thin films*, C. S. Ganpule, V. Nagarajan, H. Li, A. S. Ogale, D. E. Steinhauer, S. Aggarwal, E. Williams, R. Ramesh, P. De Wolf, Applied Physics Letters, vol. 77, no. 2, 292-294, July 2000. **Number of citations received: 70.**
- G. *Direct observation of domain dynamics in lead zirconate titanate thin films*, C. S. Ganpule, V. Nagarajan, H. Li, A. S. Ogale, A. D. Martinez, S. B. Ogale, S. Aggarwal, E. Williams, P. De Wolf, R. Ramesh, Integrated Ferroelectrics, vol. 32, nos. 1-4, 891-900, 2001.