Amit Agrawal

Principal Member Research Staff, Mitsubishi Electric Research Labs (MERL), 201 Broadway, Cambridge, MA, USA 02139
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RESEARCH INTERESTS Computational Imaging & Photography, Computer Vision, Image/Signal Processing

EDUCATION

Ph.D., Electrical and Computer Engineering — **Jan 2004 - May 2006**
University of Maryland, College Park, MD USA — *GPA: 3.92/4.0*
Advisor: Prof. Rama Chellappa
- Major: Communications and Signal Processing
- Minor: Computer Engineering

M.S., Electrical and Computer Engineering — **Aug 2001 - Dec 2003**
University of Maryland, College Park, MD USA — *GPA: 3.92/4.0*
- Major: Communications and Signal Processing
- Minor: Computer Engineering

B.Tech., Electrical Engineering — **July 1996 - May 2000**
Indian Institute of Technology (IIT), Kanpur — *GPA: 9.2/10.0*

ACADEMIC AND PROFESSIONAL EXPERIENCE

Principal Member Research Staff — **Apr 2011 - Present**
Mitsubishi Electric Research Labs (MERL), Cambridge, MA

Member Research Staff — **May 2008 - Mar 2011**
Mitsubishi Electric Research Labs (MERL), Cambridge, MA

Visiting Scientist — **May 2006 - Apr 2008**
Mitsubishi Electric Research Labs (MERL), Cambridge, MA

Research Intern — **July 2004 - Feb 2005**
Mitsubishi Electric Research Labs (MERL), Cambridge, MA

Graduate Research Assistant — **Aug 2001 - May 2006**
University of Maryland, Advisor: Prof. Rama Chellappa

Graduate Teaching Assistant — **Aug 2001 - Dec 2001**
ECE Department, UMD

DSP Software Engineer — **Jun 2000 - Aug 2001**
Hughes Network Systems, MD, USA and Hughes Software Systems (HSS), India.

SIGGRAPH & EUROGRAPHICS PUBLICATIONS (JOURNALS)

- Y. Taguchi, A. Agrawal, A. Veeraraghavan, S. Ramalingam & R. Raskar, 'Axial-Cones: Modeling Spherical Catadioptric Cameras for Wide-Angle Light Field Rendering', ACM Transactions on Graphics (**SIGGRAPH Asia**), Vol. 29, Issue 5, Dec 2010
- A. Agrawal, A. Veeraraghavan & R. Raskar, 'Reinterpretable Imager: Towards Variable Post Capture Space, Angle & Time Resolution in Photography', Computer Graphics Forum (**Eurographics**), Vol. 29, Issue 2, pages 763-773, May 2010
- A. Agrawal, Y. Xu & R. Raskar, 'Invertible Motion Blur in Video', ACM Transactions on Graphics (**SIGGRAPH**), Vol. 28, Issue 3, Aug 2009
- D. Lanman, R. Raskar, A. Agrawal, & G. Taubin, 'Shield Fields: Modeling and Capturing 3D Occluders', ACM Transactions on Graphics (**SIGGRAPH Asia**), Vol. 27, Issue 5, Dec 2008
- R. Raskar, A. Agrawal, C. Wilson & A. Veeraraghavan, 'Glare Aware Photography: 4D Ray Sampling for Reducing Glare Effects of Camera Lenses', ACM Transactions on Graphics (**SIGGRAPH**), Vol. 27, Issue 3, Aug 2008
- A. Veeraraghavan, R. Raskar, A. Agrawal, A. Mohan & J. Tumblin, 'Dappled Photography: Mask Enhanced Cameras for Heterodyned Light Fields and Coded Aperture Refocusing', ACM Transactions on Graphics (**SIGGRAPH**), Vol. 26, Issue 3, July 2007

- R. Raskar, A. Agrawal & J. Tumblin, 'Coded Exposure Photography: Motion Deblurring using Fluttered Shutter', ACM Transactions on Graphics (**SIGGRAPH**), Vol. 25, Issue 3, July 2006
- A. Agrawal, R. Raskar, S.K. Nayar & Y. Li, 'Removing Photography Artifacts using Gradient Projection and Flash-Exposure Sampling', ACM Transactions on Graphics (**SIGGRAPH**), Vol. 24, Issue 3, July 2005

Other Journal Publications

- A. Agrawal, Y. Sun, J. Barnwell & R. Raskar, 'Vision Guided Robot System for Picking Objects by Casting Shadows', International Journal of Robotics Research (IJRR) 2009
- A. Agrawal & R. Chellappa, 'Robust Ego-Motion Estimation and 3D Model Refinement using Surface Parallax', IEEE Transactions on Image Processing, Vol. 15, No. 5, May 2006

Selected Refereed Conference Publications

- A. Agrawal, S. Ramalingam, Y. Taguchi & V. Chari, 'A Theory of Multi-Layer Flat Refractive Geometry', **CVPR** 2012 (oral presentation)
- D. Wu, A. Velten, M. Toole, A. Agrawal & R. Raskar, 'Decomposing Global Light Transport using Time of Flight Imaging', **CVPR** 2012 (oral presentation)
- N. Shroff, A. Veeraraghavan, Y. Taguchi, O. Tuzel, A. Agrawal & R. Chellappa, 'Variable Focus Video: Reconstructing Depth and Video for Dynamic Scenes', **ICCP** 2012 (oral presentation)
- V. Chari, A. Agrawal, Y. Taguchi & S. Ramalingam, 'Convex Bricks: A New Primitive for Visual Hull Modeling and Reconstruction', **ICRA** 2012 (oral presentation)
- A. Agrawal, Y. Taguchi & S. Ramalingam, 'Beyond Alhazen's Problem: Analytical Projection Model for Non-Central Catadioptric Cameras with Quadric Mirrors', **CVPR** 2011 (oral presentation)
- M. Gupta, A. Agrawal, A. Veeraraghavan & S. Narasimhan, 'Structured Light 3D Scanning in Presence of Global Illumination', **CVPR** 2011
- A. Agrawal, Y. Taguchi & S. Ramalingam, 'Analytical Forward Projection for Axial Non-Central Dioptric and Catadioptric Cameras', **ECCV** 2010 (oral presentation)
- M. Gupta, A. Agrawal, A. Veeraraghavan, & S. Narasimhan, 'Flexible Voxels for Motion Aware Videography', **ECCV** 2010
- A. Sankarnarayanan, A. Veeraraghavan, O. Tuzel, & A. Agrawal, 'Image Invariants for Smooth Reflective Surfaces', **ECCV** 2010
- A. Agrawal, M. Gupta, A. Veeraraghavan, & S. Narasimhan, 'Optimal Coded Sampling for Temporal Super-Resolution', **CVPR** 2010
- Y. Taguchi, A. Agrawal, S. Ramalingam, & A. Veeraraghavan, 'Axial Light Fields for Curved Mirrors: Reflect Your Perspective, Widen Your View', **CVPR** 2010 (oral presentation)
- A. Sankarnarayanan, A. Veeraraghavan, O. Tuzel, & A. Agrawal, 'Specular Surface Reconstruction using Sparse Reflection Correspondences', **CVPR** 2010
- M-Y Liu, O. Tuzel, A. Veeraraghavan, R, Chellappa, A. Agrawal & H. Okuda, 'Pose Estimation in Heavy Clutter using a Multi-Flash Camera', **ICRA** 2010
- A. Agrawal & R. Raskar, 'Optimal Single Image Capture for Motion Deblurring', **CVPR** 2009
- A. Agrawal & Y. Xu, 'Coded Exposure Deblurring: Optimized Codes for PSF Estimation and Invertibility', **CVPR** 2009
- D. Reddy, A. Agrawal & R. Chellappa, 'Enforcing Integrability by Error Correction using L-1 Minimization', **CVPR** 2009
- J. Chang, R. Raskar & A. Agrawal, '3D Pose Estimation and Segmentation using Specular Cues', **CVPR** 2009
- A. Veeraraghavan, A. Agrawal, R. Raskar, A. Mohan & J. Tumblin, 'Non Refractive Modulators for Capturing Scene Appearance and Depth', **CVPR** 2008
- T. Koh, A. Agrawal, R. Raskar, S. Morgan, N. Miles & B.H. Gills, 'Detecting and Segmenting Un-occluded Items by Actively Casting Shadows', **ACCV** 2007 (oral presentation)
- A. Agrawal & R. Raskar, 'Resolving Objects at Higher Resolution from a Single Motion-Blurred Image', **CVPR** 2007 (oral presentation)

- A. Agrawal, R. Raskar & R. Chellappa, 'Edge Suppression by Gradient Field Transformation using Cross-Projection Tensors', **CVPR** 2006
- A. Agrawal, R. Raskar & R. Chellappa , 'What is the Range of Surface Reconstructions from a Gradient Field?', **ECCV** 2006 (oral presentation)
- A. Agrawal, R. Chellappa & R. Raskar, 'An Algebraic Approach to Surface Reconstruction from Gradient Fields', **ICCV** 2005
- J. Tumblin, A. Agrawal & R. Raskar, 'Why I want A Gradient Camera', **CVPR** 2005
- A. Agrawal & R. Chellappa, 'Moving Object Segmentation and Dynamic Scene Reconstruction using Two Frames', IEEE **ICASSP** 2005. Winner of student paper contest (IMDSP category)
- A. Agrawal & R. Chellappa, 'Fusing Depth and Video using Rao-Blackwellized Particle Filter', First International Conference on Pattern Recognition and Machine Intelligence **PRMI**, 2005 (oral presentation)
- A. Agrawal & R. Chellappa, 'Robust Ego-Motion Estimation and 3D Model Refinement in Scenes with Varying Illumination', IEEE **MOTION** 2005 (oral presentation)
- A. Agrawal & R. Chellappa, 'Robust Ego-Motion Estimation and 3D Model Refinement using Depth Based Parallax Model', IEEE **ICIP**, 2004 (oral presentation)
- A. Agrawal & R. Chellappa, '3D Model Refinement using Surface-Parallax', IEEE **ICASSP**, 2004

Miscellaneous Publications

- R. Raskar & A. Agrawal, 'Handling Motion in Surveillance using Coded Exposure Camera', IEEE Conference on Technologies for Homeland Security 2007
- R. Raskar, J. Tumblin, A. Mohan, A. Agrawal & Y. Li, 'Computational Photography', State of Art Report, Eurographics, 2006
- A. Agrawal, R. Meth & R. Chellappa, 'Hierarchical DEM Refinement using Surface Parallax', 24th Army Science Conference, Orlando FL, 2004
- A. Agrawal & C. Shekhar, 'Mapping Ground Video to Aerial DEMs', Advanced Decision Architectures, Collaborative Technology Alliances Conference 2003

United States Patents

- 'Increasing object resolutions from a motion-blurred image', U.S. Patent No. 7,639,289
- 'Method for deblurring images using optimized temporal coding patterns', U.S. Patent No. 7,580,620
- 'Method and apparatus for acquiring HDR flash images', U.S. Patent No. 7,454,136
- 'Method and apparatus for enhancing flash and ambient images', U.S. Patent No. 7,443,443
- Method for Estimating Camera Settings Adaptively, U.S. Patent No. 7,403,707
- 'Camera for directly generating a gradient image', U.S. Patent No. 7,038,185
- 10+ Patent Applications pending

Tutorials, Courses and Invited Talks

- A. Agrawal & R. Horstmeyer, 'Light Fields in Computational Photography', CVPR 2011
- A. Agrawal, A. Veeraraghavan, S. Narasimhan, A. Mohan, 'Coded Computational Imaging', CVPR 2010
- A. Agrawal & R. Raskar, 'Differential Techniques for Analysis and Synthesis in Vision and Graphics', CVPR 2008
- Coding and Modulation in Cameras: Computational Photography beyond Photo Manipulations, CMU VASC Seminar, Mar 2008
- A. Agrawal & R. Raskar, 'Gradient Domain Manipulation Techniques in Vision and Graphics', ICCV 2007
- A Framework for Surface Reconstruction from Gradient Fields, Computer Graphics Group, MIT, Apr 2007

Exhibits, Demos, Tech Shows

- Structure Light 3D Scanning in Presence of Global Illumination, Demo at CVPR 2011
- A Practical and Robust System for Object Detection and Pose Estimation in Heavy Clutter using Active Illumination, Demo at CVPR 2010

- 3D Sensing Technology for Cell Robot Manufacturing, Mitsubishi Electric Press Release, Tokyo, 2008
- Depth Edges in Real-Time using Multi-flash Camera, Demo at CVPR 2005
- Camera Non-photo, Collision Senses, Cambridge, MA, 2004

Selected Press & Media Coverage

- Computational Photography (Mar 2008), American Scientist
- Amplitude Masks for Extended Depth of Field (Nov 2007), Photonics
- Siggraph 2007 Review on Computational Photography (July 2007), Computer Graphics World, Japan
- Optical Heterodyning and Coded Aperture Camera (April 2007), Wired, Gizmodo, Engadget, DigiCamInfo, Daily Mail
- Flutter Shutter Camera (Jan 2007), Computer Graphics World (CG World Japan)
- Flutter Shutter Camera (Dec 2006), Industry News
- Flutter Shutter Camera (Aug 2006), DigitalCameraInfo, Engadget, Photographer, DP Review

Professional Activities

- PROCAMS 2012 Program Committee Member
- OMNIVIS 2011 Program Committee Member
- SIGGRAPH Asia 2011 Sketches and Posters Committee Member
- SIGGRAPH Asia 2010 Sketches and Posters Committee Member
- SIGGRAPH 2009 General Submissions Jury Member
- International Conference on Computational Photography (ICCP) 2012 Program Committee Member
- ICCP 2011 Program Committee Member
- ICCP 2010 Program Committee Member
- Workshop on Applications of Computer Vision (WACV) 2011 Program Committee Member
- Reviewer: IEEE CVPR 2007-, IEEE ICCV 2007-, ACCV 2007, SIGGRAPH 2007-, SIGGRAPH Asia 2008-, IEEE Transactions on Image Processing (2005-), Eurographics (2005-), IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI) (2006-)
- Member of ACM & IEEE

Honors and Awards

- Best Reviewer, CVPR 2011
- Recipient of 2009 MERL Director's Award
- ICASSP 2005 Student Paper Contest Winner (IMDSP category)
- Award for Excellence in *PES* project at Hughes Software Systems, India
- Best trainee project award at Hughes Software Systems, India
- First prize in Inter-Collegiate Hardware Design Contest at *Techkriti* 2000 at IIT Kanpur
- All India Rank 272 in Joint Entrance Examination-1996 for IIT among $\sim 100,000$ participants
- Silver medal in National Talent Search Contest in Mathematics (1994 and 1995), Science (1995) and General Knowledge (1993 and 1995)