

CURRICULUM VITAE

Notarization: I have read the following and certify that this curriculum vitae is a current and accurate statement of my professional record.

Signature:



Date: July 21, 2011

1 Personal Information

Ramani Duraiswami

Associate Professor with tenure

Department of Computer Science and Institute for Advanced Computer Studies

University of Maryland, College Park

Appointed: July 1, 2007.

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1.1 Education

- Ph.D. in Mechanical Engineering and Applied Mathematics
The Johns Hopkins University, January 1991
- Bachelor of Technology in Mechanical Engineering
Indian Institute of Technology, Bombay, India, June 1985

1.2 Employment

- Department of Computer Science and UMIACS, University of Maryland, Associate Professor, 2007 – present
- Department of Computer Science and UMIACS, University of Maryland, Assistant Professor, 2004 – 2007
- Institute for Advanced Computer Studies, University of Maryland, Associate Research Scientist, 2003–2004
- Institute for Advanced Computer Studies, University of Maryland, Assistant Research Scientist, 1998–2003
- Dynaflow Inc., Fulton, MD, Principal Research Scientist; also Head of the Applied Mathematics Division, 1997

- Dynaflo Inc., Fulton, MD, Senior Research Scientist 1994–1996
- Dynaflo Inc., Fulton, MD, Research Scientist 1990–1993
- The Johns Hopkins University, Baltimore, MD Research and Teaching Assistant 1985–1990

1.3 Courtesy Appointments and Affiliations

- Affiliate Associate Professor, Department of Electrical and Computer Engineering, University of Maryland, College Park, MD
- Member, Center for Automation Research, UMIACS, University of Maryland, College Park, MD
- Director, Perceptual Interfaces and Reality Laboratory, UMIACS, University of Maryland, College Park, MD
- Faculty Member, Program in Applied Mathematics and Scientific Computation, University of Maryland, College Park, MD
- Member, The Norbert Wiener Center for Harmonic Analysis and Applications, Department of Mathematics, University of Maryland, College Park, MD
- Member, Burgers Program for Fluid Mechanics, University of Maryland, College Park, MD
- Member, Robotics Center, University of Maryland, College Park, MD

1.4 Entrepreneurial Ventures and Consulting

- Fantalgo, LLC, Elkridge, MD, Partner, 2006 – present
- VisiSonics Corporation, College Park, MD, Acting CEO, 2010 – present
- Microsoft Corporation, Redmond, WA, Consultant, 06/2009
- Institute for Defense Analyses, Alexandria, VA, Consultant, 2007-2008
- SkyComp, Columbia, MD, Consultant, 2006-2007
- Applied Media Analysis, College Park, MD, Consultant, 2002-2006
- ACD Simulators, Columbia, MD, Partner, 1998-1999

2 Research, Scholarly, and Creative Activities

(In the following, an * indicates a co-author who was a student or a postdoc advised, co-advised, or supervised by Dr. Duraiswami when the work was done. A † indicates a scientist who is supported by Dr. Duraiswami.) PDF copies of almost all papers are available online at <http://www.umiacs.umd.edu/~ramani/rdpubs.html>

Books

— Authored Books —

- [B1] Nail A. Gumerov[†] and Ramani Duraiswami. *Fast Multipole Methods for the Helmholtz Equation in Three Dimensions*. The Elsevier Electromagnetism Series. Elsevier Science, Amsterdam, 2005. ISBN: 0080443710.

— Edited Proceedings —

- [B2] Derek Brock, Ramani Duraiswami, and Alexander I. Rudnicky, editors. *Papers from the AAAI Fall Symposium*, number ISBN 978-1-57735-299-0. AAAI Press, Menlo Park, CA, 2006.
- [B3] David Doermann and Ramani Duraiswami, editors. *Proceedings of the Third International Conference on Mobile and Ubiquitous Multimedia (MUM2004), College Park, Maryland, U.S.A. October 27 - 29, 2004*, volume 273 of *ACM International Conference Proceeding Series*. Association of Computer Machinery, 2004. ISBN:1-58113-981-0.

— Book Chapters —

- [B4] Ramani Duraiswami, Dmitry N. Zotkin[†], Nail A. Gumerov[†], and Adam E. O'Donovan. *Principles and Applications of Spatial Hearing*, chapter Capturing and Recreating Auditory Virtual Reality, pages 337–356. World Scientific, 2011.
- [B5] Dmitry N. Zotkin* and Ramani Duraiswami. *Handbook on Signal Processing Systems*, chapter Signal processing for audio HCI, pages 243–265. Springer, 2010.
- [B6] Vikas C. Raykar* and Ramani Duraiswami. The improved fast Gauss transform with applications to machine learning. In L. Bottou, O. Chapelle, D. Decoste, and J. Weston, editors, *Large Scale Kernel Machines*, pages 175–202. MIT Press, 2007.
- [B7] Dmitry Zotkin*, Vikas Raykar*, Ramani Duraiswami, and Larry S. Davis. Multimodal tracking for smart videoconferencing and video surveillance. In Zhigang Zhu and Thomas S. Huang, editors, *Multimodal Surveillance*. Artech House Publisher, 2007.

Journal Articles

— Published Articles in Refereed Journals —

- [J1] Wen Zhang, Thushara Abhayapala, Rodney Kennedy, and Ramani Duraiswami. New insights into head related transfer function: Spatial dimensionality and continuous representation. *The Journal of the Acoustical Society of America*, 127:2347–2355, 2010.
- [J2] Vikas Raykar*, Ramani Duraiswami, and Linda Zhao. Fast computation of kernel estimators. *Journal of Computational and Graphical Statistics*, 19:205–220, 2010.
- [J3] Dmitry N. Zotkin[†], Ramani Duraiswami, and Nail A. Gumerov[†]. Plane-wave decomposition of acoustical scenes via spherical and cylindrical microphone arrays. *IEEE Transactions on Audio, Speech & Language Processing*, 18:2–18, 2010.

- [J4] Nail A. Gumerov[†], Adam E. O’Donovan, Ramani Duraiswami, and Dmitry N. Zotkin. Computation of the head-related transfer function via the fast multipole accelerated boundary element method and its spherical harmonic representation. *Journal of the Acoustical Society of America*, 127:370–387, 2010.
- [J5] Nail A. Gumerov[†] and Ramani Duraiswami. A broadband fast multipole accelerated boundary element method for the three dimensional Helmholtz equation. *Journal of the Acoustical Society of America*, 125:191–205, 2009. Version also published as University of Maryland Department of Computer Science Technical Report CS-TR-4904.
- [J6] F. Seydou, R. Duraiswami, N.A. Gumerov, and T. Seppanen. Computation of singular and hypersingular boundary integrals by Green’s identity and application to boundary value problems. *Engineering Analysis with Boundary Elements*, 33:1124–1131, 2009.
- [J7] Nail A. Gumerov and Ramani Duraiswami. Fast multipole methods on graphical processors. *Journal of Computational Physics*, 227:8290–8313, 2008. Also published as Fantalgo LLC, Technical Report 2007-2.
- [J8] Vikas C. Raykar*, Ramani Duraiswami, and Balaji Krishnapuram. A fast algorithm for learning a ranking function from large scale data sets. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 30:1158–1170, 2008.
- [J9] Fad Seydou, Ramani Duraiswami, and Tappio Seppanen. Numerical solution of electromagnetic scattering by multiple cylinders. *Applied Computational Electromagnetics Journal*, 23:1–8, 2008.
- [J10] Nail A. Gumerov[†] and Ramani Duraiswami. Fast radial basis function interpolation via preconditioned Krylov iteration. *SIAM Journal on Scientific Computing*, 29:1876–1899, 2007.
- [J11] Zhenyu Zhang*, Isaak D. Mayergoyz, Nail A. Gumerov[†], and Ramani Duraiswami. Numerical analysis of plasmon resonances in nanoparticles based on fast multipole method. *IEEE Transactions on Magnetics*, 43:1465–1468, April 2007.
- [J12] Zhiyun Li* and Ramani Duraiswami. Flexible and optimal design of spherical microphone arrays for beamforming. *IEEE Transactions on Speech and Audio Processing*, 15:702–714, 2007.
- [J13] Ramani Duraiswami, Dmitry N. Zotkin*, and Nail A. Gumerov[†]. Fast evaluation of the room transfer function using multipole expansion. *IEEE Transactions on Speech and Audio Processing*, 15:565–576, 2007.
- [J14] Nail A. Gumerov[†] and Ramani Duraiswami. A scalar potential formulation and translation theory for the time-harmonic Maxwell equations. *Journal of Computational Physics*, 225:206–236, 2007.
- [J15] Fadoulourahmane Seydou, Omar Ramahi, Ramani Duraiswami, and Tappio Seppanen. Numerical computation of the green’s function for two-dimensional finite-size photonic crystals of infinite length. *Optics Express*, 14:11362–11371, 2006.
- [J16] Dmitry N. Zotkin*, Ramani Duraiswami, Nail A. Gumerov[†], and Elena Grassi*. Rapid measurement of head related transfer functions. *The Journal of the Acoustical Society of America*, 120(4):2202–2215, Oct 2006.
- [J17] Nail A. Gumerov[†], Ali Zandifar*, Ramani Duraiswami, and Larry S. Davis. 3-D structure recovery and unwarping of surfaces applicable to planes. *International Journal of Computer Vision*, 66(3):261–281, Mar 2006.

- [J18] Nail A. Gumerov[†] and Ramani Duraiswami. Fast multipole method for the biharmonic equation in three dimensions. *Journal of Computational Physics*, 215(1):363–383, Jun 2006.
- [J19] Dmitry N. Zotkin*, Tai-Shi Chi, Shihab A. Shamma, and Ramani Duraiswami. Neuromimetic sound representation for percept detection and manipulation. *EURASIP Journal on Applied Signal Processing*, 2005(9):1350–1364, Jun 2005.
- [J20] Vikas C. Raykar*, Ramani Duraiswami, and B. Yegnanarayana. Extracting the frequencies of the pinna spectral notches in measured head related impulse responses. *The Journal of the Acoustical Society of America*, 118(1):364–374, 2005.
- [J21] Vikas C. Raykar*, Bayya Yegnanarayana, S.R. Mahadeva Prasanna, and Ramani Duraiswami. Speaker localization using excitation source information in speech. *IEEE Transactions on Speech and Audio Processing*, 13(5):751–761, Sep 2005.
- [J22] Bayya Yegnanarayana, S.R. Mahadeva Prasanna, Ramani Duraiswami, and Dmitry N. Zotkin*. Processing of reverberant speech for time-delay estimation. *IEEE Transactions on Speech and Audio Processing*, 13(6):1110–1118, Nov 2005.
- [J23] Nail A. Gumerov[†] and Ramani Duraiswami. Computation of scattering from clusters of spheres using the fast multipole method. *The Journal of the Acoustical Society of America*, 117(4):1744–1761, 2005.
- [J24] Philip David*, Daniel F. Dementhon, Ramani Duraiswami, and Hanan Samet. SoftPOSIT: Simultaneous pose and correspondence determination. *International Journal of Computer Vision*, 59(3):259–284, Sep 2004.
- [J25] Fadoulourahmane Seydou, Ramani Duraiswami, Nail A. Gumerov, and Tappio Seppanen. Tm electromagnetic scattering from 2D multilayered dielectric bodies -. *Applied Computational Electromagnetics Society Journal*, 19(2):100–107, Jul 2004.
- [J26] Dmitry N. Zotkin* and Ramani Duraiswami. Accelerated speech source localization via a hierarchical search of steered response power. *IEEE Transactions on Speech and Audio Processing*, 12(5):499–508, Sep 2004.
- [J27] Ali Zandifar*, Ramani Duraiswami, and Larry S. Davis. Video-based framework for analysis of presentations/posters. *International Journal on Document Analysis and Recognition*, 7:178–187, 2005.
- [J28] Dmitry N. Zotkin*, Ramani Duraiswami, and Larry S. Davis. Rendering localized spatial audio in a virtual auditory space. *IEEE Transactions on Multimedia*, 6(4):553–564, Aug 2004.
- [J29] Ahmed Elgammal*, Ramani Duraiswami, and Larry S. Davis. Efficient kernel density estimation using the fast Gauss transform with applications to color modeling and tracking. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 25(11):1499–1504, Nov 2003.
- [J30] Nail A. Gumerov[†] and Ramani Duraiswami. Recursions for the computation of multipole translation and rotation coefficients for the 3-D Helmholtz equation. *SIAM Journal on Scientific Computing*, 25(4):1344–1381, 2003.
- [J31] Dmitry N. Zotkin* and Ramani Duraiswami Larry S. Davis. Joint audio-visual tracking using particle filters. *Eurasip Journal on Applied Signal Processing*, 2002(11):1154–1164, Nov 2002.

- [J32] V. Ralph Algazi, Richard O. Duda, Ramani Duraiswami, Nail A. Gumerov[†], and Zhihui Tang*. Approximating the head-related transfer function using simple geometric models of the head and torso. *The Journal of the Acoustical Society of America*, 112(5):2053–2064, 2002.
- [J33] Ahmed Elgammal*, Ramani Duraiswami, David E. Harwood, and Larry S. Davis. Background and foreground modeling using nonparametric kernel density estimation for visual surveillance. *Proceedings of the IEEE*, 90(7):1151–1163, Jul 2002.
- [J34] Nail A. Gumerov[†] and Ramani Duraiswami. Computation of scattering from N spheres using multipole reexpansion. *The Journal of the Acoustical Society of America*, 112(6):2688–2701, 2002.
- [J35] Ramani Duraiswami, Kaushik Sarkar, and Georges L. Chahine. Efficient 2D and 3D electrical impedance tomography using dual. *Engineering Analysis with Boundary Elements*, 22(1):13–31, Jul 1998.
- [J36] Ramani Duraiswami, Sankar Prabhukumar, and Georges L. Chahine. Bubble counting using an inverse acoustic scattering method. *The Journal of the Acoustical Society of America*, 104(5):2699–2717, 1998.
- [J37] Ramani Duraiswami, Georges L. Chahine, and Kaushik Sarkar. Boundary element techniques for efficient 2-D and 3-D electrical impedance tomography. *Chemical Engineering Science*, 52(13):2185–2196, Jul 1997.
- [J38] Kenneth M. Kalumuck, Ramani Duraiswami, and Georges L. Chahine. Bubble dynamics fluid-structure interaction simulation by coupling. *Journal of Fluids and Structures*, 9(8):861–883, Nov 1995.
- [J39] Ramani Duraiswami and Andrea Prosperetti. Linear pressure waves in fogs. *Journal of Fluid Mechanics*, 299:187–215, Sep 1995.
- [J40] Ramani Duraiswami and Andrea Prosperetti. Orthogonal mapping in 2 dimensions. *Journal of Computational Physics*, 98(2):254–268, Feb 1992.
- [J41] Georges L. Chahine and Ramani Duraiswami. Dynamic interactions in a multibubble cloud. *Journal of Fluids Engineering - Transactions of the ASME*, 114(4):680–686, Dec 1992.

— Accepted Articles in Refereed Journals —

- [J42] Yuancheng Luo* and Ramani Duraiswami. Efficient parallel non-negative least-squares. *SIAM Journal on Scientific Computing*, Accepted:in press, 2012.

— Submitted Articles —

- [J43] Nail A. Gumerov[†], Konstantin A. Berlin*, David Fushman, and Ramani Duraiswami. Fast Debye summation. *Journal of Computational Chemistry*, submitted:under review, 2011.

Conference Publications

— Refereed Conference Publications —

- [C1] Hu Qi*, Nail A. Gumerov[†], and Ramani Duraiswami. Scalable fast multipole methods on distributed heterogeneous architectures. In *Proceedings of the 2011 ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis*, SC '11, page accepted, Washington, DC, 2011. IEEE Computer Society.
- [C2] Hu Qi*, Monica Syal, Nail A. Gumerov[†], Ramani Duraiswami, and J. Gordon Leishman. Toward improved aeromechanics simulations using recent advancements in scientific computing. In *Proceedings of the 67th Annual Forum of the American Helicopter Society*, pages 1–15. American Helicopter Society, 2011.
- [C3] Xinhui Zhou, Daniel Garcia-Romero, Ramani Duraiswami, Carol Espy-Wilson, and Shihab Shamma. Linear versus mel-frequency cepstral coefficients for speaker recognition. In *Proceedings ASRU 2011*, volume submitted, page under review, 2011.
- [C4] Balaji Vasani Srinivasan*, Daniel Garcia Romero*, and Dmitry Zotkin[†]. Kernel partial least squares for speaker recognition. In *INTERSPEECH*, page accepted. ISCA, 2011.
- [C5] Balaji V. Srinivasan*, Dmitry N. Zotkin[†], and Ramani Duraiswami. A partial least squares framework for speaker recognition. In *Proceedings 36th IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, page accepted, 2011.
- [C6] Balaji V. Srinivasan*, Ramani Duraiswami, and Ragu Murtugudde. Efficient kriging for real-time spatio-temporal interpolation. In *Proceedings 20th Conference on Probability and Statistics in the Atmospheric Sciences, American Meteorological Society*, 2010.
- [C7] Balaji V. Srinivasan*, Hu Qi*, and Ramani Duraiswami. Gpuml: Graphical processors for speeding up kernel machines. In *Proceedings Workshop on High Performance Analytics - Algorithms, Implementations, and Applications, SIAM conference on data mining*, 2010.
- [C8] Adam E. O'Donovan*, Ramani Duraiswami, and Dmitry N. Zotkin[†]. Automatic matched filter recovery via the audio camera. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2010 (ICASSP '10)*, pages 2826–2829, 2010.
- [C9] Balaji Vasani Srinivasan*, Ramani Duraiswami, and Dmitry Zotkin[†]. Kernelized Rényi distance for speaker recognition. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2010 (ICASSP '10)*, pages 4506–4509, 2010.
- [C10] Balaji Vasani Srinivasan* and Ramani Duraiswami. Efficient subset selection via the kernelized Rényi distance. In *Proceedings Twelfth IEEE International Conference on Computer Vision, 2009.*, pages 1081–1088, 2009.
- [C11] Dmitry N. Zotkin*, Ramani Duraiswami, and Nail A. Gumerov. Regularized HRTF fitting using spherical harmonics. In *Proceedings IEEE Workshop on Applications of Signal Processing to Audio and Acoustics*, pages 257–260, 2009.

- [C12] Dmitry N. Zotkin* and Ramani Duraiswami. Plane-wave decomposition of a sound scene using a cylindrical microphone array. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2009 (ICASSP '09)*, pages 85–88, 2009.
- [C13] Wen Zhang, Thushara Abhayapala, Rodney Kennedy, and Ramani Duraiswami. Modal expansion of hrtfs: Continuous representation in frequency-range-angle. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2009 (ICASSP '09)*, pages 285–288, 2009.
- [C14] Vlad I. Morariu, Balaji Vasan Srinivasan, Vikas C. Raykar, Ramani Duraiswami, and Larry S. Davis. Automatic online tuning for fast Gaussian summation. In *Advances in Neural Information Processing Systems (NIPS)*, 2008.
- [C15] Adam M. O'Donovan, Dmitry N. Zotkin, and Ramani Duraiswami. Spherical microphone array based immersive audio scene rendering. In *Proceedings of the 14th International Conference on Auditory Display*, Paris, France, 2008. inproceedings.
- [C16] Yuancheng Luo and Ramani Duraiswami. Canny edge detection on nvidia cuda. In *Proceedings of the Workshop on Computer Vision on GPUS, CVPR 2008*, pages 1–8, 2008. Source code: <http://www.wam.umd.edu/~yluo1/canny.htm>.
- [C17] Adam O'Donovan*, Ramani Duraiswami, and Dmitry N. Zotkin*. Imaging concert hall acoustics using visual and audio cameras. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2008 (ICASSP '08)*, pages 5284 – 5287, 2008.
- [C18] Nargess Memarsadeghi, Vikas C. Raykar, Ramani Duraiswami, and David M. Mount. Efficient Kriging via fast matrix-vector products. In *Proceedings of the IEEE Aerospace Conference, Big Sky, MT*, volume I, pages 1–7, 2008.
- [C19] Dmitry N. Zotkin*, Ramani Duraiswami, and Nail A. Gumerov[†]. Sound field decomposition using spherical microphone arrays. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2008 (ICASSP '08)*, pages 277–280, 2008.
- [C20] Aniruddha Kembhavi, Ryan Farrell, Yuancheng Luo, David Jacobs, Ramani Duraiswami, and Larry Davis. Tracking Down Under: Following the satin bowerbird. In *Proceedings IEEE 2008 Workshop on Application of Computer Vision WACV '08*, volume 1, pages 1–8. IEEE, 2008.
- [C21] Nail A. Gumerov, Ramani Duraiswami, and William D. Dorland. Middleware for programming NVIDIA GPUs from Fortran 9X,. In *Proceedings of Supercomputing 2007, Reno, NV*, November 2007.
- [C22] Dmitry N. Zotkin*, Ramani Duraiswami, and Nail A. Gumerov[†]. Room acoustics: Compact representation for multi-source binaural playbackx. In *Proceedings of the 19th International Congress on Acoustics, Madrid, 2-7 September 2007*, pages RBA 11–007, 2007.
- [C23] Dmitry N. Zotkin*, Ramani Duraiswami, and Nail A. Gumerov[†]. Efficient conversion of X.Y surround sound content to binaural head-tracked form for HRTF-enabled playback. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2007 (ICASSP '07)*, volume 1, pages 21–24, 2007.
- [C24] Adam O'Donovan*, Ramani Duraiswami, and Nail A. Gumerov. Real time capture of audio images and their use with video. In *Proceedings IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, 2007*, pages 10–13, 2007.

- [C25] Adam O'Donovan*, Ramani Duraiswami, and Jan Neumann. Microphone arrays as generalized cameras for integrated audio visual processing. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 2007. CVPR '07*, pages 1–8, 2007.
- [C26] Adam O'Donovan*, Ramani Duraiswami, and Jan Neumann. Sensing the world with arrays of microphones and cameras. In *Proceedings of the 19th International Congress on Acoustics, Madrid, 2-7 September 2007*, pages ELE-03–006, 2007.
- [C27] Nail A. Gumerov[†] and Ramani Duraiswami. High frequency acoustic simulations via FMM accelerated BEM. In *Proceedings of the 19th International Congress on Acoustics, Madrid, 2-7 September 2007*, pages COM 02–008, 2007.
- [C28] Nail A. Gumerov[†], Ramani Duraiswami, and Dmitry Zotkin*. Fast multipole accelerated boundary elements for numerical computation of the head related transfer function. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2007 (ICASSP '07)*, volume I, pages 165–168, 2007.
- [C29] Zhiyun Li* and Ramani Duraiswami. Fast time-domain spherical microphone array beamforming. In *Proceedings IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, 2007*, pages 155–158, 2007.
- [C30] Vikas C. Raykar*, Ramani Duraiswami, and Balaji Krishnapuram. A fast algorithm for learning large scale preference relations. In *Proceedings of the Eleventh International Conference on Artificial Intelligence and Statistics*, pages 385–392, 2007.
- [C31] Zhiyun Li* and Ramani Duraiswami. Headphone-based reproduction of 3D auditory scenes captured by spherical/hemispherical microphone arrays. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2005 (ICASSP '06)*, volume 5, pages 337–340, 2006.
- [C32] Zhenyu Zhang*, Isaak D. Mayergoyz, Nail A. Gumerov, and Ramani Duraiswami. Numerical analysis of plasmon resonances based on fast multipole method. In *Proceedings 12th Biennial IEEE Conference on Electromagnetic Field Computation*, pages 459–465, 2006.
- [C33] Vikas C. Raykar* and Ramani Duraiswami. Fast optimal bandwidth selection for kernel density estimation. In J. Ghosh, D. Lambert, D. Skillicorn, and J. Srivastava, editors, *Proceedings of the sixth SIAM International Conference on Data Mining*, pages 524–528, 2006.
- [C34] Nail A. Gumerov[†] and Ramani Duraiswami. FMM accelerated BEM for 3D Laplace & Helmholtz equations. In *Proceedings of BETEQ 2006*, 2006.
- [C35] Arkady Yerukhimovich*, Ramani Duraiswami, Nail A. Gumerov[†], and Dmitry N. Zotkin*. Frequency independent flexible spherical beamforming via RBF fitting. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2005 (ICASSP '06)*, volume 5, pages 45–48, 2006.
- [C36] Changjiang Yang*, Ramani Duraiswami, and Larry S. Davis. Efficient mean-shift tracking via a new similarity measure. In *Proceedings IEEE Computer Society Conference on Computer Vision and Pattern Recognition, (CVPR 2005)*, volume 1, pages 176– 183, 2005.
- [C37] Changjiang Yang*, Ramani Duraiswami, and Larry S. Davis. Fast multiple object tracking via a hierarchical particle filter. In *Proceedings Tenth IEEE International Conference on Computer Vision (ICCV 2005)*, volume 1, pages 212– 219, 2005.

- [C38] Changjiang Yang*, Ramani Duraiswami, and Larry S. Davis. Efficient kernel machines using the improved fast Gauss transform. In *Advances in Neural Information Processing Systems*, volume 16, 2005.
- [C39] Bohyung Han*, Changjiang Yang*, Ramani Duraiswami, and Larry Davis. Bayesian filtering and integral image for visual tracking. In *Proceedings Workshop on Image Analysis for Multimedia Interactive Services (WIAMIS), Montreux, Switzerland, 2005*.
- [C40] Zhiyun Li* and Ramani Duraiswami. A robust and self-reconfigurable design of spherical microphone array for multi-resolution beamforming. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2005 (ICASSP '05)*, volume 4, pages 1137–1140, 2005.
- [C41] Zhiyun Li* and Ramani Duraiswami. Hemispherical microphone arrays for sound capture and beamforming. In *Proceedings IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, 2005*, pages 106–109, 2005.
- [C42] Ramani Duraiswami and Vikas C. Raykar*. The manifolds of spatial hearing. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2005 (ICASSP '05)*, volume 3, pages 285–288, 2005.
- [C43] Ramani Duraiswami, Zhiyun Li*, Dmitry N. Zotkin*, Elena Grassi*, and Nail A. Gumerov†. Plane-wave decomposition analysis for spherical microphone arrays. In *Proceedings IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, 2005*, pages 150–153, 2005.
- [C44] Ramani Duraiswami, Dmitry N. Zotkin*, Zhiyun Li*, Elena Grassi*, Nail A. Gumerov†, and Larry S. Davis. High order spatial audio capture and its binaural head-tracked playback over headphones with HRTF cues. In *Audio Engineering Society Convention Paper 6540*, pages 1–20. Audio Engineering Society, 2005.
- [C45] Vikas C. Raykar* and Ramani Duraiswami. Approximate expressions for the mean and the covariance of the maximum likelihood estimator for acoustic source localization. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2005 (ICASSP '05)*, volume 3, pages 73–76, 2005.
- [C46] Nail A. Gumerov†, Ali Zandifar*, Ramani Duraiswami, and Larry S. Davis. Structure of applicable surfaces from single views. In *Proceedings European Conference of Computer Vision, 2004, vol 3*, volume 3023 of *Lecture Notes in Computer Science*, pages 482–496, 2004.
- [C47] Ramani Duraiswami, Dmitry N. Zotkin*, and Nail A. Gumerov†. Interpolation and range extrapolation of HRTFs. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2004 (ICASSP '04)*, volume 4, pages 45–48. IEEE, May 2004.
- [C48] Vikas C. Raykar* and Ramani Duraiswami. Automatic position calibration of multiple microphones. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2004 (ICASSP '04)*, volume 4, pages 69–72, 2004.
- [C49] Zhiyun Li*, Ramani Duraiswami, and Nail A. Gumerov†. Capture and recreation of higher order 3d sound fields via reciprocity. In Stephen Barrass and Paul Vickers, editors, *Proceedings International Conference on Auditory Display*. International Community for Auditory Display (ICAD), 2004. ISBN 1-74108-048-7.

- [C50] Zhiyun Li*, Ramani Duraiswami, Elena Grassi*, and Larry S. Davis. Flexible layout and optimal cancellation of the orthonormality error for spherical microphone arrays. In *Proceedings IEEE International Conference on Acoustics, Speech, and Signal Processing, 2004 (ICASSP '04)*, volume 4, pages 41–44, 2004.
- [C51] Fadoulourahmane Seydou, O. Ramahi, Ramani Duraiswami, and T. Seppänen. Computation of green's function for finite-size photonic crystals by boundary element method. In *Proceedings IEEE Antennas and Propagation Society International Symposium, 2004*, volume 4, pages 4320–4323, 2004.
- [C52] Zhiyun Li*, Ramani Duraiswami, and Larry S. Davis. Recording and reproducing high order surround auditory scenes for mixed and augmented reality. In *Proceedings Third IEEE and ACM International Symposium on Mixed and Augmented Reality, 2004 (ISMAR 2004)*, pages 240–249, 2004.
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- [T2] Georges L. Chahine and Ramani Duraiswami. Boundary element method for calculating 2-D and 3-D underwater explosion bubble behavior in free water and near structures (Confidential). Technical Report NSWC/DD/93/44, Naval Surface Warfare Center, Dahlgren Division, 1992.
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Patent Applications

- [P1] Adam E. O'Donovan, Ramani Duraiswami, and Dmitry N. Zotkin. Method and system for dereverberation of signals propagating in reverberative environments. US Patent Application, 2011.
- [P2] Ramani Duraiswami, Adam E. O'Donovan, and Nail A. Gumerov. Audio camera using microphone arrays for real time capture of audio images and method for jointly processing the audio images with video images. US Patent Application 20090028347, 2010.
- [P3] Ramani Duraiswami and Nail A. Gumerov†. Representation, interpolation and measurement of head related transfer functions. US Patent 97720229, 2010.

[P4] Nail A. Gumerov[†] and Ramani Duraiswami. A method for unwarping paper. UMD Invention Disclosure, 2003.

2.1 Talks, Abstracts, Tutorials, and Other Professional Papers Presented

2.1.1 Invited Talks

- Colloquium at NASA Langley Research Center, April 2011.
- Colloquium on “Audio-Visual Scene Analysis and Recreation,” Army Research Lab., Adelphi, Maryland. November 2010
- Invited Lecture on “Spatial Audio Research at the Perceptual Interfaces and Reality Lab.,” Vienna, Austria, Sep 2010.
- Tutorial Keynote “Capture and Reproduction of Sound Scenes”, at DAFx 2010, Graz, Austria, Sep 2010.
- Keynote “Spherical Sound Scene Analysis”, at the Second International Symposium on Ambisonics and Spherical Acoustics (“Ambisonics 2010”), Paris, France, May 2010.
- Invited Talk on “Computational Estimation of Scattering Coefficients,” meeting of the Acoustical Society of America, Baltimore, 2010.
- Invited Talk on “Spatial Audio,” IWPASH 2009 (International Workshop on the Principles and Applications of Spatial Hearing), Sendai Japan, November 2009.
- Colloquium on “Spatial Audio Research,” Korea University, Seoul, South Korea, November, 2009.
- Colloquium on “Spatial Audio Research,” Samsung Research, Samsung Science City, Suwon, South Korea, November, 2009.
- Colloquium on “Computational Acoustics,” Korea Advanced Institute of Science and Technology, Daejeon, South Korea, November, 2009.
- Talk entitled “Audio Cameras for Audio-Visual Scene Analysis” at Microsoft Research, Seattle, Washington, June 2009
- Invited Talk on “Imaging room acoustics with the audio camera”, Acoustical Society of America, Portland, OR, May 2009.
- Colloquium on Spatial Audio, IEEE Signal Processing Society, Washington DC chapter, College Park, MD, May 2009.
- Talks at DARPA ISAT meetings on “Recreating Auditory Reality”, February 2008, July 2008, November 2008.
- Invited Colloquium at the National Aeronautical and Space Agency, Goddard, “Fast Multipole Methods on Graphics Processors,” November 2007.
- Invited Colloquium at the Naval Research Laboratory, Washington DC, “Fast Multipole Methods for High Frequency Acoustics, January 2007.
- Invited talk at the Acoustical Society of America meeting in Honolulu, Hawaii, November 2006 on “Capture of spatial sound for head-tracked playback.”

- Invited talk at the Acoustical Society of America meeting in Honolulu, Hawaii, November 2006 on “Measurement of room acoustics”
- Keynote on “Similarities and differences in the perception of space via vision and audio,” the 2006 IEEE International Workshop on Multimedia Signal Processing (MMSP06)
- University of Toronto, “Fast algorithms for statistics and machine learning using the improved fast Gauss transform,” March 2006
- University of Maryland, “Fast algorithms for statistics and machine learning using the improved fast Gauss transform,” Norbert Wiener Center, February 2006
- University of California, Santa Barbara, “Fast algorithms for statistics and machine learning using the improved fast Gauss transform,” Department of Electrical and Computer Engineering; February 2006
- University of California, Santa Barbara, “Capturing and Rendering Three Dimensional Auditory Scenes,” IGERT Seminar; February 2006
- Microsoft Research, “Capturing and Rendering Three Dimensional Auditory Scenes,” August 2005
- University of Maryland, “Boundary Integral Methods without Singular Integration,” Mathematics, May 2005
- Carnegie Mellon University, “Capturing and Rendering Perceptually Valid Three Dimensional Audio,” Electrical Engineering, September 2004
- Naval Research Laboratory, “Capturing and Rendering Perceptually Valid Three Dimensional Audio,” Artificial Intelligence Seminar, November, 2004
- Army Research Lab, Aberdeen, MD, “An Introduction to Fast Multipole Methods,” 2005
- Department of Computer Science, University of Maryland, “Creating Perceptually Valid Spatial Audio,” College Park, April 1, 2004
- Purdue University, Colloquium on Interdisciplinary Cognitive and Perceptual Technologies, “Engineering Perceptually Valid Spatial Audio Systems,” March 8, 2004
- IIT Bombay, “Audio research in Computer Science,” April 2003
- Georgia Tech., Computer Science, Sep. 2002
- Microsoft Research, July 2002
- IBM Almaden Research Center, “Creating Perceptually Valid Three Dimensional Audio,” July 2002
- Stanford University, “Creating Rendering Perceptually Valid Three Dimensional Audio,” CCRMA, July 2002
- Boston University, “Creating and Rendering Perceptually Valid Three Dimensional Audio,” April 2002
- Massachusetts Institute of Technology, April 2002
- Invited talk at the Third international workshop on Microphone Array Systems, “Microphone Array Research at the University of Maryland,” October 6, 2000, Harvard University, Cambridge, MA

- Invited colloquium on “Inverse Problems,” Department of Mathematics, Louisiana State University, Baton Rouge, March 3, 1998
- Invited talk at the special session on “Bubble measurement in the oceans,” Joint meeting of the Acoustic Societies of America and Japan, Honolulu, HI, Dec 2–6, 1996

2.1.2 Community Service Talks

Talks at eight high schools, including the three below on why students should consider a career in computer science and possibly attend the University of Maryland. Several students have told me since that their choice to pursue computer science was influenced by this talk.

- Glenelg High School, Howard County Maryland, December 13, 2008
- Mount Hebron High School, January 10, 2009
- Howard High School, Columbia, MD January 24, 2009
- Talk to about 35 high school teachers of computer science at the High School Programming Contest, College Park, MD, March 08, 2009

2.2 Research Software

1. GPUML: GPUs for Machine Learning. A software library for performing machine learning on GPUs, released under LGPL. <http://www.umiacs.umd.edu/~balajiv/GPUML.htm>
2. Non-negative least squares on multi-core architectures and GPUs. <http://www.cs.umd.edu/~yluo1/Projects/NNLS.html>
3. Fast Debye summation.
4. Flagon: A software library encapsulating several scientific computing functions, and middleware, for programming NVIDIA graphical processors from high level languages, released under LGPL, <http://sourceforge.net/projects/flagon/>
5. Commercial software for the FMM accelerated boundary element method for the Helmholtz equation, licensed to the ESI-Group <http://www.esi-group.com> for marketing.
6. Canny edge detection on NVIDIA CUDA developed by Yuancheng Luo* under my supervision released under LGPL at <http://terpconnect.umd.edu/~yluo1/canny.htm>
7. Figtree: A software package combining the improved fast Gauss transform, and tree methods for summation of Gaussians in high dimensions, released under LGPL, January 2008. <http://sourceforge.net/projects/figtree/>
8. The Improved Fast Gauss Transform (2005): Vikas Raykar* and Ramani Duraiswami, available online at http://www.cs.umd.edu/users/vikas/code/IFGT/IFGT_code.htm
9. Fast optimal bandwidth estimation univariate kernel density estimation (2006): Vikas Raykar* and Ramani Duraiswami, Available online at http://www.cs.umd.edu/users/vikas/code/optimal_bw/optimal_bw_code.htm

10. Fast Multipole Method software for the Helmholtz equation in three dimensions (2005): Nail A. Gumerov[†] and Ramani Duraiswami, Licensed by the University of Maryland Office of Technology Commercialization to Fantalgo, LLC.
11. Fast Multipole Method software for the Laplace equation in three dimensions (2005): Nail A. Gumerov[†] and Ramani Duraiswami, Licensed by the University of Maryland Office of Technology Commercialization to Fantalgo, LLC.
12. Fast Multipole Method software for the Biharmonic equation in three dimensions (2005): Nail A. Gumerov[†] and Ramani Duraiswami, Available for license from the University of Maryland Office of Technology Commercialization
13. Java Animation for the Fast Multipole Method (2005) Developed as part of Yang Wang's thesis under my supervision. Available under LGPL online at <http://www.umiacs.umd.edu/users/wpwy/fmm/>
14. Several proprietary commercial research software packages were developed or co-developed by me in my previous jobs for underwater explosion analysis, free-surface flow analysis, ship maneuvering, electrical impedance tomography, and for acoustical tomography

2.3 Major Experimental Facilities Built

I have developed or co-developed the following facilities, either to complement ongoing research, or as a main objective (the Keck laboratory). The laboratories involved a significant mixture of integrated sensing, data acquisition and computing.

1. Perceptual Interfaces and Reality Laboratory, University of Maryland. (Component laboratories for doing computer vision, microphone arrays, audio rendering, head-related transfer function measurements, auditory scene capture, rapid prototyping) 2001-present. This laboratory is often used as a demonstration for visitors and potential donors by the college.
2. Chimera Maryland CPU-GPU Cluster Infrastructure, and other smaller clusters for GPU-CPU based heterogeneous scientific computing. (with A. Varshney, F. McCall, J. Ja'Ja', D. O'Leary, R. Chellappa)
3. Keck Laboratory for the Analysis of Visual Motion, University of Maryland. A multi-perspective imaging laboratory, containing 64 digital, progressive-scan cameras organized as sixteen short baseline stereo rigs. (with Ross Cutler, Larry Davis)
4. UMD distributed multi-camera surveillance facility. A network of 10 outdoor and indoor cameras that can be used for wide area surveillance, and features an innovative multi-cast client-server architecture. (with A. Chahine, A. Elgammal*, V. Krueger, R. Chellappa, L. Davis)

2.3.1 Tutorials

- Ramani Duraiswami, An Introduction to the Fast Multipole Method and the Fast Gauss Transform, Presented as a tutorial at the NIPS Workshop on Fast N-body Learning, Whistler, BC, 2004
- Nail Gumerov[†] and Ramani Duraiswami, Tutorial on Fast Multipole Methods, Fast Multipole Method, Tree-Code and Related Approximate Algorithms. Trading Exactness for Efficiency. CSCAMM Program Spring 2004 Dates: April 19-30, 2004

2.3.2 System Demonstrations

- CVPR 2010
- ICCP 2011
- C. Yang*, R. Duraiswami, A. Elgammal and L. Davis. On-Line Kernel-Based Tracking in Joint Feature-Spatial Spaces. Demonstration presented at IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 2004
- D. Zotkin* and R. Duraiswami, Creating Localized Spatial Audio. Demonstrations presented at Boston University, ICAD Kyoto, Maryland day, and at Microsoft Research

2.4 Contracts and Grants

2.4.1 Projects at the University of Maryland

1. 03/10-03/14: Vortex-Particle Dynamics, Interaction and Control for Brownout Mitigation, \$4.5M. AFOSR MURI. (PI J. Gordon Leishman, my share approximately \$600,000)
2. 01/11-12/11: Towards Improved Structure Determination via Fast SAXS/SANS, UMIACS Seed Funding, \$50K
3. 11/09-10/11: Hand Signal Interface Between Human Operators and Unmanned Ground Vehicles, \$155K. ONR. (Co-PI; Hanseok Ko, PI), used to support post-doc Jounghoon Beh.
4. 12/09–12/11: Auditory Cortical Approaches for Robust Speaker Identification, \$ 1,941,535. I-ARPA. (Co-PI, Shihab Shamma PI, my share approximately \$450,000).
5. 02/09–01/10: Portable interactive audio scene analysis system, \$ 90,000 Maryland MIPS and Lakenheath Electronic Design (PI).
6. 05/08–04/13: Remote Multi-Modal Biometrics for Maritime Domain (ONR, MURI), \$7.5M. (Co-PI, Rama Chellappa, PI), my share approximately: \$520K.
7. 09/09–08/10: Algorithms, Scientific Computing, and Numerical Studies in Classical and Quantum General Relativity (NSF), \$100K. (Co-PI, Manuel Tiglio, PI), my share approximately \$33K.
8. 01/07–05/10: Creating Auditory Virtual Environments, \$2,100,000 DARPA. (Co-PI, Larry Davis PI), my share \$610,000.
9. 02/08 - 07/10: Center for the Study of Plasma Microturbulence, (Co-PI, Bill Dorland, PI), my share \$150,000.
10. 09/07 - 09/08: Chesapeake Bay Forecasting System, Internal Maryland effort via the President's office, Raghu Murtugudde, PI (my share \$50,000)
11. 02/08 - 01/09: Flexible and High Performance Biometric Systems, PI, Maryland Industrial Partnerships and Signal Processing, Inc., \$90,000.
12. 09/02–09/08: ITR/AITS: Customizable Auditory User Interfaces for the Visually Impaired and the Sighted, \$1,800,000, NSF award 0205271. (PI)

13. 05/05-05/08: MRI: High Performance and Visualization Cluster for Research in Coupled Computational Steering and Visualization for Large Scale Applications. NSF Major Research Instrumentation \$1.6M). (Co-PI, PI: Amitabh Varshney)
14. 01/06 – 12/06: Commercialization of UMD Fast Multipole Method Software (PI), \$50,000. Maryland Technology Development Corporation.
15. 01/06 – 11/06: Evaluation of Sound Source Localization Algorithms (PI), \$55,000. Microsoft.
16. 03/06-12/07: Development of Virtual Environments for Visually Impaired Users (PI), \$130,000, VA Atlanta.
17. 05/06-05/08 : Gifts and License Income from Offspring media, as income from intellectual property derived from [P3] \$40,000/year.
18. 09/02–09/05: ITR/SF&IT: Fast Multipole Translation Algorithms for Solution of the 3D Helmholtz Equation, \$450,000, NSF award 0219681. (Co-PI)
19. 09/00–09/05: ITR: Personalized Spatial Audio via Scientific Computing and Computer Vision, \$2,999,995 NSF award 0086075. (Co-PI)
20. 04/00–04/04 Textual Information Access for the Visually Impaired, \$700,000, NSF award 9987944. (Co-PI):
21. 04/02–04/03: Customizable Auditory Displays, \$175,000, ONR/DARPA Award N000140210571. (PI)

2.4.2 Projects at Fantalgo, LLC

1. 01/07-07/07: Fast Multipole Methods on Graphics Processors, \$100,000. NASA (Co-PI, PI: Nail Gumerov)
2. 04/09-10/09: Simulating particle dynamics on Graphics Processors, \$30,000. JHU-APL. (Co-PI, PI: Nail Gumerov)
3. 06/10-01/11: Electro-Optic Simulation of Rigid Particles, \$65,512. JHU-APL. (Co-PI, PI: Nail Gumerov)

2.4.3 Projects at Dynaflo, Inc.

1. 10/97-5/98 Development of a high-fidelity surf-zone model for USMC simulators, \$70,000, ONR (PI)
2. 8/96-8/98: Dual Reciprocity Boundary Element Based Algorithms for Efficient 2D and 3D Electrical Impedance Tomography, \$300,000, NSF. (PI)
3. 10/95-10/97: Optimal Ship Design and Simulator Development using Systems Identification Techniques, \$300,000, NSF. (PI)
4. 2/95 - 8/95: Dual Reciprocity Boundary Element Based Algorithms for Efficient 2D and 3D Electrical Impedance Tomography, \$75,000. (PI)
5. 4/94 - 10/94: Optimal Ship Design and Simulator Development using Systems Identification Techniques, \$75,000, NSF. (PI)

6. 1/94 - 1/96: Bubble Nuclei Measurement via an Inverse Acoustic Scattering Technique, \$250,000, NSF. (PI)
7. 1/93 - 7/93: A Pseudospectral Mapping Technique for the Accurate Solution of Viscous Flows in Complex Geometries, \$50,000, NASA. (PI)
8. 2/92 - 9/92: Bubble Nuclei Measurement via an Inverse Acoustic Scattering Technique, \$50,000, NSF. (PI)

2.5 Fellowships, Prizes and Awards

- University of Maryland, Invention of the Year Finalist, 2003
- University of Maryland, Invention of the Year Finalist, 2006
- University of Maryland, Invention of the Year, 2008
- University of Maryland, Top 100 Rainmakers, 2002-present
- American Society of Mechanical Engineers' Robert Knapp award for the best paper in analytical and laboratory research in 1992-1993. (with G.L. Chahine)
- Honorable-mention prize for the best student paper at Society of Industrial and Applied Mathematics annual general meeting, San Diego, California, (1989)
- Johns Hopkins University Tuition Fellowship and graduate assistantship (1985-1990)
- Travel scholarship from Mathematical Sciences Institute, Cornell University, to attend workshop on theoretical aspects of multi-phase flows (1988)
- National Merit Scholarship awarded by the Indian Government (1979)

2.6 Editorial Boards and Reviewing Activities for Learned Publications

- 2003-2009 Associate Editor ACM Transactions on Applied Perception
- Member, Audio & Electroacoustics Technical Committee, IEEE Signal Processing Society
- Reviewer, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Speech and Audio Processing, Journal of the Acoustical Society of America, Computer Vision and Image Understanding, International Journal of Multiphase Flow, ASME Journal of Fluids Engineering, Journal of Computational Physics
- Ad-hoc reviewer for IEEE WASPAA, 2001-2011, ECCV 2002-2004, CVPR 2001-2010, Event Detection 2003-2004, ICAD 2004-2010, ICCV 2003-2005, ICASSP 2006-2011.

2.7 Organization of Major Conferences

- Local chair of ACM KDD 2010, Washington DC.
- General chair of ICAD 2010, Washington DC.
- Exhibitions Chair, IEEE Image Processing, 2008, San Diego, MD

- Local Arrangements and Industrial Liaison Chair, IEEE Visualization, 2006, Baltimore, MD
- Program chair of the 3rd International Conference on Mobile and Ubiquitous Multimedia (MUM2004) College Park, Maryland, U.S.A. October 27 - 29, 2004
- Co-organizer and finance chair of The Second International Symposium on 3D Data Processing, Visualization, and Transmission held between September 7 to 10, 2004 in the city of Thessaloniki, Greece.
- Local Organizing committee and Finance Chair, IEEE CVPR, May 2004, Washington, DC
- Lead organizer of the workshop Fast Multipole Method, Tree-Code and Related Approximate Algorithms held at the Center for Scientific Computing and Applied Mathematical Modeling at the University of Maryland. (April 19 - April 30, 2004)
- Lead organizer of the workshop on Audio Assistive Technologies for the visually impaired, held in conjunction with the International Conference on Auditory Displays (ICAD) in Boston in July 2003.
- Submissions Chair for International Conference on Face and Gesture, 2002
- Submissions chair for the Fifth International Conference on Automatic Face and Gesture Recognition held in May 2002 in Washington D.C.
- Program Committee Symposium on Applied Perception in Graphics and Visualization, Boston, 2006
- Program Committee for IEEE WASPAA 2003, 2005, 2007, 2009, 2011
- Program Committee for Event Detection in Video 2003, 2004

3 Teaching, Mentoring and Advising

3.1 Courses

Spring 2010	AMSC 460/ CMSC 460	Computational Methods
Fall 2009	AMSC 662/ CMSC 662	Computer Science for Scientific Computing
Spring 2009	CMSC 828E	Scientific Computing on Graphical Processors
Fall 2008	CMSC 460/AMSC460	Computational Methods
Spring 2008	CMSC 878R/AMSC698R/MAIT 633	Fast Multipole Methods: Fundamentals & Applications
Spring 2007	CMSC 460/AMSC 460	Computational Methods
Fall 2006	CMSC 878R/AMSC698R/MAIT 633	Fast Multipole Methods: Fundamentals & Applications
Spring 2006	CMSC 828D	Spatial Audio
Fall 2005	CMSC 460/AMSC 460	Computational Methods
Spring 2005	CMSC 426	Image Processing (Computer Vision)
Fall 2004	CMSC 878R/AMSC698R	Fast Multipole Methods: Fundamentals & Applications
Fall 2003	CMSC 878R/AMSC698R	Fast Multipole Methods: Fundamentals & Applications
Fall 2002	CMSC 878R/AMSC698R	Fast Multipole Methods: Fundamentals & Applications
Fall 2000	CMSC 828D	Fundamentals of Computer Vision

3.2 Independent Study

Semester	Course	# students	Description
Fall 2004	AMSC 799	1	Topics in Applied Mathematics and Scientific Computing
Fall 2004	CMSC 899	1	Dissertation Research
Spring 2005	CMSC 899	1	Dissertation Research
Summer I&II, 2005	AMSC 799	1	Topics in Applied Mathematics and Scientific Computing
Fall 2005	CMSC 899	1	Dissertation Research
Fall 2005	CMSC 898	1	Topics in Computational Machine Learning
Spring 2006	CMSC 799	1	Topics in Computational Perception
Fall 2006	CMSC 899	1	Dissertation Research
Spring 2007	CMSC 899	1	Dissertation Research
Fall 2008	ENEE 899	1	Dissertation Research
Fall 2008	ENEE 899	0	Dissertation Research
Fall 2009	CMSC 899	1	Dissertation Research
Spring 2010	CMSC 899	1	Dissertation Research
Fall 2010	CMSC 899	3	Dissertation Research
Spring 2011	CMSC 899	3	Dissertation Research

3.3 Course and Curriculum Development

1. CMSC 828D - Computer Vision, Fall 2000: Developed a new graduate computer vision course that employed an innovative approach that emphasized fundamentals and mathematical foundations. Course was co-developed with Larry Davis and Daniel DeMenthon. The course notes (online at <http://www.umiacs.umd.edu/users/ramani/cmssc828.html>) have been used by several others at other universities and have been cited in the literature, including in the paper that developed ESPN's first down marker.
2. CMSC 878R/AMSC698R. - Fast Multipole Methods: Fundamentals & Applications, Fall 2002-2004. (with N.A. Gumerov). The first course anywhere on an important new algorithm that has tremendous potential. Several graduate students and faculty at other universities have informed me that they have used the course notes at <http://www.umiacs.umd.edu/users/ramani/cmssc878R> as a tool to learn the algorithm. Forms basis for chapters of a research monograph [B1] that has been published, and a graduate textbook that is under contract with Birkhauser. The course has since been included in to the new Masters program in Industrial Mathematics being developed by the Norbert Weiner Center for Harmonic Analysis, and was cross-listed there in Fall 2006 and Spring 2008, and Fall 2011.
3. CMSC 828D - Algorithms and Systems for Capture and Playback of Spatial Audio. (2006) - This again is a unique course emphasizing the capture and rendering of spatial audio from a computer science viewpoint. I combined elements of signal processing, applied mathematics, psychophysics, physical acoustics, human computer interaction, assistive devices, and audio technology to develop the course. There was no textbook, and I developed the lectures using a broad array of resources. I plan to develop an undergraduate course based on the same materials.
4. CMSC 828E - Scientific Computing on Graphics Processors. (2009) - This is a new course that combines elements of parallel programming, research experience on performing scientific computing on graphics processors, and hands on instruction to provide students with a background in this emerging area. There was no textbook, and I developed the lectures using a broad array of resources.

5. CMSC662/AMSC 662 - Computer Science for Scientific Computing (2009) - Revived this course, which was a core course in the Applied Math and Scientific Computing. The course introduces computer architecture, parallel computing, and basic algorithms to non CS majors.

3.4 Advising: Research Advisor

3.4.1 High School Students

- Nicholas Ober, 2010-2011. Mr. Ober worked on the statistical analysis of anthropometry collected for analysis of HRTFs.
- Anirudh Agrawal, 2009. Mr. Agrawal worked on signal processing algorithms.
- Justina Abah, 2008-2009. Ms. Abah was an African American student intern via the SIRP program. She is working with graduate student Gordon Rubin and myself on developing signal processing tools to characterise vibrato in singing.
- Sherrif Jolaoso, 2007-2008. Mr. Jolaoso was an African American student intern via the SIRP program. He is working with graduate student Adam O'Donovan and myself on developing experiments to determine people's ability to perceive sound location in virtual audio. Mr. Jolaosa was recently awarded a commendation at a research fair.
- Kenrick Rilee, Summer 2007. Mr. K. Rilee worked on developing signal processing algorithms to detect rise time in audio signals.
- Alexander Rilee, Summer 2007. Mr. A. Rilee worked on developing microphone arrays using rapid prototyping techniques.
- Matthew Curtis, 2006-2007. Mr. Curtis is an African American student intern via the SIRP program. He is working with graduate student Adam O'Donovan and myself on developing a relation between anthropometry and the HRTF. He has gone on to college at Bethune-Cookman university.
- Whitney Hymes, 2005-2006. Ms. Hymes, came to me via the CMPS STAND Internship Research Program (SIRP) that pairs minority and disadvantaged students with faculty mentors. She is an African American student from the Charles Herbert Flowers school. She worked with my postdoctoral scientist (Dr. Elena Grassi) and myself in developing new experiments for spatial audio. Ms. Hymes has since gone on to college.
- Brittany Garr and Brandon Shaheed, 2003-2004. Ms. Garr and Mr. Shaheed were interns via the CMPS STAND program. They were also from the Charles H. Flowers High School, and are African American. They worked with my former graduate student (Zhiyun Li) and myself to develop computer software to assist music learning for beginners. Their work included music notation generation, rhythm classification, user interface design, and experiments. Their work was competitively selected to be present at a county-wide scientific symposium in 2004. They have both since gone on to college.

3.4.2 Undergraduate

- Yuancheng Luo, 2008-2009: Mr. Luo was a dual-degree student in mathematics and computer science. He has worked on a number of different projects related to graphics processors and scientific computing. His work has led to two publications ([C20, C16]), two open-source software projects, and the possibility of more papers based on ongoing work. He is now in grad school at UMD.

- Jane Hwang, 2002-2003: Ms. Hwang was an electrical engineering student who did an honors project with post-doctoral scientist Dmitry Zotkin and myself. Her work lead to a publication [C75]. She has since gone on to graduate school.

3.4.3 Masters

- Balaji Vasan Srinivasan, 2008. “Gaussian Process Regression for Model Estimation.”MS Electrical Engineering. (now a Ph.D. student in Computer Science).
- Yang Wang, MS Applied Mathematics, 2005. “Animation of the Fast Multipole Algorithm for Display and Optimization,” Graduate Advisor. (went to the University of Michigan Law school with a full fellowship; and now a lawyer with Simpson Thacher in Beijing).
- Vikas Raykar, 2004, “Position Calibration of Acoustic Sensors and Actuators on Distributed General Purpose Computing Platforms, MS Electrical Engineering.
- Kexue Liu, MS., Applied Mathematics and Computer Science, 2003. Ph.D. 2004 (Now at a small R&D firm in VA).
- Ankur Mohan, M.S., Electrical Engineering, 2002. (now at Applied Media Analysis, College Park, MD) “Robust Vision Based Tracking for Virtual Auditory Spaces.” (principal advisor)
- Shravya Reddy Konda, MS, CS, 2009 (now at Microsoft).
- Liping Liu, MS, CS, 2009 (now at Schlumberger Research).

3.4.4 Graduated Doctoral Students

- Vasanth Philomin, Ph.D., Computer Science, 2000. “Quasi Random Sampling for Condensation.” (co-advisor, primary advisor Larry S. Davis) (now at Philips Research, Aachen, Germany)
- Dmitry Zotkin, Ph.D., Computer Science, 2002. “Audio input and display devices for audio-visual user interfaces and virtual reality.” (now a research scientist at the University of Maryland, College Park)
- Ahmed Elgammal, Ph.D., Computer Science, 2002. “Fast Gauss Transform for Kernel Density Estimation in Vision.” (Co-advisor, primary advisor Larry S. Davis) (now a member of the faculty at Rutgers University)
- Zhihui Tang, Ph.D., Applied Mathematics, 2003. “Fast transforms based on matrices with structure with applications to the Fast Multipole Method.” (now a research analyst at a Wall Street investment firm)
- Ali Zandifar, Ph.D., Electrical Engineering (2004), “Textual Information Access for the Visually Impaired.” (now a senior staff member at Epson research laboratories)
- Changjiang Yang, Ph.D., Computer Science, (2005), “Fast multipole methods for density estimation and interpolation, with applications to image processing and vision.” (now a scientist at Sarnoff Corporation)
- Zhiyun Li, (2005) Ph.D., Computer Science, “Acquisition and Rendering of Virtual Audio.” (now at Amazon)

- Zhenyu Zhang, (2007) “Studies of Electrostatic Plasmon Resonance,” (primary advisor: Prof. Isaak Mayergoyz) (member of his thesis committee) (now at GE).
- Vikas Raykar, (2007) “Scalable algorithms for machine learning”. (now a scientist at Siemens Corporate Research, Malvern, PA).

3.4.5 Current Students

- Adam O’Donovan, CS, “Algorithms for sound scene analysis with spherical microphone arrays” (with Larry Davis)
- Balaji Vasan CS, “Analysis of Climate Data and Speaker ID via Statistical Machine Learning Techniques”
- Hu Qi, CS, “Scientific Computing on Graphics Processors.”
- Yuancheng Luo, CS, “Large Scale Scientific Computing.”

3.4.6 Postdoctoral

- Elena Grassi, 2003-2005
- Dmitry N. Zotkin, 2003-2005
- Jounghoon Beh, 2009-2011

3.4.7 Senior Scientists

- Nail A. Gumerov, 2001-present
- Dmitry N. Zotkin, 2005-present

3.5 Advising: Ph.D. Committees (other than advisees)

1. Thanarat Horprasert Chalidabhongse, Computer Science, PhD 2002
2. Vasanth Philomin, Computer Science, 2002
3. Kexue Liu, Applied Mathematics, 2004
4. Kyong-il Yoon, Computer Science, 2004
5. Bo Hyung Han, Computer Science, 2005
6. Sandeep Gupta, Doctorate, ENAE, 2005
7. Gustavo Rohde, Applied Mathematics, 2005
8. Philip David, Computer Science, 2006
9. Haixia Zhao, Computer Science, 2006
10. Ser-Nam Lim, Computer Science, 2006
11. Nargess Memarsadeghi, Computer Science, 2007

12. Edward Zhijian Pan, Computer Science, 2007
13. Sankalita Saha, Electrical and Computer Engineering, 2007
14. M. Shivnaga Vittaldevuni Prasad, Computer Science, 2007
15. Vinay Shet, Computer Science, 2007
16. Dongming Wei, Applied Mathematics, 2007
17. Haw-ren Fang, Computer Science, 2008
18. Son-Tran Dinh, Computer Science, 2008
19. Scott McMaster, Computer Science, 2008
20. Sameer Sheorey, Computer Science, 2008
21. Yik-Loon Kee, Aerospace Engineering, 2008
22. Ingmar B. Broemstrup, Physics, 2008
23. Michael Barnes, Physics, 2008
24. Hazem El-Alfy, Computer Science, 2009
25. Mohamed Hussein, Computer Science, 2009
26. Abhinav Gupta, Computer Science, 2009
27. Il-Chul Yoon, Computer Science, 2010
28. William R. Schwartz, Computer Science, 2010
29. Vlad Morariu, Computer Science, 2010
30. Eric Greenwood, Aerospace Engineering, 2011
31. Mudit Agrawal, Computer Science, 2011
32. Behjat Siddiquie, Computer Science, Current
33. Vinod K. Lakshminarayana, Aerospace Engineering, current
34. Monica Syal, Aerospace Engineering, current
35. Arunkumar Mohananchettiar, Electrical Engineering, current
36. Moble Benedict, Aerospace Engineering, current
37. Brandon Bush, Aerospace Engineering, current
38. Ryan Harvey, AMSC, current
39. Benjamin Silbaugh, Aerospace Engineering, current
40. Asitav Mishra, Aerospace Engineering, current

41. Arkady Yerukhimovich, Computer Science, current
42. Kathryn Linehan, Applied Math and Scientific Computing, current
43. Kumar Ravichandran, Aerospace Engineering, current
44. Ria Malhan, Aerospace Engineering, current
45. Sebastian Thomas, Aerospace Engineering, current

3.6 Advising: Master's Committees (other than advisees)

1. Karthikeyan Duraisamy, Applied Mathematics and Scientific Computing, 2004
2. Umut Akdemir, Electrical Engineering, 2005
3. Gary Gang Zi, Electrical Engineering, 2005
4. Eric Greenwood, Aerospace Engineering, 2008

3.7 Advising: AMSC Academic Advising

- Steve Penny, 2005
- Scott Seiler, 2005
- Kathleen Chapman, 2005
- Yang Wang, 2004

3.8 Advising: AMSC 663-664 Project Course

- Fei Xue, AMSC, 2005-2006
- Marina Kim, Physics, 2006-2007

3.9 Senior Visitors Hosted

- Prof. Pascal Fua, EPFL. Summer 2001.
- Prof. Bayya Yegnanarayana, Department of Computer Science, Indian Institute of Technology, Madras, India. Summer 2001; Summer 2002 and Summer 2004
- Prof. Fadoulourahmane Seydou, Department of Electrical Engineering, University of Oulu, Oulu, Finland, 2002-2003; Summer 2004.
- Prof Hanseok Ko, Department of Electrical Engineering, Korea University, 2010-2011.

3.10 Senior Group Members Supported

- Dr. Nail A. Gumerov, Assistant/Associate/Senior Research Scientist, UMIACS, 2000 - present.
- Dr. Dmitry N. Zotkin, Assistant/Associate Research Scientist, UMIACS, 2005-present.

4 Service

4.1 Professional

4.1.1 Offices in Professional Organizations

- Member of the Technical Committee on Audio and Electro Acoustics, IEEE Signal Processing Society, 2004-present
- Vice President, University of Maryland Chapter, Signal Processing Society, IEEE

4.1.2 Reviewing activities for agencies

- Proposal reviewer, National Science Foundation, 1998-2010.
- National Academy of Sciences, ad-hoc
- National Institutes for Health, ad-hoc

4.1.3 Other non-University Panels and Positions

- Co-chaired a DARPA ISAT study on “Machine Listening: Learning the Sense of a Firefight”, 2007-2008.
- Member of a DARPA panel of eleven selected young computer science faculty to suggest future directions for computer science research to DARPA, April-June, 2006. The panel was organized by the Potomac Institute for Policy Studies to advise DARPA director Dr. Tony Tether on approaches to address the crisis caused by declining enrollment of young US students in computer science graduate students.

4.1.4 Consulting/Entrepreneurial Activities

- Co-founder, Fantalgo, LLC, Elkridge, MD, 2006-present. Software for scientific computing.
- Co-founder, Acting CEO, VisiSonics Corporation, Highland, MD, 2010-present. Systems for Audio-Visual Scene Analysis.
- Consultant, Applied Media Analysis, LLC, College Park, MD, 2003-present. Perception based technologies for mobile e-commerce
- Consultant, Skycomp Inc., Columbia, MD, 2006-2007. Photogrammetry for traffic monitoring
- ACD Simulators, Partner, 1998. A software company that provided simulation solutions to the marine industry (partnership now disbanded)
- Internet Cargo Services, System Design Principal, 1998. A now defunct venture-funded dot-com that designed high-volume e-commerce solutions

4.2 Campus

4.2.1 Departmental Service

- Educational committee, 2004 - 2010
- Computer Science-Electrical Engineering Liaison, 2011-present
- Teaching evaluation committee, 2004 - present
- Graduate admissions committee, 2006 - present
- Friday faculty lunch, 2008, 2010.

4.2.2 UMIACS

- UMIACS Education Committee Member, 2002–2004
- UMIACS Infrastructure Committee Member, 2002–2004
- UMIACS Industrial Interactions Committee Member, 2003-2004
- Organizer/co-organizer of the weekly CFAR seminar since 1999

4.2.3 CMPS

- Have presented various demonstrations of research in my laboratory to college visitors, donors, and other important guests at the request of Dean Halperin, CMPS, 2004-2011.
- On a committee appointed by the dean to write a proposal to Google on climate and associated data and forecast serving on the internet 2008.