

Gonzalo R. Arce

University of Delaware
Dept. of Electrical and Computer Engineering
Evans Hall Room 312
Newark, DE 19716

Telephone: (302) 831-1493
Mobile: (302) 690-6298
arce@udel.edu
<http://www.udel.edu/~arce/>

Education

Ph.D. in Electrical Engineering (1982) Purdue University, West Lafayette, IN 47907. *Research Topic: Theory and Analysis of Median Filters.*

Master of Science in Electrical Engineering (1980) Purdue University, West Lafayette, IN 47907.

Bachelor of Science in Electrical Engineering (1979) *Summa Cum Laude*
University of Arkansas, Fayetteville, AR 72701.

Professional Experience

University of Delaware, Newark, DE 19716

Charles Black Evans Professor

JPMorgan Chase Faculty Fellow

Department of Electrical and Computer Engineering and
Institute of Financial Services Analytics. 2014-2017.

**Fulbright-Nokia Distinguished Chair in Information and
Communications Technologies**

Aalto University, Helsinki, Finland. 2017.

University of Delaware, Newark, DE 19716

Charles Black Evans Professor

JPMorgan Chase Faculty Scholar

Department of Electrical and Computer Engineering and
Institute of Financial Services Analytics. 2014-2017.

**Fulbright-Nokia Distinguished Chair in Information and
Communications Technologies**

Aalto University, Helsinki, Finland. 2010-2011.

University of Delaware, Newark, DE 19716

Charles Black Evans Distinguished Professor and Chairman

Department of Electrical and Computer Engineering. 2004-2009.

University of Delaware, Newark, DE 19716

Professor and Chairman

Department of Electrical and Computer Engineering. 2000-2004.

University of Delaware, Newark, DE 19716

Interim Chairman

Department of Electrical and Computer Engineering. 1999.

University of Delaware, Newark, DE 19716

Professor

Department of Electrical and Computer Engineering. 1992-1996.

University of Delaware, Newark, DE 19716

Associate Professor

Department of Electrical and Computer Engineering. 1987-1992.

Unisys Corporate Research center, Reston, VA 19716

Visiting Member of Technical Staff. 1985.

University of Delaware, Newark, DE 19716

Assistant Professor

Department of Electrical and Computer Engineering. 1982-1987.

Purdue University, West Lafayette, IN 47907

Research Assistant

School of Electrical and Computer Engineering. 1980-1982.

Awards and Honors

JPMorgan Chase Faculty Fellow at the Institute of Financial Services Analytics, 2017-2019.
Fulbright-Nokia Distinguished Chair in Information Technologies and Communications 2017.
JPMorgan Chase Scholar at the Institute of Financial Services Analytics, 2014-2016.
Fulbright-Nokia Distinguished Chair in Information Technologies and Communications Helsinki, Finland, 2010-2011.
Elected Member, Arkansas Academy of Engineering, University of Arkansas, 2008.
DuPont Science and Engineering Awards 1998, 2002, 2008.
Fellow of the IEEE for contributions on the theory and applications of nonlinear signal processing, 2000.
Fellow, Center for Advanced Studies, University of Delaware, 1998.
ARL ATIRP Federated Laboratory Symposium Best Paper Award 1997.
Best Scientific Paper Award, Whitaker Foundation and Rehabilitation Engineering Society of North America (RESNA), 1995.
ASEE Teaching Fellow, 1992.
Sperry Corporation Research Award, 1985.
National Science Foundation Research Initiation Award, 1983.

Awards to Students Supervised

Allan P. Colburn Prize in Mathematical Sciences and Engineering for the most outstanding dissertation in the engineering and mathematical disciplines, Xu Ma (2010).
Allan P. Colburn Prize in Mathematical Sciences and Engineering for the most outstanding dissertation in the engineering and mathematical disciplines, Yinbo Li (2006).
Allan P. Colburn Prize in Mathematical Sciences and Engineering for the most outstanding dissertation in the engineering and mathematical disciplines, Juan G. Gonzalez (2002).
Allan P. Colburn Prize in Mathematical Sciences and Engineering for the most outstanding dissertation in the engineering and mathematical disciplines, Kenneth Barner (1992).

Editorial Boards

Special Issue of the Journal of Electronic Imaging on Compressed Sensing, SPIE, 2012-2013
IEEE Transactions on Signal Processing, 1999-2003.
IEEE Transactions on Acoustics, Speech, and Signal Processing, 1991-1996.
IEEE Transactions on Image Processing, 1995-1996.
Optics Express, 1998.
EURASIP Journal on Applied Signal Processing, 2001-2005.
Special Issue of JASP, Nonlinear Signal Processing and Applications, Dec. 2002.
Special Issue of JASP, Nonlinear Signal Processing and Applications, Dec. 2001.

Professional Societies and Activities

- **The Institute of Electrical and Electronics Engineers (IEEE)**
 - IEEE Society on Signal Processing
 - IEEE Fellow.

- Tutorials Chair, International Conference on Acoustics, Speech, and Signal Processing, 2005.
- Co-Chair, Nonlinear Signal and Image Processing Workshop, 2001.
- Program Committee, Workshop on Nonlinear Digital Signal Processing, 1993, 1995, 1997, 1999, 2003, 2005.
- Program Committee, International Conference on Image Processing, 1994, 1998.
- Program Committee, ICASSP, 1994.
- Technical Committee Chair, MicroDelcon Conference, 1983.
- Student Chapter Advisor, 1985-1993.

IEEE Circuits and Systems Society

- Member, Technical Committee on Digital Signal Processing, 1985-2003.
- Program Committee, Midwest Symposium on Circuits and Systems, 1989.
- Program Committee, International Symposium on Circuits and Systems, 1997.

• **Optical Society of America**

- Guest Editor, Optics Express.

• **Nonlinear Signal and Image Processing Board**

- Board Founding Member.
- Program Committee Member, NSIP. 1993, 1995.
- General Co-Chair, NSIP Workshop, 2001.

• **Society of Photographic and Instrumentation Engineers**

- Guest Editor, Journal of Electronic Imaging, Special Issue on Compressed Sensing, 2012-2013.
- Conference Co-Chair, SPIE Symposium on Security and Defense, Compressed Sensing, 2013, 2014, 2015.
- General Co-Chair, International Symposium on Computers and Information Technology (IT COM 2002).
- Conference Co-Chair, Symposium on Nonlinear Electronic Imaging, 1990, 1991.
- Lecturer, Short Course on Nonlinear Image Processing, 1990.

• **European Association of Signal and Image Processing (EURASIP)**

- Program committee, European Signal and Image Processing Conference, 1997, 2000.
- Lecturer, EURASIP Short Course on Compressed Sensing and Its Applications in Imaging, Aalborg Denmark, 2010.

*Boards and
Panels*

- Natural Sciences and Engineering of the Academy of Finland, Academy Professorship Proposal Review, 2009.
- Research Grants Council (RGC) of Hong Kong, Review Panel, 2009.
- National Science Foundation, Review panel for CISE Division, 2009, 2012, 2014,2015,2016.
- National Science Foundation, Review panel for CAREER Awards, 2009, 2011, 2013, 2014,2015.
- External Advisory Board, College of Engineering, University of Central Florida, 2004 - 2007.
- Image Science and Technology, Advisory Board Member, 1998, 1999, 2001.
- Army's Telecommunications and Information Distribution (ATIRP) Federated Laboratory Consortium Management Board, 1997-1998.
- National Science Foundation, Review panel for Microelectronics and Information Processing Division, 1986, 1988, 1995, 2000.
- National Science Foundation, Review panel for the Small Bus. Innovation Awards, 1994.

- Canada Research Office, Review panel for the Postdoctoral Awards Program, 1996.
- University IDEAS, Bogota, Colombia, Scientific Advisory Board Member, 1997.
- Chair, Panel on Signal Processing for Heavy Tailed-Distributions, 1998.

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- Post Doctoral Supervision*
- Iftekar Mirza (PhD Delaware, jointly with D. Prather): Compressive spectral imaging, 2010 - 2012.
 - Jan Bacca (PhD Delaware): Voronoi dithering for multitoning, 2007-2009.
 - InKoo Kang (PhD KAIST - Korea): Visual cryptography and authentication, 2007-2009.
 - Jose L. Paredes (PhD Delaware): UWB communications with compressive sensing, 2006, 2008 - 2009.
 - Daniel L. Lau (PhD University of Delaware): Electronic printing, 2001.
 - Sudhakar Kalluri (PhD University of Delaware): Communications theory, 1998.

Ph.D Student Supervision

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- [1]. Hoover Rueda, "Compressive spectral imaging," in progress.
 - [2]. Claudia Correa, "Colored patterned spectral imaging," in progress.
 - [3]. Laura Galvis, "Compressed sensing," in progress.
 - [4]. Juan Becerra, "Compressed sensing applied to non-linear processing," in progress.
 - [5]. Chen Fu, "Polarimetric spectral imaging," in progress.
 - [6]. Chris Peitsch, "Sparse computed tomography," in progress.
 - [7]. Alejandro Parada, "Compressed sensing," in progress.
 - [8]. Angela Cuadros, "Sparse CT imaging," in progress.
 - [9]. Michael Don, "IR spectral compressive imaging," in progress.
 - [10]. Carlos Mendoza, "Sparse signal processing," in progress.
 - [11]. Edgar Salazar, "Compressed Imaging and Sensors", in progress.
 - [12]. Juan Florez, "Compressed Imaging and Sensors", (Co-advised with K. Barner), in progress.
 - [13]. Andre Rauh, "Fast Algorithms for Selection and Multidimensional Sparse Fourier Transform," 2015.
 - [14]. Gonzalo Garateguy, "Optimal embedding of QR codes into color, gray scale and binary images," 2014. Now with Mathworks.
 - [15]. Henry Arguello, "Coded aperture optimization in compressive spectral imaging," 2013. Now with Universidad Industrial de Santander, Colombia.
 - [16]. Ana Ramirez, "Compressive spectral image classification," 2013. Now with Universidad Industrial de Santander, Colombia.
 - [17]. Jirar Helou (F. Kiamilev co-advisor), "CMOS architectures for threshold data converters," 2011. Now with Intel.
 - [18]. Ivan Barrera, "Statistical Approaches to Congestion Control in Internet Routers," 2010. Now with Intel.
 - [19]. Zhongmin Wang, "Ultra Wide Band Compressed Sensing," 2010. Now with Qualcomm.
 - [20]. Xu Ma, "Optimization of resolution enhancement techniques in optical lithography," Winner of the Allan P. Colburn Best Dissertation Award as the most outstanding doctoral dissertation in engineering, mathematics, and computer sciences, 2009. Currently on the faculty at the Beijing Institute of Technology.
 - [21]. Michael Wilson, "Projectile Navigation and the application to magnetometers," 2007. Now with the Army Research Laboratories.

- [22]. Jan Bacca, "Blue Noise Methods for Hexagonal Grids and Multitone Dithering," 2007. Now with the University Nacional de Colombia in Bogota.
- [23]. Renwei Ge, "Information Security in Mobile Ad Hoc Networks," 2006. Now with Qualcomm.
- [24]. Yinbo Li, "Nonlinear signal processing in the complex domain and high dimensions," Winner of the Allan P. Colburn Best Dissertation Award as the most outstanding doctoral dissertation in engineering, mathematics, and computer sciences, 2005. Now with Qualcomm.
- [25]. Liangping Ma (K. Barner co-advisor), "Signal processing analysis and algorithms for internet congestion control," 2005. Now with San Diego Research Center.
- [26]. Karen Bloch, "Signal analysis methods for biological data," 2004. Now with DuPont.
- [27]. Sebastian Hoyos (B. Sadler co-advisor), "Mixed signal high speed processing solutions for broadband systems and technologies," 2004. Now with the faculty at Texas A & M University.
- [28]. Zhi Zhou, "Advances on digital video and visual cryptography," 2004. Now with Google Research.
- [29]. Cesar Nino, "New imaging technologies in halftoning: data hiding, color modeling and color matching," 2002. Now with Pontificia Universidad Javeriana, Bogota, Colombia.
- [30]. Jose Luis Paredes, "New robust signal processing tools for multimedia and communications," 2001. Now with the faculty at the University of Los Andes, Venezuela.
- [31]. Alexander Flaig, "Nearfield spot-beamforming," Aug. 2000. Now with Texas Instruments.
- [32]. Liehua Xie, "Authentication codes and watermarking for multimedia communications in lossy networks," May 2000. Now with Eye Cast.
- [33]. Daniel L. Lau (N. C. Gallagher co-supervisor), "Modern digital halftoning," May 1999. Now with the faculty at the University of Kentucky.
- [34]. Sudhakar Kalluri, "Nonlinear adaptive algorithms for robust signal processing and communication in impulsive environments," Dec. 1998. Now with Intel.
- [35]. Juan G. Gonzalez, "Robust technologies for wireless communications in non-gaussian environments," Winner of the Allan P. Colburn Best Dissertation Award as the most outstanding doctoral dissertation in engineering, mathematics, and computer sciences, May 1997.
- [36]. David E. Griffith, "Robust time-frequency representations for signals in alpha-stable noise: methods and applications," December 1997. Now with NIST.
- [37]. Edwin A. Heredia, "A piecewise polynomial theory for nonlinear signal processing," May 1996. Now with Microsoft Research.
- [38]. Yeong T. Kim, "Permutation and combination filter lattices and their applications in non-linear signal processing," Aug. 1993. Now VP of Samsung America.
- [39]. Timothy Hall, "Permutation and combination weighted order stastic filters for image processing," May 1994. Now with NIST.
- [40]. Martin Mueller, "Tomographic algorithms and synthetic detector arrays," May 1993. Now with Siemens Corp.
- [41]. Kenneth E. Barner, "Permutation filters: a new group theoretic class of non-linear filters," Winner of the Allan P. Colburn Best Dissertation Award as the most outstanding doctoral dissertation in engineering, mathematics, and computer sciences, May 1993. Now with the faculty at the University of Delaware.
- [42]. Shoupu Chen, "Micro-structured adoptive filter theory for robust signal processing," May 1992. Now with Kodak Research.
- [43]. David C. Brown (C. Ih co-supervisor), "Scene segmentation and definition for autonomous robotic navigation using structured light processing," May 1989. Now with the Army Research Laboratories.

- [1]. Xiao Ma, 2017.
- [2]. Yuksel Karahan, 2017.
- [3]. Angela Cuadros, "Coded aperture design by uniform sensing in compressive X-ray tomosynthesis systems," 2016.
- [4]. Hoover Rueda, "Higher order discretization model for coded aperture spectral imaging systems," 2015.
- [5]. Kai Wang, "Coded aperture compressive tomosynthesis," 2014.
- [6]. Sergio Matiz, "Analog joint source channel coding for wireless optical communications and image transmission," 2013.
- [7]. Claudia Correa, "Lapped-windowed reconstructions in compressive spectral imaging," 2013.
- [8]. Diego Pienovi, "Threshold data converters," 2009.
- [9]. Xu Ma, "Generalized Inverse Lithography Methods for Phase-shifting Mask Design," 2008.
- [10]. Rafael Nunez, "Fast Sample Myriad Computation," 2008.
- [11]. Andres Medina, "Statistical Approach to Neighborhood Congestion Control," AdHoc Network Congestion control, 2007.
- [12]. Liangping, Ma, "New packet delay network protocols based on robust signal processing," 2007.
- [13]. Alvaro Gonzalez, "Alpha Stable Human Visual System Models for Digital Halftoning," 2007.
- [14]. J. Bacca, "Spectral design of weighted median filters: a general iterative approach," 2003.
- [15]. F. Faheem, "Digital multitone using gray level separation," Dec. 2002.
- [16]. A. M. Khan, "Stochastic Moire," Jan. 2002.
- [17]. N. Grabowski, "Sigma Delta Modulation Using Weighted Median Filters," Jan. 2002.
- [18]. S. Hoyos, "Mixed-signal architectures for printed circuit board channels," Aug. 2001.
- [19]. C. Nino, "Data embedding in digital halftones with screen mask codes," May. 2000.
- [20]. S. Hasan, "Elimination of interference terms of discrete wigner distribution using nonlinear filtering," 1999.
- [21]. Y. Berananda, "Adaptive myriad filters for image processing in alpha-stable impulsive noise," 1999.
- [22]. J. Paredes, "Stack filters, stack smoothers, and mirrored threshold decomposition," 1998.
- [23]. L. Xie, "Watermarking digital image signatures for authentication," 1998. Now with Eye Cast.
- [24]. A. Flaig (K. Barner co-supervisor), "Affine-order-statistic filters: medianization of linear FIR filters," 1998.
- [25]. F. Strobel, "Wavelet encoded zero tree compressed still image transmission using a partial reliability/partial order transport protocol," (Technical University Uhlm FHTE), May 1997.
- [26]. H. Cui (N. C. Gallagher co-supervisor), "The development of a simulator for neuromorphic circuits," Fall 1996.
- [27]. Y. Kim (A. Khayrallah co-supervisor), "Nonlinear filters in robust data compression of speech signals," 1996.
- [28]. A. Flaig, "Fuzzy order-statistics," (Technical University Aalen FHTE), 1996.
- [29]. P. Zurbach, "Weighted myriad filters for image processing," June, 1996.
- [30]. L. Li, "Detection of evoked potentials as a method for brain computer interfacing," Fall 1996.

- [31]. J. Gonzalez (K. Barner co-supervisor), "A new approach to suppressing abnormal tremor through signal equalization," 1995.
- [32]. D. Griffith, "Partially decoupled volterra filters: formulation and adaptive algorithms," 1994.
- [33]. M. Tian, "Transform domain adaptive order stastic based filters," Aug 1994.
- [34]. W. Reynolds, "Micro-statistics in adaptive antenna arrays," Aug. 1992.
- [35]. R. Hardie, "Ranking multivariate data and its use in color image estimation," May 1990.
- [36]. K. Barner, "Optimal detection schemes for the restoration of images with signal dependent noise," Dec. 1989.
- [37]. T. Hu, "Applications of subband decomposition to data compression," Dec. 1989.
- [38]. R. Feehs, "Optimal detection approaches to image restoration: signal independent noise," Dec. 1989.
- [39]. R. Foster, "Algorithms architectures and the VLSI implementation of ranked-order filters for multidimensional signal processing," May 1988.
- [40]. T. Rao, "Fourier based analysis of ordered dither halftoning," Dec 1988.
- [41]. S. Fontana, "Temporal ranked filters for stationary and motion compensated imagery," Dec. 1986.
- [42]. M. Mc Loughlin, "Deterministic properties of two-dimensional medial type filters," Dec. 1985.
- [43]. R. Crinon, "Theoretical analysis of the median filtering of impulse type noise," May 1984.
- [44]. J. Dalton, "Visual model based image halftoning using markov random field error diffusion," Dec. 1984.

Contracts and Grants

Summary: *As principal investigator or co-principal investigator, I have been responsible for close to \$25 million in research funding from various DoD organizations, NSF, and Industry.*

- National Science Foundation, "Coded Aperture X-ray Compressive Spectral Tomography," \$450,000, 08/01/2017-07/31/2020.
- Institute for Financial Services Analytics and JPMorgan Chase, "JPMC Faculty Fellow" \$300,000, 2015-2017.
- Institute for Financial Services Analytics and JPMorgan Chase, "JPMC Faculty Fellow" \$2,000,000 (with 6 other investigators), 2017-2019.
- National Science Foundation and Intel, "Collaborative Research: Joint Compressive Spectral Imaging and 3D Ranging Sensing using a commodity Time-Of-Flight Range Sensor," \$900,000 from NSF; \$25,000 from Intel, Co-PI Daniel Lau, 09/01/2015-08/31/2018.
- Johns Hopkins University Applied Physics Laboratory, "Compressive Colored Raman Imaging (CCRI) of Optical Standoff Explosive Detection," \$100,000, 06/21/2016 -05/10/2017.
- Army Research Laboratories, "A compressive sensing infrared camera for spinning munitions," \$329,500, 09/26/2014-09/25/2017.
- Fulbright, Colfuturo, "Colombian PhD fellowships," \$900,000, 2013-2019.
- Army Research Office, "A system for compressive spectral and polarimetric imaging," \$90,000, 2014-2015.
- Institute for Financial Services Analytics and JPMorgan Chase, "JPMC Faculty Scholar" \$279,000, 02/01/2014-01/31/2017.
- Army Research Office, "Compressive Spectral Image Classification," \$150,000, 8/12-5/15.
- Unidel Foundation, "Global Partnerships" \$ 27,000, 8/11 -9/12.
- Michelin Corporation, with J. Garcia-Frias and X.-G. Xia, "Anomaly pattern analysis and prediction using low-rank and sparse models," \$ 360,000, 5/11 - 6/14.

- Army Research Office, “Compressed Sensing Imaging,” \$50,000, 8/11-5/12.
- Office of Naval Research, with D. Prather and J. Garcia-Frias, “Spectrally adaptive compressed imaging system,” \$1,450,000, 7/10-7/13.
- ARL through DSCI subcontract, with D. Sincoskie, and other ECE faculty, “Cybersecurity in tactical environments,” \$ 706,999 , 10/10-8/12.
- National Science Foundation, with J. Garcia-Frias, “Analog compressive sensing,” \$500,000, 7/09-7/13.
- National Science Foundation, with J. Garcia-Frias, “Compressed sensing using a-priori information,” \$310,000, 9/07-8/13.
- Army Research Office, “Network Intrusion Detection,” \$50,000, 8/10-5/11.
- Intel Corporation, “Inverse Lithography with partially coherent illumination,” \$200,000, 1/08-08/10.
- Army Research Laboratories, “Signals and Controls Laboratory,” \$60,000, 12/08-12/09.
- State of Delaware, with C.Ih, “Smart universal power inverter for reactive power generation and recuperation,” \$100,000, 3/07-3/08.
- Telcordia Technology/Army Research Laboratory, with S. Bohacek, “Collaborative Technology Alliance Consortium Phase II,” \$400,000 5/06-9/09.
- Office of Naval Research, with D.Prather, “Compressed Sensing Imaging with Wide FOV and Dynamic Magnification,” \$2,213,586, 12/06-6/10.
- Army Research Laboratories, with D. Weile, “Nonlinear signal processing and EM modeling of attitude RF polarimetric sensors, \$300,000, 12/06-12/08.
- DuPont, “Authentication with visual cryptography,” \$10,000, 12/07 - 12/08.
- Unidel Foundation, “Sub-terahertz and Millimeter wave imaging and spectroscopy laboratory,” \$320,000, 9/05-9/06.
- Army Research Laboratories, “Digital Signal Processing Laboratory,” \$50,000, 12/05-12/07.
- Unidel Foundation, “Spintronics laboratory in ECE,” \$300,000, 9/04-9/05.
- National Science Foundation, with D. Mills, “ITR: Optimal Diffusion Mechanisms for Fast and Robust TCP Congestion Control,” \$349,978, 9/03-8/07.
- Intel Corporation, “Wavelet Inverse Imaging for Sub Wavelength Lithography,” \$200,000, 1/04-06/06.
- Agere, “HVS Model-based halftoning,” \$177,000, 2004-2005.
- Army Research Laboratory, “Collaborative Technical Alliance in Networks and Communications,” with 8 faculty in ECE and CIS, \$6,000,000 , 2001 - 2006.
- Unidel Foundation, “Undergraduate laboratories in ECE,” \$300,000, 9/01-9/02.
- Battelle, with F. Kiamilev, “Power-saving communication protocols for VCSEL arrays,” \$24,000, 9/01-9/02.
- Raytheon Systems Co., with F. Kiamilev, “Raytheon A.C.N. Project,” \$44,000, 5/00-9/01.
- DE Research Partnership, “Delaware Research Partnership Program,” \$54,000.00, 1/01-6/02.
- PMC-Sierra, Inc., “Signal processing for internet technology,” \$35,000, 3/00-2/02.
- Lexmark International, Inc., “Advances in Color and green noise halftoning for electronic imaging,” \$30,000, 6/00-5/02.
- Direct Radiology Corporation (with K. Barner), “New methods for improved noise reduction, contrast enhancement, and volume rendering of directray images,” \$46,000, 2000 - 2001.
- DARPA ITO (with F. Kiamilev), “Low power communication protocols for high speed cross switchers,” \$200,000, 10/00 - 9/01.
- Du Pont iTechnologies, “Digital Halftoning for Prepress Technologies,” \$80,000, 6/01 - 6/03.

- Lexmark International, “Advances in Color and Green Noise Halftoning for Electronic Imaging,” \$30,000, 6/00-5/02.
- Battelle, “Power-saving Communication Protocols for VCSEL Arrays,” \$24,000, 9/01-9/02.
- Direct Radiology Corporation (with K. Barner), “Digital processing of X-ray imagery” \$5,000, 1999.
- AANETCOM, “Signal processing for gigabit Ethernet,” \$90,000, 1999-2000.
- Lexmark International, “Green noise halftoning masks,” \$27,000, 1999.
- Du Pont, “Digital image watermarking,” \$25,000, 1998-1999.
- National Science Foundation, “Parallel and distributed computing,” with 8 faculty in ECE and CIS, \$900,000, 1997 - 2001.
- National Science Foundation (with N. Gallagher), “Weighted myriad filters and their application to communications,” \$310,000, 1996 - 2000.
- Army Research Laboratories, “Robust Viterbi decoders,” \$30,000, 1998-1999.
- National Science Foundation, “Research Experiences for Undergraduates,” \$10,000, 1997 -1998.
- Army Research Laboratory, “Advanced Telecommunications/Information Distribution Research Federated Laboratory,” with 6 faculty in ECE and CIS, \$ 4 million, 1996 - 2001.
- Silicon Graphics (with N. C. Gallagher, K. Barner, C. Boncelet), “Multimedia equipment for Instruction and research,” \$420,000, 1995 - 1996.
- National Science Foundation, “Video signal processing research,” with C. Boncelet, et al, \$ 100,000, 1994 - 1995.
- National Science Foundation, “Microstatistic signal decomposition and the optimal filtering problem,” \$130,000, 1991 - 1993.
- ALCOA, “Three dimensional computerized tomography with truncated projections,” \$95,000, 1990 - 1992.
- Sperry Corporation, “Multidimensional signal processing and computer vision,” \$30,000, 1986 - 1987.
- Du Pont, “Data compression methods in process control,” \$28,000, 1987 - 1988.
- Du Pont and The Delaware Research Partnership, “Visual communications of computer networks,” \$57,000, 1989 - 1990.
- Unidel Foundation, “A Computer Vision and Image Processing Laboratory,” \$170,000, with P. Warter and C. Boncelet, 1986 -1987.
- University of Delaware Research Foundation, “Analysis of Two Dimensional Median Filters,” \$15,000, 1983 - 1984.
- National Science Foundation, Research Initiation Grant, “Theoretical analysis of recursive median filters,” \$55,000, 1983 - 1985.

Patents

- [1]. G. Arce, and H. Arguello, “Spectral Imaging Sensors and Methods”, US Patent 9,343,491. May, 2016.
- [2]. D. Lau and G. R. Arce, “Image Quantization for Digital Printing”, US Patent 8,867,100B2, Oct. 2014.
- [3]. Z. Zhou, Y. T. Kim, and G. R. Arce, ”Method of motion compensated temporal noise reduction”, US Patent 7,535,517, June 19, 2009.
- [4]. S. Hoyos, B. Sadler, G. R. Arce, ”Analog to Digital Conversion with Signal Expansion,” US Patent 7,253,761, August 7, 2007.
- [5]. L. Russo, J. Paredes, G. R. Arce, ”Bijection Mapping for Compression/Denoising of Multi-Frame Images,” US Patent 7,224,845, May 29, 2007.

- [6]. C. Nino, and G. R. Arce, "Method for Modeling Color Halftones," US Patent 7,173,733, February 7, 2007.
- [7]. D. Lau, G. R. Arce, and N. Gallagher, "Digital color halftoning with generalized error diffusion vector green-noise masks" US Patent 6,798,537, September 28, 2004.
- [8]. K. Bloch and G. R. Arce, "Method of Non-Linear Analysis of Biological Sequence Data," US Patent 6,728,642, April 27, 2004.
- [9]. L. Xie, A. Lewis, E. Basch, G. R. Arce, "Message Authentication Code with Improved Error Tolerance," US Patent 6,665,420, December 16, 2003.
- [10]. L. Xie, A. Lewis, A. Michelson, E. Basch, G. R. Arce, "Message Authentication Code Using Image Histograms," US Patent 6,606,393, August 12, 2003.
- [11]. X. Xia, C. Boncelet, and G. R. Arce, "Watermarking Methods for Digital Images and Videos," US Patent 6,556,689, April 12, 2003.
- [12]. L. Xie, A. Lewis, E. Basch, G. R. Arce, "Systems and Methods for Etching Digital Watermarks," US Patent 6,512,836, January 28, 2003.
- [13]. G. R. Arce and D. Lau, "Method and apparatus for producing halftone images using green-noise masks having adjustable coarseness" US Patent 6,493,112, December 10, 2002.
- [14]. M. Mueller, G. R. Arce, and R. Blake, "Cone beam synthetic arrays in three-dimensional computerized tomography," US Patent 5,740,224,593, April 14, 1998.
- [15]. M. Mueller and G. R. Arce, "Tilted Detector Microscopy in Computerized Tomography," US Patent 5,493,593, February 20, 1996.

*Keynote and
Invited Talks*

- [1]. "Robust Norms in Sparse Representations and Compressed Sensing, 2016 Joint IEEE SPS and EURASIP Summer School on Robust Signal Processing, September 19-24, 2016. Rhein, Germany.
- [2]. "Coded Aperture Optimization for Compressive Spectral and Tomographic Image Sensing," Distinguished Seminar Series, Johns Hopkins Applied Physics Laboratory. July 28, 2016.
- [3]. "Coded Aperture Optimization for Compressive Spectral and Tomographic Image Sensing," Distinguished Speaker Talk, University of Sevilla, 2016.
- [4]. "Coded Aperture Optimization for Compressive Spectral and Tomographic Image Sensing," Distinguished Speaker Talk, Tongji University, Shanghai, 2016.
- [5]. "Coded Aperture Optimization for Compressive Spectral and Tomographic Image Sensing," Distinguished Speaker Talk, Tsinghua University, Beijing, 2016.
- [6]. "Coded Aperture Optimization for Compressive Spectral and Tomographic Image Sensing," Distinguished Speaker Talk, Beijing Institute of Technology, 2016.
- [7]. "Compressive Spectral and Tomographic Sensing and Imaging," Distinguished Speaker Talk, Johns Hopkins University, Nov. 2015.
- [8]. "Compressive Spectral Imaging: A review," IEEE Global Conference on Signal and Information Processing (GLOBALSIP 2014), Atlanta, GA, Dec. 3, 2014.
- [9]. "Compressive Spectral Imaging in EO/IR surveillance," NATO Science and Technology Office Specialists Meeting, Tallin, Estonia, May 10-14, 2014.
- [10]. "Coded aperture optimization in compressive spectral imaging," Aalto University, Helsinki, Finland, May 7, 2014.
- [11]. "Compressive Spectral Imaging: Sensing, Processing, and Optimization," Distinguished speaker talk, Villanova University, 2013.
- [12]. "Compressive Spectral Imaging: Sensing, Processing, and Optimization," Air Force Research Laboratory, Dayton OH, Nov. 2012.
- [13]. "Compressive Spectral Imaging," ARL, Night Vision Laboratories, Fort Belvoir VA, Sept. 2012.

- [14]. "Compressive Sensing and Imaging," Jia Tong University, Shanghai China, Oct. 2012.
- [15]. "New Algorithms for Computational Lithography," Beijing Institute of Technology, Oct. 2012.
- [16]. "Compressive Sensing and Imaging," Jia Tong University, Xi'an China, Oct. 2012.
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