

RALPH ETIENNE-CUMMINGS

Dept. of Electrical and Computer Engineering
The Johns Hopkins University
Baltimore, MD 21218
Tel: (410) 516 3494
Fax: (410) 516 5566
email: retienne@jhu.edu
<http://etienne.ece.jhu.edu/~etienne>

RESEARCH INTEREST

VLSI circuits, systems and algorithms for biologically inspired and low-power, parallel mixed-signal processing, with applications to sensory information process, biomorphic robotics and neural prosthetics, low-power instrumentation, acoustic signal processing MEMS and computer integrated surgical systems and technologies.

EDUCATION

University of Pennsylvania, Moore School of Electrical Engineering, Philadelphia, Pennsylvania
Ph.D. in Electrical Engineering, December 1994
Master in Electrical in Electrical Engineering, December 1990
Lincoln University, Department of Physics, Lincoln University, Pennsylvania
Bachelor of Science in Physics, May 1988, Summa Cum Laude, Valedictorian

EXPERIENCE

Faculty Positions:

Johns Hopkins University, Baltimore, MD, *Professor of ECE*, July 1st, 2008 – present
Johns Hopkins University, Baltimore, MD, *Associate Professor of ECE*, July 2002 – July 1st, 2008
Johns Hopkins University, Baltimore, MD, *Associate Director for Education and Outreach of the ERC on Computer Integrated Surgical Systems and Technology*, January 2004 – present
Johns Hopkins University, Baltimore, MD, *Secondary Appointment in CS*, November 2005 – present
University of Maryland, College Park, MD, *Adjunct Associate Professor*, July 2004 – Present
Institute of Neuromorphic Engineering, *Director*, July 2002 – July 2008
University of Cape Town, Cape Town, South Africa, *Visiting African Scholar*, June 2006 – February 2007
Johns Hopkins University, Baltimore, MD, *Director of CE*, July 2002 – July 2006
University of Maryland, College Park, MD, *Associate Professor*, January 2002 – January 2004
Johns Hopkins University, Baltimore, MD, *Assistant Professor*, July 1998 – July 2002
Southern Illinois University, Carbondale, IL, *Assistant Professor*, January 1995 – June 1998

Visiting Scientist Positions:

Lawrence Livermore National Laboratory, Livermore, CA, *Visiting Scientist*, May 1997 – August 1998

Consulting Activities:

Panasonic N. America & Corporation, Palo Alto, *Consultant Engineer*, January 2009 – present
Singular Computing, Baltimore, MD, *Consultant Engineer*, March 2007 – present
Adequate Energy, Cape Town, RSA, *Consultant Engineer*, October 2006 – present
Innovative Wireless Technologies, Forest, VA, *Research Collaborator*, August 2005 – present
Avago Inc, *Expert Witness*, August 2006 – Present
Agilent Technologies, *Expert Witness*, June 2004 – August 2006

Iguana Robotics Inc., Champagne, IL, *Consultant Engineer*, January 1999 – present
Nova Sensors Inc., Solvang, CA, *Consultant Engineer*, November 2000 – present
AC Group, Ellicott City, MD, *Consultant Engineer*, June 2002 – June 2003
Boulder Nonlinear Systems Inc., Boulder, CO, *Consultant Engineer*, June 2000 – January 2002
I.E.Med Inc., Baltimore, MD, *Consultant Engineer*, November 2000 – July 2001
Corticon Incorporated, Philadelphia, PA, *Consultant Engineer*, May 1991 - January 1998
Imperium Incorporated, Rockville, MD, *Consultant Engineer*, August 1996 - August 1997

EDUCATIONAL LEADERSHIP

Co-Organizer of MRCIIS Winter School, *JHU*, January 12th – 16th, 2009
Member of Johns Hopkins University Strategic Planning Committee, Co-Chair of People Working Group, *JHU*, April 2008 – September, 2008
Member of Engineering and Applied Science Programs for Professionals Curriculum Committee, Whiting School of Engineering, *JHU*, 2007 – Present
Leader of the ABET Committee for Computer Engineering, *JHU*, 2005/2006
Member of WSE Diversity Committee, Whiting School of Engineering, *JHU*, 2005 – 2008
Associate Director for Education and Outreach, ERC on CISST, *JHU*, 2004 – Present
Co-Chair of Diversity Committee, ERC on CISST, *JHU*, 2004 – Present
Director of Computer Engineering, *JHU*, 2002 – 2006
Co-PI SITE REU Program & Supervised REU Students, ERC on CISST, *JHU*, 2000 – Present
Director, Research and Education Outreach, *Institute of Neuromorphic Engineering*, 2002 - 2008
Instructor, *NSF Sponsored Course on Telluride Neuromorphic Engineering*, 1996 - Present
Organization Committee, *NSF Sponsored Course on Telluride Neuromorphic Engineering*, 2002 –Present
Served on various committees to improve the education experience for undergraduate students, *SIUC, JHU*, 1995 – Present
Organized/Lead various tutorials, workshops and panels at international conferences, *ISCAS, NIPS, ISSCC, BioCAS*, 1997 - Present
Organized and Supervised Competition RoboCup Team, *JHU*, 2001 – 2005
Curriculum Development, Advising and ABET, *JHU, UMCP, SIUC*, 1995 – 2006
Designed/Developed New Computer Engineering Laboratory, *SIUC* 1996, *JHU* 1999
Supervised Various Research, Senior Design and Independent Studies, *SIUC, JHU, UMCP, UCT*, 1995 - Present
Developed New Course, 520.391/491, 520.738, 520.427, 520.661/662, 520.771/772, *JHU*, 1998 – Present
Developed New Course, CAD VLSI, Senior Thesis Topics, *UCT*, 2006
Developed New Course, CAD VLSI, Mixed Signal VLSI, *UMCP*, 2002
Developed New Course, CAD VLSI, Neuromorphic Engineering, *SIUC*, 1995 – 1998

AWARDS and HONORS

Achieved IEEE Senior Member Status, *IEEE*, December 2008
Best “Ph.D in a Nutshell,” *IEEE BioCAS 2008 Conference*, Baltimore, MD, November 2008
Best Student Paper Finalist, *International Symposium of Circuits and Systems*, Seattle, WA, April 2008
Best Paper Honorable Mention, *North East BioEngineering Conference*, Providence, RI, April 2008
National Academies of Science Kavli Frontiers in Science Fellow, 2007
Science Spectrum Trailblazer Award for Top Minorities in Science, 2006
Fulbright Fellowship Award to South Africa, 2006/2007
Visiting African Fellowship Award, *University of Cape Town*, 2006/2007
Diversity Leadership Council Diversity Award, *JHU* 2006

2003 Best Paper Award, *EURASIP Journal of Applied Signal Processing*, 2004
Young Investigators Program Award, *Office of Naval Research*, 2000-2004
CAREER Award, *National Science Foundation*, 1996-2000
Harris Fellow, *University of Pennsylvania*, 1992-1994
Fountain Fellow, *University of Pennsylvania*, 1988-1992
Valedictorian, *Lincoln University*, 1988
Oakridge Fellow, *Lincoln University*, 1986-1988

PROFESSIONAL ACTIVITIES AND SERVICE

Appointed Conference General Chair, *IEEE Biomedical Circuits and Systems 2008 Conference*, 2007 – 2008
Elected Chair of the Technical Committee on Neural Systems and Applications, *IEEE ISCAS*, 2003 – 2005
Elected to the Board of Governors, *IEEE CAS Society*, 2003-2005, 2005 – 2008
Elected Chairman of the Technical Committee on Sensors, *IEEE ISCAS*, 2001 – 2003
Elected Secretary of the Technical Committee on Neural Networks, *IEEE ISCAS*, 2001 – 2003
Appointed Assoc. Director for Education and Outreach, *ERC on CISST at Johns Hopkins University*, 2004 – Present
Appointed to the Program Committee on Emerging Technology, *NIPS Society*, 2003 – 2004
Appointed Organizing Committee of the NSF Telluride Neuromorphic Engineering Workshop, 2003 – Present
Appointed Past-Chair of the Technical Committee on Sensors, *IEEE ISCAS*, 2003 – 2004
Appointed Director of the Computer Engineering Program, *Johns Hopkins University*, 2002 – 2006
Appointed Director of the Institute of Neuromorphic Engineering, 2002 – 2008 (an Institute “with-out walls”)
Appointed Senior Associated Editor, *IEEE Sensors Journal*, 2002 – July 2008
Appointed Senior Associated Editor, *IEEE Sensors Journal*, July 2008 – Present
Appointed Associated Editor, *IEEE Sensors Journal*, July 2004 – 2008
Appointed Associated Editor, *IEEE Trans. Biomedical Circuits and Systems*, 2006 – Present
Appointed to the Strategic Committee: IEEE CASS Board of Governors, 2003 – present
Appointed to the Regional Activities Committee: IEEE CASS Board of Governors, 2003 – 2008
Appointed to the Technical Activities Committee: IEEE CASS Board of Governors, 2003 – 2008
Appointed to the Journal Formation Committee Member: IEEE CASS, *Trans. Biomedical Circuits and Systems*, 2005 – 2006
Member of the Editorial Board: *INE The Neuromorphic Engineer*, 2002 – present
Guest Editor: *IEEE Sensors Journal*, Special Issue on Array Processing in VLSI, December 2002
Guest Editor: *Kluwer’s AICSP Journal*, Special Issue on Smart Sensors, July 2004
Guest Editor: *IEEE Trans. Biomedical Circuits and Systems*, Special Issue on BioCAS 2007, February 2008
Member: Senior Member IEEE, Circuits and Systems, Solid-State Circuits, SPIE, Electron Devices
Member of Awards Committee: Westgate Scholars, JHU/WSE, 2004, 2006
Member of Program Committee: ISSCC, SPIE, BIS, ISCAS, NIPS, COSI, BioCAS
Member of Promotion and Tenure Committee: Served on one P & T committee at JHU, 2006
Promotion and Tenure Referee: Associate Professor for 2 candidates, 2005
Promotion and Tenure Referee: Associate Professor for 1 candidates, 2007
Reviewer: IEEE SJ, IEEE TCAS II, IEEE TNN, IEEE TR, IEEE TBME, IEEE IJSSC, IJCV, NIPS, EWNS, ISCAS, Wiley, NSF, NIH

PUBLICATIONS

Journal Articles:

1. Y. M. Chi, R. Etienne-Cummings and G. Cauwenberghs, “Focal-Plane Change Triggered Video Compression for Low-Power Vision Sensor Systems,” accepted to *Public Library of Science One*, January, 2009

2. J. Tapson, C. Jin, A. van Schaik and R. Etienne-Cummings, "A First-Order Non-Homogeneous Markov Model for Integrate-and-Fire Neurons Stimulated by Small Phase-Continuous Signals," to appear in *Neural Computation*, January, 2009.
3. F. Tenore, A. Ramos Murguialday, A. Fahmy, R. Etienne-Cummings, and N. V. Thakor, "Towards Real-Time Control of Individuated Finger Movements using Surface Myoelectric Signals," accepted to *IEEE T. Biomedical Engineering*, Spring 2008.
4. R. Jacob Vogelstein, Lisa Stirling, Francesco Tenore, Vivian K. Mushahwar, and Ralph Etienne-Cummings. "A Silicon Central Pattern Generator Controls Locomotion in vivo," *IEEE T. Biomedical Circuits and Systems*, Vol. 2, No. 3, pp 212 – 222, Sept. 2008.
5. A. Acharya, F. Tenore, V. Aggarwal, R. Etienne-Cummings, M. H. Schieber, and N. V. Thakor, "Decoding Finger Movements Using Volume-Constrained Neuronal Ensembles," *IEEE Trans. Neural Systems and Rehabilitation Engineering*, Vol. 16, No. 1, pp. 15-23, 2008.
6. V. Aggarwal, S. Acharya, F. Tenore, R. Etienne-Cummings, M. H. Schieber, and N. V. Thakor, "Asynchronous Decoding of Dexterous Finger Movements using M1 Neurons," *IEEE Trans. Neural Systems and Rehabilitation Engineering*, Vol. 16, No. 1, pp. 3-14, 2008.
7. N. Ekekeke, P. Kazanzides and R. Etienne-Cummings, "A Wide Speed Range and High Precision Position and Velocity Measurements Chip with Serial Peripheral Interface," *Elsevier Integration, the VLSI Journal*, Vol. 41, No. 2, pp. 297 – 305, Feb 2008.
8. R. Philipp, V. Gruev, D. Orr, J. Van der Spiegel and R. Etienne-Cummings, "A Linear and Low-Noise Current Domain Imager," *IEEE J. Solid-State Circuits*, Vol. 42, No. 11, Nov. 2007.
9. M. Chi, U. Mallik, E. Choi, M. Clapp, G. Cauwenberghs and R. Etienne-Cummings, "CMOS Pixel-Level ADC with Change Detection," *IEEE J. Solid-State Circuits*, Vol. 42, No. 10, pp. 2187-2196, Oct. 2007.
10. J. Vogelstein, U. Mallick, G. Cauwenberghs and R. Etienne-Cummings, "Real-Time Image Processing using a Spiking Imager and an Integrate-and-Fire Array Transceiver System," *Neural Computation*, Vol. 19, pp. 2281-2300, 2007.
11. J. Vogelstein, F. Tenore, R. Etienne-Cummings, M. A. Lewis, N. Thakor and A. Cohen, "Control of Locomotion After Injury or Amputation," *Biological Cybernetics*, Vol. 95, No. 6, pp. 555 – 566, December 2006.
12. J. Vogelstein, R. Etienne-Cummings, N. Thakor and A. Cohen, "Phase-Dependent Effects of Stimulation of the Spinal Central Pattern Generator for Locomotion," *IEEE Trans. Neural Systems and Rehabilitation Engineering*, Vol. 14, No. 3, pp. 257 – 265, September 2006.
13. N. Ekekeke and R. Etienne-Cummings, "Power Dissipation Sources and Possible Control Techniques in Ultra Deep Submicron CMOS Technologies," *Elsevier Journal of Microelectronics*, Vol. 37, No. 9, pp. 851-860 September 2006
14. M. Clapp and R. Etienne-Cummings, "Bearing Angle Estimation for Sonar Micro-Array Using Analog VLSI Spatiotemporal Processing," *IEEE Trans. Circuits and Systems-I*, Vol. 53, No. 4, pp. 769 – 783, 2006.
15. S. Mehta and R. Etienne-Cummings, "A Simplified Normal Optical Flow CMOS Camera," *IEEE Trans. Circuits and Systems-I*, Vol. 53, No. 6, pp. 1223 – 1234, June 2006
16. S. Mehta and R. Etienne-Cummings, "Normal Optical Flow CMOS APS Imager," *IEE Electronics Letters*, Vol. 41, No. 13, pp. 732 – 733, June 2005.
17. T. Horiuch and R. Etienne-Cummings, "A Time-Series Processor for Sonar Mapping and Novelty Detection," *Int. J. Robots and Automation*, Vol. 19, No. 4, pp. 171 – 177, 2004.
18. M. Clapp and R. Etienne-Cummings, "Sensing Signal Input Bearing to a Sensor Array Using Velocity-Sensitive Spatiotemporal Filters," *IEE Electronics Letters*, Vol. 40, No. 3, pp. 211-212, February 2004.
19. V. Gruev and R. Etienne-Cummings, "A Pipelined Temporal Difference Imager," *IEEE J. Solid-State Circuits*, Vol. 39, No. 3, pp. 538 – 543, March 2004.
20. R. Philipp and R. Etienne-Cummings, "A Single Chip Stereo Vision System," *Analog Integrated Circuits and Signal Processing Journal*, Vol. 7, pp. 703-712, July 2004.
21. E. Culurciello, R. Etienne-Cummings, and K. Boahen, "An Address Event Digital Imager," *IEEE J. Solid-State Circuits*, Vol. 38, No. 2, pp. 281 – 294, February 2003.

22. M. Anthony Lewis, R. Etienne-Cummings, M. H. Hartmann, A. H. Cohen, and Z. R. Xu, "An *In Silico* Central Pattern Generator: Silicon Oscillator, Coupling, Entrainment, Physical Computation & Biped Mechanism Control," *Biological Cybernetics*, Vol. 88, No. 2, pp 137-151, February 2003.
23. R. Etienne-Cummings, P. Pouliquen and M. A. Lewis, "A Vision Chip for Color Segmentation and Object Recognition," *EURASIP J. Applied Signal Processing*, Vol. 2003, No. 7, pp. 703-712, June 2003. (Best Paper 2003)
24. M. Clapp and R. Etienne-Cummings, "Dual Pixel Array for Imaging, Motion Detection and Centroid Tracking," *IEEE Sensors Journal*, Vol. 2, No. 6, pp. 529 – 548, December 2002.
25. V. Gruev and R. Etienne-Cummings, "A Pipe-Lined Differencing Imager," *IEE Electronics Letter*, Vol. 38, No. 7, pp. 315-317, March 2002.
26. R. Etienne-Cummings, P. Pouliquen and M. A. Lewis, "Single Chip for Imaging, Color Segmentation, Histogramming and Template Matching," *IEE Electronic Letters*, Vol. 38, No. 4, pp. 172 –174, February 2002.
27. V. Gruev and R. Etienne-Cummings, "Implementation Of Steerable Spatiotemporal Image Filters on the Focal Plane," *IEEE Trans. Circuits and Systems-II*, Vol. 49, No. 4, pp. 233-244, April 2002.
28. E. Culurciello, R. Etienne-Cummings, and K. Boahen, "An Address Event Digital Imager," *IEE Electronic Letters*, Vol. 37, No. 24, pp. 1443-1445, November, 2001.
29. R. Etienne-Cummings, V. Gruev and M. Clapp, "High Performance Biomorphing Image Processing Under Tight Space and Power Constraints," *Autonomous Robots*, Vol. 11, No. 3, pp. 227-232, November 2001.
30. R. Etienne-Cummings, "Neuromorphic Visual Motion Detection in VLSI," *Int. J. Computer Vision*, Vol. 44, No. 3, pp. 175-198, September 2001.
31. M. A. Lewis, M. Hartmann, R. Etienne-Cummings, and A. Cohen, "Biomorphing Control of a Running Robot Leg using a Custom aVLSI CPG Chip," *Neurocomputing*, Vol. 38-40, pp. 1409-1421, June 2001.
32. V. Gruev and R. Etienne-Cummings, "Programmable Spatial Processing Imager Chip," *Electronic Letters*, Vol. 37, No. 11, pp. 688 – 690, May, 2001.
33. R. Etienne-Cummings, Z. Kalayjian and D. Cai, "A Programmable Focal-Plane MIMD Image Processor Chip" *IEEE J. Solid-State Circuits*, Vol. 36, No. 1, pp 64 – 73, January 2001.
34. R. Etienne-Cummings, J. Van der Spiegel and P. Mueller, "A Foveated Silicon Retina for Two-Dimensional Tracking," *IEEE Trans. Circuits and System II*, Vol. 47, No. 6, pp. 504 – 527, June 2000.
35. R. Etienne-Cummings, "Intelligent Robot Vision Sensors in VLSI," *Autonomous Robots*, Vol. 7, No. 3 pp. 225-237, 1999.
36. R. Etienne-Cummings, J. Van der Spiegel and P. Mueller, "Hardware Implementation of a Visual Motion Pixel using Oriented Spatiotemporal Neural Filters," *IEEE Trans. Circuits and System II*, Vol. 46, No. 9, pp. 1121 – 1136, 1999.
37. R. Etienne-Cummings, J. Van der Spiegel and P. Mueller, "A Focal Plane Visual Motion Measurement Sensor," *IEEE Trans. Circuits and System I*, Vol. 44, No. 1, pp. 55 – 66, 1997.
38. R. Etienne-Cummings and J. Van der Spiegel, "Neuromorphic Vision Sensors," *Sensors and Actuators: A*, Vol. SNA056, pp. 19 – 29, 1996.
39. R. Etienne-Cummings, R. Hathaway and J. Van der Spiegel, "An Accurate and Simple CMOS 'One-Over' Circuit," *Electronic Letters*, Vol. 29-18, pp. 1618 – 1620, Sept. 1993.
40. J. Van der Spiegel, D. Blackman, P. Chance, C. Donham, R. Etienne-Cummings and P. Kinget, "An Analog Neural Network with Modular Architecture for Real-Time Dynamic Computations," *IEEE J. Solid-State Circuits*, Vol. 27, pp. 82 – 92, 1992.
41. P. Mueller, J. Van der Spiegel, D. Blackman, P. Chance, C. Donham, R. Etienne-Cummings, J., J. Kim, M. Massa and S. Samarasekera, "Design and Performance of a Prototype General Purpose Analog Neural Computer," *Neurocomputing*, Vol. 4, pp. 311 – 324, 1992.

Journal Articles (In Review):

1. V. Gruev, Z. Yang, R. Etienne-Cummings and J. Van der Spiegel, "Switchless Current Mode Active Pixel Sensor," submitted to *IEEE T. Circuits and Systems I*, Novmber 2008.
2. N. Ekeke, R. Etienne-Cummings, "On-Chip Bi-directional Resistance Trimming using Binary Weighted Currents," submitted to *IEE Electronics Letters*, Spring 2008.

3. C. Clark, C. White and R. Etienne-Cummings, "Design and Optimization of Tissue Specific Ultrasonic Systems," submitted to *IEEE T. Ultrasonics, Ferroelectrics and Frequency Control*, Spring 2008.

Books and Chapters:

1. O. Yadid-Pecht and R. Etienne-Cummings, *CMOS Imagers: from Phototransduction to Image Processing*, Kluwer Academic Publishers, Spring 2004
2. R. Etienne-Cummings, M. Clapp and V. Gruev, "Focal-Plane Analog Image Processing," in O. Yadid-Pecht and R. Etienne-Cummings, *CMOS Imagers: from Phototransduction to Image Processing*, Kluwer Academic Publishers, Spring 2004
3. R. Etienne-Cummings, "Visual Motion Detection Chip," in Ali Moini, *Vision Chips*, Kluwer Academic Publishers, 1999.
4. R. Etienne-Cummings, J Van der Spiegel and P. Mueller, "Neuromorphic and Digital Hybrid Systems," *Neuromorphic Systems: Engineering Silicon from Neurobiology*, L. Smith and A. Hamilton (Eds.), World Scientific, 1997.
5. J. Van der Spiegel and R. Etienne-Cummings, "Smart Sensors and Biologically Inspired Algorithms," (Invited) 15th Sensor Symposium, Kawasaki, Japan, June 3-4, 1997.
6. R. Etienne-Cummings, S. Fernando, N. Takahashi, V. Shtonov, J. Van der Spiegel and P. Mueller, "A New Temporal Domain Optical Flow Measurement Technique for Focal Plane VLSI Implementation," (reprint) *Vision Chips: Implementing Vision Algorithms with Analog VLSI Circuits*, C. Koch and H. Li (Eds.), IEEE Computer Press, 1995.
7. J. Van der Spiegel, R. Etienne-Cummings, C. Donham, A. Apsel, P. Mueller and D. Blackman, "A General Purpose Analog Neural Computer for Real-Time Spatiotemporal Pattern Analysis: Visual Motion Estimation", *Fuzzy Logic and Neural Networks Handbook-Architectures and Systems*, C. H. Chen (Ed.), Chapter 31, McGraw-Hill, New York, NY, 1995.

Invited Presentations:

1. R. Etienne-Cummings, "Current Mode Active Pixel Imagers Make Focal-Plane Processing Easier," *CMOS Emerging Technology*, Vancouver, Canada, Aug 2008.
2. R. Etienne-Cummings, "Generation and Control of Spinal Locomotion Circuits and Their application to Neural Prosthetics," *National Academies of Science Kavli Frontiers of Science*, Irvine, CA, Nov 2007.
3. R. Etienne-Cummings, "Focal-Plane Image Processing with Neuromorphic Vision Systems," *SPIE EOS*, Munich, Germany, June 2007.
4. R. Etienne-Cummings, S. Mehta, R. Philipp and V. Gruev, "Neuromorphic Vision Systems for Mobile Applications," *IEEE CICC'06*, San Jose, CA, September 2006.
5. R. Etienne-Cummings, "Neuromorphic Vision Systems," Workshop on Neuromorphic Systems, *IJCNN'05*, Montreal, Canada, August 2005.
6. F. Tenore, M. A. Lewis and R. Etienne-Cummings, "A Programmable Array of Silicon Neurons for the Control of Legged Locomotion," *IEEE ISCAS'04*, Vancouver, Canada, May 2004.
7. M. Massie, J.P. Curzan, C. Baxter, P. McCarley and R. Etienne-Cummings, "Vision Chips for Robot Navigation," *IEEE ISCAS'03*, Bangkok, Thailand, May 2003.
8. J. van der Spiegel, R. Etienne-Cummings and M. Nishimura, "Neuromorphic Vision Chips," *23rd International Conference On Microelectronics*, May, 2002.
9. M. Clapp and R. Etienne-Cummings, "Tracking Multiple Targets in 3D," *Proc. CISS'01*, Johns Hopkins University, Baltimore, 2001.
10. R. Etienne-Cummings, Z. Rong Xu and F. Tenore, M. A. Lewis, "Spike-Based Adaptive Control of a Biped," *Proc. CISS'01*, Johns Hopkins University, Baltimore, 2001.
11. R. Etienne-Cummings, "Computational Acoustic Sensors: Focal-Plane MEMS/CMOS Arrays," *Proc. of Biologically Inspired System*, Wollongong, Australia, 2000.
12. R. Etienne-Cummings, V. Gruev and M. Clapp, "High Density Focal-Plane Image Processing," *Proc. SPIE*, Orlando, 2001.

13. R. Etienne-Cummings, "Intelligent Visual Sensors: Will They Benefit Robotics," *Proc. Workshop on Biomorphic Robots, IROS98*, Victoria, BC, 1998.

Refereed Conference Presentations

1. S. Mitra, R. Zele and R. Etienne-Cummings, "Low-Voltage, High CMRR OTA For Electrophysiological Measurements," accepted for *ISCAS 2009*, Tiejpei, Taiwan, May 2009.
2. F. Folowosele, A. Harrison, A. Cassidy, A. Andreou, R. Etienne-Cummings, S. Mihalas, E. Niebur, T. Hamilton, "A Switched Capacitor Implementation of the Generalized Linear Integrate-and-Fire Neuron," accepted for *ISCAS 2009*, Tiejpei, Taiwan, May 2009.
3. J. Tapson, J. Diaz, D. Sander, N. Gurari, E. Chicca, P. Pouliquen and R. Etienne-Cummings, "The Feeling of Color: a Haptic Feedback Device for the Visually Disabled," *IEEE BioCAS 2008*, Baltimore, MD, November 2008.
4. P. Pouliquen, J. Vogelstein and R. Etienne-Cummings, "Considerations for the Use of a Howland Current Source for Neural Stimulation," *IEEE BioCAS 2008*, Baltimore, MD, November 2008.
5. S. Chen, F. Folowosele, D. Kim, R. J. Vogelstein, E. Culurcielle, and R. Etienne-Cummings, "A Size and Position Invariant Event-Based Human Posture Recognition," *IEEE BioCAS 2008*, Baltimore, MD, November 2008.
6. F. Tenore, and R. Etienne-Cummings, "Biomorphic Circuits and Systems: Control of Robotic and Prosthetic Systems," *IEEE BioCAS 2008*, Baltimore, MD, November 2008.
7. F. Folowosele, R. J. Vogelstein and R. Etienne-Cummings, "Real-Time Silicon Implementation of V1 in Hierarchical Visual Information Processing," *IEEE BioCAS 2008*, Baltimore, MD, November 2008.
8. R. Smith, F. Tenore, D. Huberdeau, R. Etienne-Cummings, N. Thakor, "Continuous Decoding of Finger Position from Surface EMG Signals for the Control of Powered Prostheses," *30th Annual International IEEE EMBS Conference*, Vancouver, Canada, August 2008.
9. A. Russell, F. Tenore, G. Singhal, N. Thakor, R. Etienne-Cummings, "Towards control of dexterous hand manipulations using a silicon Pattern Generator," *30th Annual International IEEE EMBS Conference*, Vancouver, Canada, August 2008.
10. N. Ekeke, R. Etienne-Cummings, "Adaptive Hysteretic Comparator with Opamp Threshold Level Setting," *IEEE International Midwest Symposium on Circuits and Systems, MWSCAS 2008*, August 2008.
11. N. Ekeke, R. Etienne-Cummings, "A 5-bits Precision CMOS Bandgap Reference with On-Chip Bi-directional Resistance Trimming," *IEEE International Midwest Symposium on Circuits and Systems, MWSCAS 2008*, August 2008.
12. F. Tenore, D. Huberdeau, N. Thakor and R. Etienne-Cummings, "Using Real-time Finger Tracking to Detect User Errors," *North East BioEngineering Conference*, Providence, RI, April 2008, **Honorable mention**.
13. Y. M. Chi, G. Cauwenberghs and R. Etienne-Cummings, "Image Sensor with Focal Plane Change Event Driven Video Compression," *IEEE ISCAS 2008*, Seattle, WA, May 2008.
14. C. Clarke, C. White and R. Etienne-Cummings, "Finite Element Modeling of Tissue for Optimal Ultrasonic Transducer Array Design," *IEEE ISCAS 2008*, Seattle, WA, May 2008.
15. G. Orchard, A. Russell, K. Mazurek, F. Tenore, R. Etienne-Cummings, "Configuring Silicon Neural Networks Using Genetic Algorithms" *IEEE ISCAS 2008*, Seattle, WA, May 2008.
16. F. Folowosele, F. Tenore, A. Russell, G. Orchard, M. Vismer, J. Tapson, and R. Etienne-Cummings, "Implementing a Neuromorphic Cross-Correlation Engine with Silicon Neurons," *IEEE ISCAS 2008*, Seattle, WA, May 2008.
17. J. Tapson, M.P. Vismer, C. Jin, A. van Schaik, F. Folowosele, R. Etienne-Cummings, "A Two-Neuron Cross-Correlation Circuit with a Wide and Continuous Range of Time Delay," *IEEE ISCAS 2008*, Seattle, WA, May 2008.
18. Y. M. Chi, G. Cauwenberghs, R. Etienne-Cummings, "Image Sensor with Focal Plane Change Event Driven Video Compression," *IEEE ISCAS 2008*, Seattle, WA, May 2008.
19. F. Folowosele, R.J. Vogelstein, R. Etienne-Cummings, "Spike-based MAX network for nonlinear pooling in hierarchical vision processing," *Proceedings of IEEE Biomedical Circuits and Systems Conference (BioCAS)*, Montreal, Canada, November 2007

20. Y. Chi, T. Tran and R. Etienne-Cummings, "Optical Flow Approximation of Sub-Pixel Accurate Block Matching for Video Coding" *IEEE ICASSP 2007*, Honolulu, HI, April 2007.
21. F. Tenore, A. R. Murguialday, A. Fahmy, S. Acharya, R. Etienne-Cummings and N.V. Thakor, "Towards the Control of Individual Fingers of a Prosthetic Hand Using Surface EMG Signals," *29th IEEE EMBS International Conference*, Lyon, France, August 2007.
22. A. Cassidy and R. Etienne-Cummings, "Non-Linear Neural Spike Train Decoding via Polynomial Kernel Regression," *29th IEEE EMBS International Conference*, Lyon, France, August 2007.
23. S. Acharya, V. Aggarwal, F. Tenore, H.C. Shin, R. Etienne-Cummings, M.H. Schieber, N.V. Thakor, "Towards a Brain-Computer Interface for Dexterous Control of a Multi-Fingered Prosthetic Hand," *IEEE EMBS NeuroEngineering*, Honolulu, HI, USA, Summer 2007.
24. A. Linares-Barranco, S.-C. Liu, A. van Schaik and R. Etienne-Cummings, "AER Audition Filtering and CPG for Robot Control," *IEEE ISCAS 2007*, New Orleans, LA, May 2007.
25. J. Tapson and R. Etienne-Cummings, "A Simple Neural Cross-Correlator Engine," *IEEE ISCAS 2007*, New Orleans, LA, May 2007.
26. N. Ekeke, P. Kazanzides and R. Etienne-Cummings, "Incremental Encoder Based Position and Velocity Measurements VLSI Chip with Serial Peripheral Interface," *IEEE ISCAS 2007*, New Orleans, LA, May 2007.
27. C. Clark, C. White and R. Etienne-Cummings, "Design and Optimization a Capacitive Micromachined Ultrasonic Transducer Micro-Array for Near Field Sensing," *IEEE ISCAS 2007*, New Orleans, LA, May 2007.
28. V. Gruev, Z. Yang, J. van der Spiegel and R. Etienne-Cummings, "2 Transistor, Current-Mode Active Pixel Sensor," *IEEE ISCAS 2007*, New Orleans, LA, May 2007.
29. A. Russell, G. Orchard and R. Etienne-Cummings, "Configuring Spiking Central Pattern Generator Networks with Genetic Algorithms," *IEEE ISCAS 2007*, New Orleans, LA, May 2007.
30. R. Philipp and R. Etienne-Cummings, "A Single Chip Stereo Imager" *ISSCC'06 Digest of Technical Papers*, Vol. 49, Feb 2006.
31. R. Etienne-Cummings, V. Gruev, S. Mehta and R. Philipp, "Neuromorphic Vision Systems for Mobile Applications," *IEEE CICC 2006*, San Jose, CA, September 2006 (Invited)
32. R. Philipp and R. Etienne-Cummings, "Second Generation Single-Chip Imager," *IEEE ISCAS 2006*, Kos, Greece, May 2006.
33. N. Ekeke, R. Etienne-Cummings and Peter Kazanzides, "Modeling and simulation of a VLSI chip for adaptive speed control of brushed DC motors", *IASTED International Conference on Control and Applications*, Montreal, Canada, May 2006.
34. F. Tenore, J. Vogelstein, R. Etienne-Cummings, G. Cauwenberghs and P. Hasler, "A Floating-Gate Programmable Array of Silicon Neurons for Central Pattern Generating Networks," *IEEE ISCAS 2006*, Kos, Greece, May 2006.
35. M. Chi, U. Mallik, E. Choi, M. Clapp, G. Cauwenberghs and R. Etienne-Cummings, "CMOS Pixel-Level ADC with Change Detection," *IEEE ISCAS 2006*, Kos, Greece, May 2006.
36. N. Ekeke, R. Etienne-Cummings and P. Kazanzides, "A Configurable VLSI Chip for DC Motor Control for Compact, Low-Current Robotic Systems," *IEEE ISCAS 2006*, Kos, Greece, May 2006.
37. J. Vogelstein, R. Etienne-Cummings and A. Cohen, "Dynamic Control of Spinal Locomotion Circuits," *IEEE ISCAS 2006*, Kos, Greece, May 2006.
38. S. Mehta and R. Etienne-Cummings, "Normal Flow Measurement Visual Motion Sensor" *IEEE ISCAS 2006*, Kos, Greece, May 2006.
39. V. Gruev, R. Philipp and R. Etienne-Cummings, "General Image Processing Chip in 3D Integration," *IEEE ISCAS 2006*, Kos, Greece, May 2006.
40. A. Lewis, F. Tenore and R. Etienne-Cummings, "CPG Design using Inhibitory Networks," *Int. Conf. Robotics and Automation*, Barcelona, Spain, 2005.
41. M. Clapp and R. Etienne-Cummings, "Sonar Echo-Location in 2D Using Mini-Microphone Array and Spatiotemporal Frequency Filtering," *IEEE ISCAS 2005*, Kobe, Japan, May 2005.
42. U. Mallik, R. J. Vogelstein, E. Culurciello, R. Etienne-Cummings and G. Cauwenberghs, "A Real-Time Spike Domain Sensory Information Processing System," *IEEE ISCAS 2005*, Kobe, Japan, May 2005.

43. U. Mallik, E. Choi, M. Clapp, G. Cauwenberghs and R. Etienne-Cummings, "Temporal Change Threshold Detection Imager," *ISSCC'05 Digest of Technical Papers*, Vol. 48, Feb 2005.
44. R. Philipp and R. Etienne-Cummings, "A 1V Current-Mode CMOS Active Pixel Sensor," *IEEE ISCAS 2005*, Kobe, Japan, May 2005.
45. F. Tenore, R. J. Vogelstein, R. Etienne-Cummings, M. A. Lewis and P. Hasler, "A Spiking Silicon Central Pattern Generator with Floating Gates Synapses," *IEEE ISCAS 2005*, Kobe, Japan, May 2005.
46. R.J. Vogelstein, Thakor NV, Etienne-Cummings R, Cohen AH, "Electrical Stimulation of a Spinal Central Pattern Generator for Locomotion," *Proc. 2nd International IEEE EMBS Conference on Neural Engineering*, Arlington, VA, pp. 475-478, 2005
47. J. Vogelstein, U. Mallik, E. Culurciello, R. Etienne-Cummings and G. Cauwenberghs, "Spatial Acuity Modulation of an Address-Event Imager," *IEEE ICECS 2005*, Tel Aviv, Israel, December 2004.
48. V. Gruev and R. Etienne-Cummings, "Active Pixel Sensor with On-Chip Normal Flow Computation on the Read-Out," *IEEE ICECS 2005*, Tel Aviv, Israel, December 2004.
49. R. J. Vogelstein, U. Mallik, G. Cauwenberghs, E. Culurciello and R. Etienne-Cummings, "Saliency-Driven Image Acuity Modulation on a Reconfigurable Silicon Array of Spiking Neurons," *Proc. of Neural Information Processing Systems*, Vancouver, Canada, December 2004.
50. F. Tenore, R. Etienne-Cummings and M. A. Lewis, "Entrainment of Silicon Central Pattern Generators for Legged Locomotory Control," *Proc. of Neural Information Processing Systems 16*, S. Thrun, L. Saul and B. Scholkopf (Eds.), MIT Press, Cambridge, MA, 2004.
51. V. Gruev, T. Horiuchi and R. Etienne-Cummings, "Linear Current Mode Imager with Low Fix Pattern Noise" *IEEE ISCAS'04*, May 2004.
52. S. Mehta and R. Etienne-Cummings, "Normal Optical Flow Measurement on a CMOS APS Imager" *IEEE ISCAS'04*, Vancouver, Canada, May 2004.
53. M. Clapp and R. Etienne-Cummings, "Bearing Angle Estimation For Sonar Micro-Array Using Analog VLSI Spatiotemporal Processing" *IEEE ISCAS'04*, Vancouver, Canada, May 2004.
54. E. Culurciello and R. Etienne-Cummings, "Second Generation of High Dynamic Range, Arbitrated Digital Imager" *IEEE ISCAS'04*, Vancouver, Canada, May 2004.
55. R. Philipp and R. Etienne-Cummings, "Low Power Current Rectifiers for Large-Scale Current-Mode Signal Processing" *IEEE ISCAS'04*, Vancouver, Canada, May 2004.
56. S. Mehta and R. Etienne-Cummings, "A 2D Normal Flow Chip," *IEEE ISCAS'03*, May 2003.
57. R. Philipp and R. Etienne-Cummings, "A Single Chip Stereo System," *IEEE ISCAS'03*, May 2003.
58. T. Horiuch and R. Etienne-Cummings, "A Time-Series Processor for Sonar Mapping and Novelty Detection," *IEEE ISCAS'03*, May 2003.
59. V. Gruev, Ralph Etienne-Cummings and M. Voronstov, "A Pipe-Lined Differencing Imager," *IEEE ISCAS'02*, May 2002.
60. M. Clapp and Ralph Etienne-Cummings, "Ultrasonic Bearing Estimation Using a MEMS Microphone Array and Spatiotemporal Filters," *IEEE ISCAS'02*, May 2002.
61. R. Phillip, B. Reddy, Ralph Etienne-Cummings and M. A. Lewis, "An Algorithm for a Single Chip Stereo Vision System," *IEEE ISCAS'02*, May 2002.
62. R. Etienne-Cummings, P. Pouliquen and M. A. Lewis, "A Single Chip for Color Segmentation, Histogramming and Object Recognition," *IEEE ISCAS'02*, May 2002.
63. R. Etienne-Cummings, P. Pouliquen and M. A. Lewis, "Single Chip for Color Segmentation, Histogramming and Object Recognition," *ISSCC'02 Digest of Technical Papers*, Vol. 45, Feb 2002.
64. E. Culurciello, R. Etienne-Cummings and K. Boahen, "Large Dynamic Range Arbitrated Address Event Representation Digital Image Sensor," *IEEE ISCAS*2001*, Sydney, Australia, May 2001.
65. Matthew Clapp and R. Etienne-Cummings, "A Dual Pixel-Type Imager For Imaging And Motion Centroid Localization," *IEEE ISCAS*2001*, Sydney, Australia, May 2001.
66. R. Etienne-Cummings and Matthew Clapp, "Architecture For Source Localization With A Linear Ultrasonic Array," *IEEE ISCAS*2001*, Sydney, Australia, May 2001.
67. R. Etienne-Cummings, V. Gruev and E. Huh, "Single-Capacitor-Single-Contact Active Pixel," *IEEE ISCAS*, Geneva, Switzerland, May 2000.

68. E. Culurciello, R. Etienne-Cummings and K. Boahen, "Arbitrated Address Event Representation Digital Image Sensor," *ISSCC'01 Digest of Technical Papers*, Vol. 44, pp. 92-93, Feb 2001.
69. R. Etienne-Cummings, Viktor Gruev and Mohammed Abdel-Ghani, "VLSI Implementation of Motion Centroid Localization for Autonomous Navigation," *Advances in Neural Information Processing Systems 11*, S. A. Solla, T. K. Leen and K.-R. Müller (Eds.), MIT Press, pp. 685-691, 1999.
70. R. Etienne-Cummings and Donghui Cai, "A General Purpose Image Processing Chip: Orientation Detection," *Advances in Neural Information Processing Systems 10*, M. Jordan, M. Kearns and S. Solla (Eds.), MIT Press, pp. 873-879, 1998.
71. R. Etienne-Cummings, J. Van der Spiegel and P. Mueller, Mao-zhu Zhang, "A Foveated Tracking Chip," *ISSCC'97 Digest of Technical Papers*, Vol. 40, pp. 38-39, Feb. 1997.
72. R. Etienne-Cummings, J. Van der Spiegel and P. Mueller, "VLSI Implementation of Cortical Motion Detection Using an Analog Neural Computer," *Advances in Neural Information Processing Systems 9*, M. Mozer, M. Jordan and T. Petsche (Eds.), MIT Press, pp. 685-691, 1997.
73. R. Etienne-Cummings, J. Van der Spiegel and P. Mueller, "A Visual Smooth Pursuit Tracking Chip," *Advances in Neural Information Processing systems 8*, D. Touretzky, M. Mozer and M. Jordan (Eds.), pp. 706-712, 1996.
74. V. Gruev and R. Etienne-Cummings, "A Programmable Spatiotemporal Processing Chip," *IEEE ISCAS*, Geneva, Switzerland, May 2000.
75. T. Lewis, R. Etienne-Cummings, M. Hartmann and A. Cohen, "Towards Biomorphic Control Using aVLSI CPG Chips," *Proc. IEEE ICRA*, San Francisco, CA, April 2000.
76. P. Mueller, J. Van der Spiegel, D. Blackman, C. Donham and R. Etienne-Cummings, "A Programmable Analog Neural Computer with Applications to speech Recognition", *Proc. 1995 Conf. Inf. Science and Systems*, Johns Hopkins University, Baltimore, MD, June 1995.
77. R. Etienne-Cummings, C. Donham, J. Van der Spiegel and P. Mueller, "Spatiotemporal Computation with a General Purpose Analog Computer: Real-Time Visual Motion Estimation", *Proceedings of ICNN*, Orlando, FL., June 26-July 2 1994.
78. J. Van der Spiegel, R. Etienne-Cummings, C. Donham, S. Fernando, D. Blackman and P. Mueller, "Large-Scale Analog Neural Computer with Programmable Architecture and Programmable Time-Constants for Temporal Pattern Analysis", *Proceedings of ICNN*, Orlando, June 26-July 2 1994.
79. R. Etienne-Cummings, S. Fernando, N. Takahashi, V. Shtonov, J. Van der Spiegel and P. Mueller, "A New Temporal Domain Optical Flow Measurement Technique for Focal Plane VLSI Implementation," *CAMP 93*, M. Bayoumi, L. Davis and K. Valavanis (Eds.), pp. 241-251, 1993.
80. R. Etienne-Cummings, J. Van der Spiegel, C. Donham, S. Fernando, R. Hathaway, P. Mueller and D. Blackman, "A General Purpose Analog Neural Computer and a Silicon Retina for Real Time Target Acquisition, Recognition and Tracking," *CAMP 93*, M. Bayoumi, L. Davis and K. Valavanis (Eds.), pp. 48-57, 1993.
81. R. Etienne-Cummings, S.A. Fernando, J. Van der Spiegel and P. Mueller, "Real Time 2-D Analog Motion Detector VLSI Circuit," *Proc. IJCNN '92*, Vol. IV, pp. 426-431, 1992.
82. P. Mueller, J. Van der Spiegel, V. Agami, P. Aziz, D. Blackman, P. Chance, A. Choudhury, C. Donham, R. Etienne-Cummings, L. Jones, P. Kinget, W. von Koch, J. Kim and J. Xin, "Design and Performance of a Prototype General Purpose Analog Neural Computer," *Proc. Intl. Joint Conf. on Neural Systems*, Vol. I, pp. 463-468, 1991.

Abstracts Presentations:

1. V. Aggarwal, S. Acharya, F. Tenore, R. Etienne-Cummings, M. H. Schieber, N. V. Thakor, "Real-time Neuronal Decoding for Individuated and Combined Finger Movements of a Robotic Hand," accepted for *2007 BMES Annual Meeting*, Summer 2007 (extended abstract)
2. F. Folowesele, R. Etienne-Cummings, J. Tapson, "Wireless Address Event Representation System For Biological Sensor Network," *Proc. SPIE (Bioengineered and Bioinspired Systems)*, May 2007
3. C. Clark, J. Whitney and R. Etienne-Cummings, "Design of an Ultrasonic Micro-Array for Near Field Sensing during Retinal Microsurgery," *Proc. EMBS*, New York, NY, August 2006.

4. R. Vogelstein, N. Thakor, R. Etienne-Cummings, and A. Cohen, "Electrical Stimulation of a Spinal Central Pattern Generator for Locomotion," Proc. 2nd International IEEE EMBS Conference on Neural Engineering. Arlington, VA, March 2005.
5. S. Mehta and R. Etienne-Cummings, "An Optical Flow Camera," *Proc. SPIE*, Orlando, FL, April 2004.
6. L. Beresnev, M. Vorontsov, V. Gruev and R. Etienne-Cummings, "Differential Zernike Filter Based on Ferroelectric Liquid Crystal OASLM," *Proc. SPIE*, Orlando, FL, April 2002.
7. D. Tomlin, A. Thakral, J. Wallace, R. Etienne-Cummings, and N. Thakor, "Precision Minimally Invasive Surgery By Adaptive Organ Motion Tracking And Compensation," *Annals of Biomedical Engineering*, Vol. 28, SUPPL. 1, 2000.
8. M. A. Lewis, R. Etienne-Cummings, M. Hartmann, and A. H. Cohen, "Sensorimotor Integration in Lampreys and Robots II: CPG Hardware Circuit for Controlling a Running Robot Leg," (Abstract), *International Symposium on Adaptive Motion of Animals and Machines*, Motreal, Canada, Aug 8-12, 2000.
9. Ralph Etienne-Cummings, M. Anthony Lewis, Mitra Hartmann and Avis H. Cohen, "CPU-Less Robotics: Distributed Control of Biomorphs," *Proceedings of the SPIE*, Vol. 4109, San Diego, CA, August, 2000.
10. M. Anthony Lewis, Ralph Etienne-Cummings, Mitra Hartmann, and Avis H. Cohen, "Biomorphic Control of a Running Robot Leg using a Custom aVLSI CPG Chip," (Abstract), *4th International Conference on Cognitive and Neural Systems*, Boston, 2000.
11. M. Anthony Lewis, Ralph Etienne-Cummings, Mitra Hartmann, and Avis Cohen, "Control of a Robot Leg with an Adaptive aVLSI CPG Chip," *Computational Neuroscience Meeting 2000 (CNS*2000)*, Brugge, Belgium, July 16-20, 2000.
12. R. Etienne-Cummings and T. Lewis, "CPU-Less Sensory-Motor Control of Real-Time Behaving Systems," *SPIE Conference on Critical Technologies for the Future of Computing*, San Diego, California, August, 2000.
13. R. Tumber, V. Gruev, M. R. Fetterman, R. Etienne-Cummings, and D. Brady, "Focal-Plane Processing for Interferometric Imaging," *OSA*99*, Santa Clara, CA, 1999.
14. R. Etienne-Cummings, Viktor Gruev and Donghui Cai, "A High Density Focal-Plane Image Processing Array," *33rd. Conf. Information Sciences and Systems*, pp. 866-870, March, 1999.
15. R. Etienne-Cummings, F. Pourboghrat, H. Maruboyina and S. Dhali, "Architecture for Distributed Actuation and Sensing Using Smart Piezoelectric Elements," *Proceedings of SPIE Smart Structure and Integrated Systems 98*, San Diego, CA, March 1998.
16. R. Etienne-Cummings, P. Longo, J. Van der Spiegel and P. Mueller, "Real Time Visual Target Tracking: Two Implementations of Velocity-Based Smooth Pursuit," *Proceedings of SPIE AeroSense 95*, Vol. 2486, Orlando, FL., April 1995.
17. R. Etienne-Cummings, S. Fernando, J. Van der Spiegel and P. Mueller, "VLSI Implementation of a Focal Plane Motion Sensor," *Proc. SENSOR EXPO*, Philadelphia, Oct. 26-28 1993.
18. P. Mueller, J. Van der Spiegel, D. Blackman, C. Donham and R. Etienne-Cummings, "Real Time Decomposition of Acoustical Patterns with an Analog Neural Computer," *SPIE Conf. on Applications of Artificial Neural Networks III*, Vol. 1709, pp. 758-769, 1992.
19. P. Mueller, J. Van der Spiegel, V. Agami, D. Blackman, P. Chance, C. Donham, R. Etienne-Cummings, J. Flinn, J. Kim, M. Massa, S. Samarasekera, "Design and Performance of a Prototype General Purpose Analog Neural Computer," *Proc. 2nd Intl. Conf. Microelectronics for Neural Networks*, pp. 347-357, Munich, Germany, Oct. 16-18 1991.
20. P. Mueller, J. Van der Spiegel, V. Agami, D. Blackman, P. Chance, C. Donham, R. Etienne-Cummings, J. Flinn, J. Kim, M. Massa, S. Samarasekera, "Design and Performance of a Prototype General Purpose Analog Neural Network," *Proc. 2nd Government Neural Network Application Workshop*, Huntsville, AL, 10-12, Sept. 1991.
21. J. Van der Spiegel, P. Mueller, V. Agami, P. Aziz, D. Blackman, P. Chance, A. Choudhury, C. Donham, R. Etienne-Cummings, L. Jones, P. Kinget, M. Massa, W. von Koch, J. Xin, "A Multi-Chip Analog Neural Network," *Proc. 1991 Intl. Symp. on VLSI Tech., Systems and Applications*, pp. 64-68, Taipei, Taiwan, May 22-24 1991.
22. J. Van der Spiegel, P. Mueller, D. Blackman, C. Donham, R. Etienne-Cummings, P. Aziz, A. Choudhury, L. Jones and J. Xin, "Artificial Neural Networks: Principles and VLSI Implementation," *Proc. SPIE of Vth*

Congress of the Brazilian Society of Microelectronics SPIE, Vol. 1405, pp. 184-197, Campinas, Brazil, July 1990.

Patents:

1. N. Ekekwe, R. Etienne-Cummings, P. Kazanzides, "Adaptive and Reconfigurable Chip for DC Motor Control," Utility Patent Filed, USPTO Publication # 2008/0247735 A1, October 2008.
2. R. Etienne-Cummings and M. A. Lewis, "ColorStick," Patent #7,251,031, December 2006.
3. R. Etienne-Cummings, M. A. Lewis and P. Pouliquen, "Color Segmentation, Histogramming and Object Recognition System," Patent #6,897,426, May 2005.
4. R. Etienne-Cummings and M. A. Lewis, "A Biomorphic Rhythmic Movement Controller," Patent #7,164,967, September 2006.
5. M. Massie, R. Etienne-Cummings, S. Baxter, J.P. Curzan, "Variable Acuity Imager with Pitch, Yaw and Roll Measurement," Utility Patent Filed May 2004. Application #10/613,126

Workshops/Conferences/Panels/Invited Talks:

Participant: Computational Sensors Workshop, Grasp Lab, U. of Pennsylvania, Philadelphia, PA, 1993.

Participant: International CMOS Camera Workshop, AT&T Laboratories, Holmdel, NJ, 1994.

Participant: NSF Workshop on Neuromorphic Engineering, Telluride, CO, 1996-1999.

Participant: NIPS Workshops, Snowmass, CO, 1996.

Participant: DARPA RP2009 Phase II Kick-Off Meeting, St. Michaels, MD, April 2008.

Instructor: NSF Workshop on Neuromorphic Engineering, Telluride, CO, 1997.

Session Chairman: Conference on Information Sciences and Systems, Baltimore, MD, 1999.

Session Chairman: International Solid-State Circuits Conference, San Francisco, CA, 2000, 2003, 2004.

Session Chairman: International Symposium on Circuits and Systems, 2001-2007

Panel Moderator: IEEE ISSCC, San Francisco, CA, 2002.

Panel Moderator: NSF ERC Annual Meeting, 2004.

Co-chairman: Workshop on Understanding the Brain and Engineering Models, Sydney, Australia, 1999.

Co-Chairman: Neural Information Processing Systems Workshop, December 1997, 1998, 2002, 2003.

Program Co-Chair: IEEE BioCAS Conference, Montreal, Fall 2007

General Co-Chair and Organizer: IEEE BioCAS Conference, Baltimore, Fall 2008

Invited Speaker: 1st European Workshop on Neuromorphic Systems, Stirling, Scotland, 1997.

Invited Speaker: IROS Workshop on Biomorphic Robots, Victoria, Canada, 1998.

Invited Participant/Speaker: Evolvable Distributed Sensors and Systems, Bozeman, MT, 1999.

Invited Participant: Workshop on Biomorphic Robots, Pasadena, CA, 2000.

Invited Participant: ARO Workshop on Personnel Detection, Columbus, OH, 2002.

Invited Participant: DARPA Workshop on Intelligent Arthropods, Arlington, VA, 2003.

Invited Speaker: SPIE Conference, Orlando, FL, 2001, 2005

Invited Speaker: Post IJCNN Neuromorphic Workshop, Montreal, Canada, 2005

Invited Speaker: Carnegie Mellon University, Pittsburgh, PA, 2001.

Invited Speaker: ETH-Zurich, Switzerland, 2001.

Invited Speaker: IEEE Low-Power Electronics Workshop, Arlington, VA, 2001.

Invited Speaker: OIDA Workshop, Washington, DC, 2002.

Invited Speaker: Bio-Technology Review Day, College Park, MD, 2002.

Invited Speaker: ISCAS 2003, Special Session, Bangkok, Thailand, May 2003

Invited Speaker: NSF Telluride Workshop on Neuromorphic Engineering, CO, 2000, 2001, 2002, 2003, 2004.

Invited Speaker: LPS Seminar Series, University of Maryland, College Park, MD, 2003.

Invited Speaker: Neuroscience and Cognitive Sciences, University of Maryland, College Park, MD, 2003, 2004.

Invited Speaker: SRC Review, Seattle, WA, 2003.

Invited Speaker: Cornell University, Ithaca, NY, 2004.

Invited Speaker: University of Sydney, Sydney, Australia, 2004.

Invited Speaker: Edith Cowen University, Perth, Australia, 2004.

Invited Speaker: University of Queensland, Brisbane, Australia, 2004.

Invited Speaker: Johns Hopkins University, Baltimore, MD, 2004.

Invited Speaker: Mitre Corporation, McClean, VA, 2004.

Invited Speaker: NRO, Chantilly, VA, 2005.

Invited Speaker: Agilent Corp., Palo Alto, CA, 2005.

Invited Speaker: SPIE Conference, Orlando FL, 2005.

Invited Speaker: NSF Grantees Meeting, Washington, DC, 2005.

Invited Speaker: Columbia University, NY, 2005.

Invited Speaker: NASA, Goddard, MD, 2005.

Invited Speaker: Workshop on Neuromorphic Systems, IJCNN'05, Montreal, Canada, 2005.

Invited Speaker: ETHZ-INI/INE Workshop, Zurich, Switzerland, 2005.

Invited Speaker: National Society of Black Engineers, Greenbelt, MD, 2005.

Invited Speaker: Yale University, CT, 2006.

Invited Speaker: University of Alberta, Canada, 2006.

Invited Speaker: IEEE CICC '06, Signal and Data Processing, San Jose, CA, 2006.

Invited Speaker: University of Cape Town, IEEE Chapter, 2006.

Invited Speaker: Arizona State University, Catalyst Symposium, Mar 2007

Invited Speaker: Institute of Neuromorphic Engineering, Sardinia Meeting, Apr 2007

Invited Speaker: Keynote Address, Center for Talent Youths, Baltimore, MD, June 2007.

Invited Speaker: European Optical Society, Munich, Germany, June 2007.

Invited Speaker: NASA Goddard, Laurel, MD, July 2007.

Invited Speaker: University of Cape Town, South Africa, Sept 2007.

Invited Speaker: Cornell University, Oct 2007.

Invited Speaker: Army Research Lab – Aberdeen Proving Grounds, Nov 2007.

Invited Speaker: National Academy of Science, Kavli Frontiers in Science, Irvine, CA, Nov 2007.

Invited Speaker: Biomedical Circuits and Systems Conference, Tutorial, Montreal, CA, Nov 2007.

Invited Speaker: DARPA DRSC Electronic StemCell Workshop, DC, Jan 2008.

Invited Speaker: University of Pennsylvania, Feb 2008.

Invited Speaker: Institute for Neuro Informatics, ETHZ, Zurich, Switzerland, October, 2008

Invited Speaker: Intelligent Sensors, Sensor Networks and Information Processing, Sydney, Australia, December, 2008 (Keynote Address)

Review Panel: NIH SBIR Panel, Washington, DC, Nov. 2002, Mar. 2004, Nov. 2004, Nov 2005.

Review Panel: NSF ECS Panel, Arlington, VA, Jan., Oct. 2003.

Review Panel: DoE Retina Prosthesis Project, Rockville, MD, Sept 2007.

Review Site Visitor: NSF-SLC CELEST, March 25-27, 2007

Organizer: CMOS Imagers Tutorial, ISCAS 2003, May 2003; ISCAS 2004, May 2004, ICECS Dec 2004.

Organizer: NSF Telluride Neuromorphic Engineering Workshop, Telluride, CO, 2003 – Present.

Organizer: Topical Meeting on Time Domain Neural Signal Processing, Zurich, Switzerland, 2005.

Organizer: ISCAS 2004, Special Sessions on Spiking Neural Systems, Vancouver, Canada, May 2004.

Organizer: ISCAS 2005, Special Sessions on Sensory Systems for Biological Applications, Kobe, Japan, May 2005.

Organizer: ISCAS 2005, Demonstration Sessions on Sensory Systems, Kobe, Japan, May 2005.

Organizer: ISCAS 2006, Special Sessions on Sensory Systems for Biological Applications, Kos, Greece, May 2006.

Organizer: ISCAS 2006, Demonstration Sessions on Sensory Systems, Kos, Greece, May 2006.
Organizer: IEEE BioCAS Conference, Baltimore, MD, November 2008 (General Chair).

TEACHING

JHU:

CAD Digital VLSI Design, 520.491/391: Fall 1998-2008, Enrollment to date: ~170
Electronic Design Laboratory, 520.448/738: Spring 1999-2008, Enrollment to date: ~233
Senior Design Project, 520.498: 1998-2004, Enrollment to date: ~30
Independent Study/Research, 520.502/504: 1998-2004, Enrollment to date: ~15
Advanced Integrated Circuits, 520.671/672/771/772: 2007-2008, Enrollment to date: 34
Product Design Laboratory, 520.427: 2007, Enrollment to date: 16

UCT:

CAD Digital VLSI Design: Fall 2006, Enrollment: 7
Senior Thesis Advisor: Fall 2006, Enrollment: 11

UMCP:

CAD Digital VLSI Design, ENEE408B: Spring 2002, Enrollment: 9
Advanced Mixed Signal VLSI Design, ENEE719C: Fall 2002, Enrollment: 20 (+ ~5 sit-ins)

SIUC:

Introduction to Digital Systems, Fall 1995-1997
Computer Architecture, Spring 1996, 1998
CAD Digital VLSI Design, Fall 1995-1997
Advanced Computer Design, Spring 1995, 1997
Advanced Mixed Signal VLSI Design, Spring 1995-1998
Senior Design Project, 1996, 1997, 1998

GRADUATE STUDENTS

Masters

Per Stomhagen, MSEE 1996 (SIU), Intel Corp.
Dinakaran Chidambaram, MSEE 1996(SIU), Thompson Electronics
Donghui Cai, MSEE 1997 (SIU), Intel Corp.
Eunsung Huh, MSEE 1997 (SIU), IC Works
Timothy McKinney, MSEE 1997 (SIU), Ph.D. Candidate, Texas A&M
Tom Burke, MSEE 1998 (SIU), Northrop Grumman
How-Yue Chen, MSEE 1999 (SIU), Intel Corp.
Clarence Keith, MSEE 1999 (SIU), Northrop Grumman
Mohamed Abdel Ghani, MSEE 1999 (SIU), IBM
Francesco Tenore, MSEE (JHU), Trieste U., Italy
Mark Nesky, MSEE 2001 (JHU), EVI
Zi Rong Xu, MSEE 2001 (JHU), Temple University Med. School
Bharath Reddy, MSEE 2001 (JHU), Analog Devices Inc.
Katherine Tsai, MSEE 2005 (JHU), Stanford University, CA
Vikram Shirgur, MSEE 2005 (JHU)
Ndubuisi Ekekwe, MSEE 2005 (JHU)

Fopefolu Folowosele, MSEE 2007 (JHU)
Andre Harrison, MSEE 2008 (JHU)
Kerron Duncan, ECE Master Program, Started Fall 2008

Ph.D.

Viktor Gruev, Ph.D. 2004 (ECE/JHU), "Implementation of Steerable Spatiotemporal Filters and Adaptive Image Processing on the Focal-Plane," Currently a Post-Doc at U. Pennsylvania, PA
Mathew Clapp, Ph.D. 2005 (ECE/JHU), "3-D Sensing Using Smart Sensors: Compact Efficient Sensor Processing," Currently Technical Staff of LSI Logic, CA
Swati Metha, Ph.D. 2006, "Compact, Low-Power and High Resolution Optical Flow Camera," Currently Technical Staff of Canesta, CA
Jacob Vogelstein, Ph.D. 2007 (BME/JHU), "Towards a Spinal Neural Prosthesis Device," Currently Technical Staff of The Johns Hopkins U. Applied Physics Lab
Francesco Tenore, Ph.D. 2008 (ECE/JHU), "Biomorphic Robotic Systems: Silicon Spinal Networks for Robotic Limb Control," Currently a Post Doctoral Fellow at The Johns Hopkins U. Applied Physics Lab
Clyde Clark, Ph.D. 2008 (MSU/EE), "Design and Optimization of Tissue Specific Ultrasonic Arrays," JHU/SOM Department of Radiology for a Post Doctoral Fellowship
Ralf Phillip, Ph.D. 2008 (ECE/JHU), "VLSI Systems for 3D Vision," Looking for a Position
Ndubuisi Ekekwe, ECE Ph.D. Candidate, Graduation Expected, Spring 2009, JHU
Fopefolu Folowosele, ECE Ph.D. Candidate, Graduation Expected, Fall 2009, JHU
Andre Harrison, ECE Ph.D. Candidate, Graduation Expected, Fall 2010, JHU
Alexander Russel, ECE Ph.D. Program, Started Fall 2007
Garrick Orchard, ECE Ph.D. Program, Started Fall 2007
Kevin Mazurek, ECE Ph.D. Program, Started Fall 2008
Amit Bhatia, ECE Ph.D. Program, Started Fall 2008