

Education

- 2012 **Ph.D. in Electrical and Computer Engineering**
University of Florida, Gainesville, FL
Dissertation: Time Encoded Compression and Classification using the Integrate and Fire Sampler
- 2008 **M.S. in Electrical and Computer Engineering**
University of Florida, Gainesville, FL
- 2005 **B.S. Electronics Engineering**
Instituto Tecnológico de Costa Rica (I.T.C.R.), Cartago
Thesis: Segmentation of MR images for skin surface model generation

Research Interests

- Technical:** Large Scale Machine Learning, Optimization Theory, Digital Signal Processing, Statistical Signal Processing, Nonuniform Sampling Theory, Multivariate Spline based Reconstruction, Point Processes, Time Series Analysis, Applied Statistics and Computational Neuroscience.
- Applications:** Large Scale Sensor Networks, Healthcare, Oil and Gas, Brain Machine Interfaces and Medical Imaging.

Experience

- 2013
Present **Senior Algorithm Research Engineer, Apple**
- Data Scientist, Hewlett Packard**
- 2013-2011 Designed and implemented analytical algorithms for big data applications, in sensor networks, social media, financial transactions and image processing. These solutions involved a combination of HP's Autonomy engine, the Vertica database and tools from the Hadoop ecosystem. These projects involve cross collaboration with teams in HP Laboratories and client facing groups. The responsibilities span from technical algorithm design, implementation and verification to client collaborations and solution architectures.
- 2013-2011 Designed and implemented signal processing algorithms for precise time synchronization in large-scale wireless sensor networks. These algorithms will be used in mega-channel subsurface imaging systems, specifically the Shell funded Voyager project.
- 2013-2011 Designed and implemented blind source separation tools, which were used in conjunction with HP's proprietary accelerometer technology to provide an accurate representation of cardiac vibrations. The results improved upon the commercially available digital stethoscope.
- Research Assistant, Computational Neuro-Engineering Lab (CNEL), University of Florida**
Adviser: **Dr. Jose C. Principe**, Distinguished Professor
- 2013-2011 Part of the project Florida Wireless Implantable Recording Electrodes (FWIRE), funded by National Institutes Health (NIH).
- 2007-2011 Designed and implemented real time reconstruction algorithms for the integrate and fire sampler. The sampler was designed for efficient encoding of neural data, specifically micro-electrode recordings used in current Brain Machine Interfaces (BMIs).
- 2007-2011 Described the features of neural recordings for which the sampler produces sub-Nyquist data rates and still provides a reliable reconstruction in the action potential region, allowing for accurate spike detection and classification.
- Research Associate, Innovation Research Program, Hewlett Packard Laboratories**
Collaborators: **Choudur Lakshminarayan, Meichun Hsu**
- 2010
Fall Worked on the detection of turbulence and other phenomena in oil and gas production using statistical signal processing, machine learning and nonlinear dynamical systems.
- 2010
Summer Proposed a novel time encoded representation for classification of heartbeat cycles using electrocardiogram recordings.
- Visiting Scholar, Numerical Harmonic Analysis Group (NuHAG), University of Vienna**
Adviser: **Dr. Hans G. Feichtinger**, Professor
- 2009
Summer Designed new reconstruction algorithms for bandlimited functions sampled by the integrate and fire model. These algorithms exploit the structure of the sampler and provide a different avenue than that provided by the current framework in nonuniform sampling.

2005
Fall

Research Intern, Radiology and Radio Biology laboratory, University of Florida

Adviser: **Dr. Frank J. Bova**, Professor, Staff Physicist

Developed image segmentation algorithms on magnetic resonance images for skin surface model generation. The recovered skin surfaces could then be used to create custom made probes for the particular treatment.

Graduate Course work

Digital Signal Processing	Machine Learning
Sampling and Reconstruction	Computational Neuroscience
Statistical Pattern Recognition	Neural Networks
Multivariate Splines	

Publications

Journal

H.G. Feichtinger, J. C. Principe, J.L. Romero, A. S. Alvarado and G. Velasco. "A sampling and reconstruction framework for the integrate and fire model", *Advances in computational mathematics*, 36,1,67-78, 2012

Xu X., Alvarado A. S. and Entezari A. "Reconstruction of Irregularly-Sampled Volumetric Data in Efficient Box Spline Spaces", *Medical Imaging, IEEE Transactions on*, vol.31, no.7, pp.1472-1480, July 2012

Alvarado A.S., Lakshminarayan C. and Principe J.C. "Time-Based Compression and Classification of Heartbeats", *Biomedical Engineering, IEEE Transactions on*, vol.59, no.6, pp.1641-1648, June 2012

Manu Rastogi, Alexander Singh Alvarado, John G. Harris and JC Principe. "The Integrate and Fire Sampler: A Replacement for Conventional ADCs". *Transactions on Circuits and Systems - I, IEEE*. [Invited paper] [submitted].

Conference

Alvarado, A.S. and Principe, J.C. "A real-time reconstruction algorithm for the integrate and fire sampler", *Signals, Systems and Computers (ASILOMAR), 2011 Conference Record of the Forty Fifth Asilomar Conference on*, vol., no., pp.1093-1097, 6-9 Nov. 2011

Singh Alvarado Alexander, Choudur Lakshminarayan and Principe C. Jose. "Time encoding using the Integrate and fire sampler: A Discriminative Representation for Neural Action Potentials", *International Conference on Sampling Theory and Applications SAMPTA'11*, 2011

Alexander Singh-Alvarado, Evan Kriminger, and Choudur Lakshminarayan. "Local frequency based estimators for anomaly detection in oil and gas applications", *Joint Statistical Meetings*, Miami, Florida, 2011

Alvarado, A.S. and Principe, J.C. "From compressive to adaptive sampling of neural and ECG recordings", *Acoustics, Speech and Signal Processing (ICASSP), 2011 IEEE International Conference on*, vol., no., pp.633-636, 22-27 May 2011

Rastogi M., Alvarado A.S., Harris J.G. and Principe J.C. "Integrate and fire circuit as an ADC replacement", *Circuits and Systems (ISCAS), 2011 IEEE International Symposium on*, vol., no., pp.2421-2424, 15-18 May 2011. [**Best Prize Award given by the Neural Systems and Applications Technical Committee**]

Alvarado A.S., Rastogi M., Harris J.G. and Principe J.C. "The integrate-and-fire sampler: A special type of asynchronous sigma-delta modulator", *Circuits and Systems (ISCAS), 2011 IEEE International Symposium on*, vol., no., pp.2031-2034, 15-18 May 2011

John G. Harris, Jie Xu, Manu Rastogi, Alexander Singh-Alvarado, Vaibhav Garg, Jose C. Principe and Kalyana Vuppamandla. "Real time signal reconstruction from spikes on a digital signal processor", *In: 2008 IEEE International Symposium on Circuits and Systems*, 2008, 1060-1063

Alvarado A.S., Principe J.C. and Harris J.G. "Stimulus reconstruction from the biphasic integrate-and-fire sampler", *Neural Engineering. NER '09. 4th International IEEE/EMBS Conference on*, 415-418, May, 2009

Grants (Co-authored)

Anomaly Detection in Multivariate Data Streams using Kernel Methods and Information Theoretic Cost Functions, **HP Labs open Innovation office, 2010 (contract CW221761)**

Event-Based Encoding for the Processing and Analysis of Continuous Data Streams, **HP Labs open Innovation office, 2011 (contract CW221761)**

Patents

US20160058371, Sensor fusion approach to energy expenditure estimation , 2016
US20160058302, Latent load calibration for calorimetry using sensor fusion, 2016
US20160058372, Terrain type inference from wearable with motion sensing , 2016
US20160058329, Method and system to estimate day-long calorie expenditure based on posture , 2016
US20160058356, Method and system to calibrate fitness level and direct calorie burn using motion, location sensing, and heart rate, 2016.
US20160058370, Accurate calorimetry for intermittent exercises , 2016
US20160058332, Local model for calorimetry , 2016
700211487US01, In stream similarity test on trace data characteristics for spatially neighboring nodes, 2012
700209666US01, Time-based compression and classification of heartbeats, 2011
700206817US01, Local frequency based estimators for anomaly detection, 2011
201006101US01, Dynamical systems approach to on-line detection, 2011
700205859US01, Statistical classification of Point Processes, 2011

Awards and Achievements

Best Prize Award given by the Neural Systems and Applications Technical Committee, at the International Symposium on Circuits and Systems, 2011

Referee Activities

2012 Journal of Neurocomputing
2011 International Symposium on Circuits and Systems
 Journal of Neurocomputing
2009 Journal on Advances in Signal Processing

Talks

2011 Neural Coding and Computation Lab, Department of Psychology, University of Texas at Austin
 A sampling and reconstruction framework based on the deterministic and stochastic integrate and fire model
 Information Analytics Laboratory, Hewlett Packard Laboratories
 Biologically inspired algorithms for compression and processing
2009 Poster presentation, International conference on Time Frequency Analysis, Strobl, Austria: *Stimulus reconstruction from the biphasic integrate-and-fire sampler.*

Computer skills

Matlab
Familiar languages: Java, C++, Python
OS familiarity: Windows, Linux, OSX

References

Dr. Choudur Lakshminarayan Principal Research Scientist Information Analytics Laboratory Hewlett Packard Company, Austin, TX, USA Email: choudur.lakshminarayan@hp.com Tel: +1 (512) 432 8042	Dr. Jose C. Principe Distinguished Professor, Bellsouth Professor Director, Computational NeuroEngineering Lab University of Florida, Gainesville, FL 32611, USA Email: principe@cnel.ufl.edu Tel: +1 (352) 392 2662
Dr. Hans G. Feichtinger Group leader of Numerical Harmonic Analysis Group (NuHAG) University of Vienna, Institute of mathematics Nordbergstrasse 15, A-1090 Wien, AUSTRIA Email: hans.feichtinger@univie.ac.at Tel: +431 4277 50696	Dr. John G. Harris Professor, Interim Chair Director, Computational NeuroEngineering Lab University of Florida, Gainesville, FL 32611, USA Email: harris@cnel.ufl.edu Tel: +1 (352) 3920913