

Three technologies have been selected for development into Virtual Companies

CIBMI Faculty and Students hold first “All Hands” Meeting August 31



The joy of learning: MBA and CNEL students participate in the first meeting of the two groups. These students will participate in the process of turning three engineering projects into virtual companies.

Work is beginning in earnest toward building virtual bioengineering companies under the auspices of the Center for Innovative Brain Machine Interfaces (CIBMI), funded by the National Science Foundation's Partnerships for Innovation program.

After the May 10 Industrial Board meeting and Poster Day, three technologies were selected:

- “Wireless, Wearable Computers for Brain Machine Interfaces,” by David Cheney
- “Flexible Substrate Technology for Hybrid-Packaged

Implantable Neural Interfaces,” by Erin Patrick

- “Integrate-and-Fire Signal Representation for Ultra Low Power Sensing Applications,” by Manu Rastogi and Jie Xu.

Over the next year, teams of graduate students from the colleges of Engineering and Business will apply their expertise toward market research, development, and commercialization of a prototype from each of these projects.

The first step for Engineering students is to take EGN 6640, “Entrepreneurship

for Engineers” this semester. This course is designed to introduce graduate students to the concepts and practices of entrepreneurial thinking. Course objectives are:

- Explore entrepreneurial mindset and culture;
- Examine the entrepreneurial process, from idea generation to implementation;
- Experience business team dynamics;
- Create and present a business plan for a technology idea;
- Provide the background tools and life skills to participate in the entrepreneurial process.

As the Engineering students are taking this course, they are interacting closely with their MBA counterparts, and moving toward the establishment of their virtual companies. Teams will meet throughout the semester to track progress. For more information on EGN 6640, please see <http://www.eng.ufl.edu/egn6640/>

CNEL Seminars

- CNEL SEMINARS WILL BE HELD THIS FALL EVERY TUESDAY AT 2:00 PM . IN FOOM 409, ENGINEERING BUILDING.

Inside this issue:

“DISABLED GET HELP IN	2
CNEL STUDENTS IN THE REAL WORLD	2
WHERE ARE THEY NOW?	3
MIGUEL ANGEL PRADA	3
UPCOMING EVENTS	4

Congratulations to our graduates!

During the summer semester, four CNElers successfully defended their dissertations:

“Nonlinear Signal Processing based on Reproducing Kernel Hilbert Space.” **Jianwu Xu**

“Time Series Analysis with Information Theoretic Learning and Kernel Methods.” **Puskal Pokharel**

“The Correntropy MACE Filter for Image Recognition.” **Kyu-Hwa Jeong**

“A Family of Minimum Renyi's Error Entropy Algorithm for Information Processing.” **SeungJu Han**

Blast from the Past... While packing to move to his new home, Dr. Principe found the following article, which appeared in the **July 6, 1993 Gainesville Sun**.

Disabled get help in using computers

Computer program at UF lets a person move a cursor on the screen by thinking yes or no.

By **JIM BOOTS**
Special to The Sun

Physically disabled people may one day be able to respond to a computer by merely thinking, with the help of a computer interface University of Florida researchers are developing.

The computer user wears an electrode-imbedded cap connected to a computer. Electrical engineering Professor Jose Principe calls it the "cortical mouse."

Electrodes on the disabled person's scalp collect and amplify the brain's electrical responses to a computer-generated query and transmit them to the computer. The computer then digitally processes the signals.

The computer is programmed to recognize, by analyzing electrical activity, whether the user agreed with the computer query, said psychology professor Ira

Fischler, who also is working on the project. The computer distinguishes between brain waves produced when the user agrees with the query and those produced when the user does not.

The user manipulates a cursor between manus on the screen by thinking yes or no to the computer's queries, "up?", "down?", "right?" and "left". Menus and queries can be specially tailored to meet the needs of each disabled user.

"Yes or no is really a simple decision," Principe said. "But you can have a really elaborate sequence of paths. It depends on the questions."

The cortical mouse interface could even allow the user to control the surrounding environment, Fischler said.

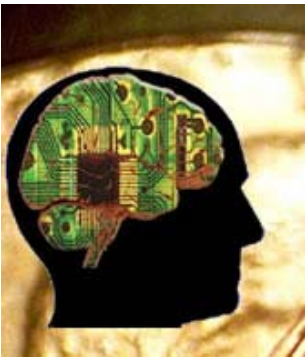
"This technology could be an interface with the physical world, said Fischler. "That could mean helping in everything from opening doors to brewing coffee."

But the interface is far from being perfect," said Principe, who has tested the cortical mouse on UF engineering students. The computer recognizes the response intended by the user three fourths of the time. The system will be viable with the agreement rate is greater than 90 percent, he said.

The user must concentrate on thinking yes or no, and the computer must be "trained" to recognize each user's brain wave patterns, Fischler said. Users can improve agreement by concentrating on responses.

The complexity of the brain's electrical activity hampers the system's accuracy, Principe said. Brain waves are difficult to process because they are "a summation of the activity of millions of neurons," he said.

"The problem is that although you control your conscious thoughts, they are only a fraction of the electrical activity going on in your brain," Principe said.



Drs. Jose Principe and Justin Sanchez presented workshops at IJCNN (August 12-17, Orlando) and EMBC (August 23-26, Leon, France). Both workshops focused on "Innovation in Computational Approaches in Brain Machine Interfaces." Materials are available at the Neuroprosthetics Research Group website: <http://nrg.mbi.ufl.edu/>

CNELers test their skills in the real world

Our summer CNEL graduates are beginning their careers.

Puskal Pokharel will be working as a Senior Development Engineer with Seagate Technology in Minneapolis. He will be using signal processing techniques to improve certain aspects of the servo channel of hard drives.

Kyu-Hwa Jeong is working at Intel in San Diego, CA, focusing on Critical Dimension (CD)

metrology technology development.

SeungJu Han has accepted a position with Samsung Research in Seoul, South Korea.

JianWu Xu is working at Siemens Medical Solutions, Philadelphia, on automatic translation of medical documents using weighted Ridge regression and multi-task learning.

Several CNEL students also

completed industry internships: **Sudhir Rao** worked at Motorola Labs Advanced Technology Group, Plantation FL, on cognitive radio/cooperative sensing—part of new IEEE standards 802.22). During his internship, Sudhir filed three patents and is submitting a paper to the 2008 ICASSP conference.

Yiwen Wang interned in spring at Siemens, Princeton, NJ. Her focus was refining parameters effects of point process algorithm on BMI.

Journal Papers

To Appear

S. Han, S. Rao, D. Erdogmus, K-H. Jeong, J. Principe. "A Minimum-Error Entropy Criterion with Self-Adjusting Step Size (MEE-SAS)." *Signal Processing*, Volume 87, Issue 11, November 2007.

J.C. Sanchez, A. Gunduz, P.R. Carney, J.C. Principe. "An information measure of temporal structure for multichannel spike trains." *J. Neuroscience Methods—Special Issue on BCI*.

Submitted

J.C. Sanchez, J.C. Principe, T. Nishida, R. Bashirullah, J.G. Harris, and J. Fortes. "Brain-Machine Interfaces: The need for beyond state-of-the-art technology and signal processing." *IEEE Signal Processing Magazine*.

A.R. C. Paiva, I. Park, J.C. Principe, T.B. DeMarse, J.C. Sanchez. "An information measure of temporal structure for multichannel spike trains." *Neural Computation*.

Where are they now: Armando Barreto

Looking back, what Dr. Armando Barreto remembers most about his time in CNEL is the camaraderie. "I was lucky to enjoy the friendship of a group of great individuals, and we stuck together through thick and thin."

Today, Dr. Barreto is Associate Professor at Florida International University in Miami. He teaches graduate and undergraduate courses encompassing Digital Signal Processing, Computer Engineering, and Biosignal Processing, and conducts research in these areas. Currently, he leads some federally funded sponsored projects to apply digital signal and image processing techniques toward helping individuals with disabilities access computers. Dr. Barreto is also a key partner in the Center for Innovative Brain Machine Interfaces.

As a student, Dr. Barreto joined CNEL in its infancy, and enjoyed the cutting-edge research environment.

"We participated in the sense of purpose and

pride that existed in the lab....It was an incredible experience when I traveled with Dr. Principe to a Cleveland Clinic Epilepsy Symposium and he introduced me to some of the EEG gurus that were the authors of papers and book chapters from which I had learned, such as Alan Gevins and Paul Nunez. Our ideas were being discussed by the people that helped shape the field—and the efforts paid off."

The Ph.D. experience provides opportunities unique in one's academic career, says Dr. Barreto.

"It allows the student to completely focus on one and only one problem. This might be the last time one can exclusively devote all of his or her attention to a single problem. It may also be the last time one has full involvement in all levels of a project, from conception to implementation."

For current or prospective students, Dr. Barreto has this advice:

"Take pride in the

knowledge that you are attempting to attain a degree from a top-ranked engineering school and being advised by a highly-recognized researcher." Also, "don't be too quick to judge faculty members—including your advisor. As a graduate student, one does not appreciate all the effort—and stress—that goes into building something like CNEL. One only learns that when one's turn comes around to try to develop as a faculty member."

"Most of all, realize that you are in a wonderful stage of your lives, and enjoy it, even if it may not feel so enjoyable sometimes." He also advises paying heed to these lyrics by Green Day:

"So make the best of this test and don't ask why

It's not a question, but a lesson learned in time

For what it's worth it was worth all the while

It's something unpredictable, but in the end it's right

I hope you had the time of your life"



Armando Barreto
Associate Professor, FIU
http://dsplab.eng.fiu.edu/DSP/Dr_Barreto.html



The natural beauty of Castilla y León (above) is different from that of Gainesville. Compared to the temperate vistas of his home, the UF campus is "like a jungle," says visiting scholar Miguel Angel Prada Medrano (below).

Visiting Scholar: Miguel Angel Prada Medrano, University of León, Spain

"When does it get cool here?" asked Miguel Angel Prada Medrano when he arrived in the CNEL lab on the first morning of his three-month stay. From the mild Mediterranean climate of his home in Spain, Miguel Angel traveled in late July to sultry, sweltering Gainesville. Having the naturally curious nature of an engineer, he thought it might be a good idea to walk from his apartment to campus. He soon learned the benefits of Gainesville's air conditioned buses.

A Ph.D. student at the University of León, Miguel

Angel is working with CNELers to identify nonlinear systems using Kohonen self-organizing maps.

His interests, including data mining for supervision of industrial processes, projection and dimensionality reduction, self-organizing maps, and remote laboratories, lead him to visit our lab. He is funded through the regional government of Castilla y León, and has been a valuable asset to CNEL during his short time with us.

It has been a worthwhile visit, he says, as CNEL's research atmosphere stimulates thought.

"You have a lot of people working in different areas, and they are also working in some of the same areas. They question each other," and this constant exploration and critique fuels the development of new ideas.

Like so many of our visitors, Miguel Angel misses food from home, especially "jamón, chorizo and cecina." He departs for home at the end of October.

As of this writing, the temperature in León is 72° F (22° C). Here in beautiful Gainesville, it is a balmy 91° F.





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The Computational NeuroEngineering Laboratory explores the principles that guide our ability to comprehend brain function, treat brain disorders, and ultimately to interface directly with the brain. Our researchers combine principles from machine learning, signal processing theory, and computational neuroscience to advance the science of engineering systems. On the horizon is a technological revolution, where machines can be controlled by the brain. We envision a time when brain and machine can interface through conscious thought, enabling normal function in cases of brain injury or disease.

CNEEL's Hybrid Computation Group combines elements of analog/digital and biological/artificial in an effort to develop biologically inspired algorithms for sensory and neural processing.

Visit us on the web:

www.cnel.ufl.edu

Upcoming Events

Conference	Location & Date	Early Registration
IEEE International Symposium on Circuits and Systems (ICSSAS 2008) http://www.icsas2008.org/	Seattle, Washington, USA May 18-20, 2008	Submission Deadline: October 5, 2007
IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2008) http://www.icassp2008.org/CallForPapers.asp	Las Vegas, Nevada, USA March 30—April 4, 2008	Submission Deadline: October 5, 2007
IEEE Information Theory Workshop (ITW 2008) http://www.dcc.fc.up.pt/itw08/index.htm	Porto, Portugal May 5-9, 2008	Submission Deadline: Nov. 16, 2007
1st IAPR Workshop on Cognitive Information Processing http://cip2008.di.uoa.gr/index.html	Santorini, Greece June 9-10, 2008	Submission Deadline: January 5, 2008

Conference Papers

To Appear—Proc. IEEE International Joint Conference on Neural Networks (IJCNN) Orlando FL August 2007

- R. Sacchi, M. Ozturk, J. Principe, A. Carneiro, I. Silva. "Water Inflow Forecasting using the Echo State Network."
- A. Paiva, S. Rao, I. Park, J. Principe. "Spectral Clustering of Synchronous Spike Trains."
- N. Dedual, M. Ozturk, J. Sanchez, J. Principe. "An Associative Memory Readout in ESN for Neural Action Potential Detection."
- I. Park, A. Paiva, J. Principe, J. Harris. "A Closed Form Solution for Multiple-Input Spike Based Adaptive Filters."
- S. Rao, A. Paiva, J. Principe. "A Novel Weighted LBG Algorithm for Neural Spike Compression."
- S. Rao, S. Han, J. Principe. "Information Theoretic Vector Quantization with Fixed Point Updates."
- Y. Wang, A. Paiva, J. Principe, J. Sanchez. "A Monte Carlo Sequential Estimation of Point Process Optimum Filtering for Brain Machine Interfaces."
- J. Xu, J. Principe, H. Bakardjian, C. Andrzej. "A New Nonlinear Similarity Measure for Multichannel Biological Signals."

To Appear—Proc. IEEE Int'l Conference Engineering in Medicine and Biology Society (EMBC 2007) Lyon, France, August 07

- J. Bourien, J.C. Sanchez, J.J. Bellanger, F. Wendling, J. Principe. Detection of Synchronized Firings in Multivariate Neural Spike Trains During Motor Tasks."

To Appear—Proc. IEEE Int'l Workshop on Machine Learning for Signal Processing (MLSP) Thessaloniki, Greece, August 07

- W. Liu, P. Pokharel, J. Principe. "Recursively Adapted Radial Basis Function Networks and its Relationship to Resource Allocating Networks and Online Kernel Learning."
- S. Seth, M. Ozturk, J. Principe. "Signal Processing with Echo State Networks in the Complex Domain."
- D. Duan, W. Liu, P. Chen, M. Rao, J. Principe. "Variance and Bias Analysis of Information Potential and Symmetric Information Potential."
- S. Han, K-H. Jeong, J. Principe. "Robust Adaptive Minimum Entropy Beamformer in Impulsive Noise."
- J. Xu, J. Principe. "A Novel Pitch Determination Algorithm Based on Generalized Correlation Function."



The ITW 2008 conference will be held in beautiful Porto, Portugal.