

SUNG-PHIL KIM

940 Quaker Ln #2505
East Greenwich RI 02818
H: (401) 301-4086, O: (401) 863-7660
spkim@cs.brown.edu

EDUCATION

PhD in Electrical and Computer Engineering, Jan. 2001 – May 2005
University of Florida, Gainesville, FL
GPA: 4.0/4.0

M.S. in Electrical and Computer Engineering, Aug. 1998 - Dec. 2000
University of Florida, Gainesville, FL
GPA: 4.0/4.0

B.S. in Nuclear Engineering, Mar. 1990 - Feb. 1994
Seoul National University, Seoul, South Korea

EXPERIENCE

Postdoctoral Associate, Sep. 2005 – Present

Computer Science Dept., Brown University, Providence, RI (Dr. M.J. Black)

- Conduct researches for the improvement of **human brain-machine interfaces** (BrainGate™ pilot clinical trials, Cyberkinetics, Inc., Foxborough, MA)
 - 1) Analyze neural activity recorded from motor cortex of humans with tetraplegia
 - 2) Design **decoding methods** to improve cursor control by paralyzed humans
 - 3) Design multi-state decoding methods for **point-and-click** neural cursor control
 - 4) Design **training paradigms** for both paralyzed humans and decoding algorithms
- Study **learning** and **adaptation** in human motor cortical activity during control of neural prostheses

Research Assistant, May 2000 – May 2005

Computational NeuroEngineering Lab (Dr. J.C. Principe), Univ. of Florida, Gainesville, FL

- Conducted researches for **non-human brain-machine interfaces**: collaboration with a primate lab in Duke Univ. (Dr. J.M. Carmena and Dr. M.A.L. Nicolelis)
 - 1) Analyzed a class of decoding models with data recorded from several monkeys.
 - 2) Analyzed **spatio-temporal neural firing patterns** using multiresolution analysis and non-negative matrix factorization
- Developed a system identification model as a **nonlinear mixture of local linear experts**
- Developed an **on-line channel selection** algorithm based on L_1 -norm regularization

Teaching Assistant, May 1999 - Apr. 2000

Electrical and Computer Engineering Dept., Univ. of Florida, Gainesville, FL

- System administration in the department computer lab
- Digital and Computer Systems

Assistant Manager, Feb 1994 - Jul. 1997

Network Solution team, Comtec Systems, Inc., Seoul, South Korea

PUBLICATIONS

Journals

1. S.-P. Kim, J.C. Sanchez, J.M. Carmena, M.A.L. Nicolelis and J.C. Principe, "Real-time quantification of neural ensemble correlation with behavioral tasks," submitted to *IEEE Neural Sys. and Rehabil. Eng.*, 2007.
2. S.-P. Kim, J.C. Sanchez and J.C. Principe, "Real time input subset selection for linear time-variant MIMO systems," *Optimization Methods and Software*, Vo. 22, pp. 83-89, 2007.
3. J. Cho, A.R.C. Paiva, S.-P. Kim, J.C. Sanchez and J.C. Principe, "Self-organizing maps with dynamic learning for spike reconstruction," *Neural Networks*, Vol. 20 (2), pp. 274-284, 2007.
4. S.-P. Kim, J.C. Sanchez, Y.N. Rao, D. Ergodmus, J.C. Principe, J.M. Carmena, M.A. Lebedev, and M.A.L. Nicolelis, "A comparison of optimal MIMO linear and nonlinear models for brain-machine interfaces," *Journal of Neural Engineering*, Vol. 3, pp. 145-161, 2006.
5. S.-P. Kim, Y.N. Rao, D. Ergodmus, J.C. Sanchez, M.A.L. Nicolelis, and J.C. Principe, "Determining patterns in neural activity for reaching movements using non-negative matrix factorization," *EURASIP Journal of Applied Signal Processing*, 2005(19), pp. 3113-3121, 2005.
6. S.-P. Kim, J.C. Sanchez, D. Ergodmus, Y.N. Rao, J.C. Principe, and M.A.L. Nicolelis, "Divide-and-conquer approach for brain-machine interfaces: Nonlinear mixture of competitive linear models," *Neural Networks*, Vol. 16, No. 5-6, pp. 865-871, 2003.

Conference proceedings

1. S.-P. Kim, J.D. Simeral, L.R. Hochberg, J.P. Donoghue, G.M. Friehs and M.J. Black, "Multi-state decoding of point-and-click control signals from motor cortical activity in a human with tetraplegia," *Proc. of the 3rd IEEE EMBS Conf. on Neural Engineering*, pp. 486-489, May 2007.
2. G. Shakhnarovich, S.-P. Kim, M. Fellows, J.P. Donoghue, and M.J. Black, "Nonlinear physically-based models for decoding motor-cortical population activity," *Advances in Neural Information Processing System*, 19, pp. 1257-1264, 2007.
3. S.-P. Kim, J. Simeral, J.P. Donoghue, L.R. Hochberg, G.M. Friehs, J.A. Mukand, D. Chen, M.J. Black, "A comparison of decoding models for imagined motions from human motor cortex," *Program No. 256.11. 2006 Neuroscience Meeting Planner*. Atlanta, GA: Society for Neuroscience, online.
4. S. Darmanjian, S.-P. Kim, M.C. Nechyba, J.C. Principe, J. Wessberg and M.A.L. Nicolelis, "Independently coupled HMM switching classifier for a bimodal brain-machine interface," *Proc. of the IEEE Int'l Workshop on Machine Learning for Signal Processing*, pp. 379-384, Sept. 2006.
5. S.-P. Kim, F. Wood, M. Fellows, J.P. Donoghue, and M.J. Black, "Statistical analysis of the non-stationarity of neural population codes," Presented at the *IEEE RAS/EMBS Int'l. Conf. on Biomedical Robotics and Biomechanics*, 2006
6. S.-P. Kim, J.M. Carmena, M.A.L. Nicolelis, and J.C. Principe, "Multiresolution analysis and data mining of neural spikes for brain-machine interfaces," *Proc. of the 2nd IEEE EBMS Conf. on Neural Engineering*, pp. 221-224, Mar. 2005.
7. Y.N. Rao, S.-P. Kim, J.C. Sanchez, D. Erdogmus, J.C. Principe, J.C. Carmena, M.A. Lebedev, and M.A.L. Nicolelis, "Learning mappings in brain-machine interfaces with echo state networks," *Proc. of the IEEE Int'l Joint Conf. on Neural Networks*, Vol. 5, pp. 233-236, Mar. 2005.
8. D. Han, S.-P. Kim, and J.C. Principe, "Sparse channel estimation with regularization method using convolutional inequality for entropy," *Proc. of Int'l Joint Conf. on Neural Networks*, Vol. 4, pp. 2359-2362, July 31-Aug 4, 2005.
9. Y. Wang, S.-P. Kim and J.C. Principe, "Comparison of TDNN Training Algorithms in Brain Machine Interfaces," *Proc. of Int'l Joint Conf. on Neural Networks*, Vol. 4, pp. 2459-2462, July 31-Aug 4, 2005.

- 10.R. Yan, G. He, D. Erdogmus, S.-P. Kim, J.C. Principe, and Y. Lui, "Separating spatial and temporal activation patterns in fMRI using competitive subspace projection," *Proc. of the IEEE Int'l Conf. on Acoustic, Speech, and Signal Processing*, Vol. 2, pp. 473-476, Mar. 2005.
- 11.S.-P. Kim, Y.N. Rao, D. Erdogmus, and J.C. Principe, "Tracking multivariate time-variant systems based on on-line variable selection," *Proc. of the IEEE Int'l Workshop on Machine Learning for Signal Processing*, pp. 123-132, Sept. 2004.
- 12.J.C. Sanchez, D. Erdogmus, Y.N. Rao, S.-P. Kim, M.A.L. Nicolelis, J. Wessberg, and J.C. Principe, "Interpreting neural activity through linear and nonlinear models for brain machine interface," *Proc. of the Int'l Conf. on the IEEE EMBS*, Vol. 3, pp. 2160-2163, Sept. 2003.
- 13.S.-P. Kim, Y.N. Rao, D. Erdogmus, and J.C. Principe, "A hybrid subspace projection method for system identification," *Proc. of IEEE Int'l Conf. on Acoustic, Speech, and Signal Processing*, pp. VI312-VI314, 2003.
- 14.S. Darmanjian, S.-P. Kim, M. Nechyba, S. Morrison, and J.C. Principe, "Bimodal brain-machine interfaces for motor control of robotic prosthetic," *Proc. of the IEEE/RSJ Int'l Conf. on Intelligent Robots and Systems*, Vol. 4, pp. 3612-3617, Oct. 2003.
- 15.S.-P. Kim, J.C. Sanchez, D. Ergodmus, Y.N. Rao, J.C. Principe, and M.A.L. Nicolelis, "Modeling relation from motor control neuronal firing to hand movements using competitive linear filters and a MLP," *Proc. of Int'l Joint Conf. on Neural Networks*, Vol. 1, pp. 66-70, Jul. 2003.
- 16.J.C. Sanchez, S.-P. Kim, D. Ergodmus, Y.N. Rao, J.C. Principe, J. Wessberg, and M.A.L. Nicolelis, "Input-output mapping performance of linear and nonlinear models for estimating hand positions from cortical neuronal firing patterns," *Proc. of IEEE Workshop on Neural Networks for Signal Processing*, pp. 139-148, Sept. 2002.
- 17.D. Erdogmus, J.C. Principe, S.-P. Kim, and J.C. Sanchez, "A recursive Renyi's entropy estimator," *Proc. of IEEE Workshop on Neural Networks for Signal Processing*, pp. 209-217, Sept. 2002.

PRESENTATIONS

The workshop on Brain-machine interfaces, IEEE IJCNN'07, Aug. 17, 2007, Orlando, FL, "Cortical control of a computer cursor using an intracortical neural interface system in humans with tetraplegia"

World Congress on Medical Physics and Biomedical Engineering, Aug.30-Sep.2 2006, Seoul, Korea, "Finding directional movement representations in motor cortical neural populations using nonlinear manifold learning"

Conference on Systems Analysis, Data Mining and Optimization in Biomedicine, Feb. 2-4 2005, University of Florida, Gainesville, FL, "Real time neuronal subset selection in BMIs"

AWARDS

Sheridan Teaching Certificate, Brown University, Providence, RI, 2006

International Students Academic Award, University of Florida, Gainesville, FL, 2004

Employee of the year, Comtec Systems, Inc., Seoul, South Korea, 1996

PROFESSIONAL ACTIVITIES

Reviewer: IEEE Trans. on Neural Systems and Rehabilitation, IEEE Trans. on Neural Networks, 2004 IEEE International Joint Conference on Neural Networks, 2007 Neural Information Processing Systems.

Member: IEEE EMBS, Society for Neuroscience

SKILLS

Computer: Linux, Matlab, C/C++, NeuroSolution™

Course: Neuroinformatics, Marine Biology Laboratory, MA, Aug. 12-27, 2006