

# SUNG-PHIL KIM

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

---

## EDUCATION

**Ph.D. Electrical and Computer Engineering**, Jan. 2001 – May 2005  
University of Florida, Gainesville, FL, USA (GPA: 4.0/4.0)

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

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

## EXPERIENCE

**Postdoctoral Research Associate**, Sep. 2008 – Present (Advisor: Dr. J.P. Donoghue)  
Computer Science and Neuroscience Dept., Brown University, Providence, RI, USA

**Postdoctoral Research Associate**, Sep. 2005 – Oct. 2008 (Advisor: Dr. M.J. Black)  
Computer Science Dept., Brown University, Providence, RI, USA

- Conduct research for the development of human neural interface systems, involved in the BrainGate™ pilot clinical trial (Dr. J.P. Donoghue, Cyberkinetics, Inc., MA, USA)
  - 1) Analyze kinematics representation in the motor cortical spiking activity
  - 2) Design a probabilistic decoding model for reliable 2D cursor movement
  - 3) Design a multi-state decoding model for point-and-click neural cursor control
  - 4) Study the training paradigm for paralyzed persons and decoding algorithms
  - 5) Study learning and adaptation in human motor cortical activity during control of neural prostheses
  - 6) Study standard performance metrics for neural cursor control

**Research Assistant**, May 2000 – May 2005 (Advisor: Dr. J.C. Principe)  
Computational NeuroEngineering Lab, University of Florida, Gainesville, FL

- Conducted research for non-human brain-machine interfaces: collaboration with the primate lab at the Duke University (Dr. J.M. Carmena)
  - 1) Developed regularized decoding models with the data recorded from monkeys performing the 2D and the 3D movement tasks
  - 2) Analyzed spatio-temporal neural firing patterns using multiresolution analysis and non-negative matrix factorization
- Developed a nonlinear mixture of localized linear filters for system identification
- Developed an on-line channel selection algorithm based on the  $L_1$ -norm regularization

**Teaching Assistant**, May 1999 - Apr. 2000  
Electrical and Computer Engineering Dept., Univ. of Florida, Gainesville, FL, USA

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

**Assistant Manager**, Feb 1994 - Jul. 1997  
Data Network Solution team, Comtec Systems, Inc., Seoul, South Korea

## PUBLICATIONS

### Peer-reviewed papers

1. **S.-P. Kim**, J.D. Simeral, L.R. Hochberg, J.P. Donoghue and M.J. Black, "Neural cursor of computer cursor velocity by decoding motor cortical spiking activity in humans with tetraplegia," *Journal of Neural Engineering*, 5, pp. 455-476, 2008.
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 Systems*, Vol. 19, pp. 1257-1264, 2007.
3. **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*, Vol. 22, pp. 83-89, 2007.
4. 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.
5. **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.
6. **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*, Vol. 2005(19), pp. 3113-3121, 2005.
7. **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, 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 IEEE EMBS Conf. on Neural Engineering*, pp. 486-489, 2007.
2. 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 IEEE Int'l Workshop on Machine Learning for Signal Processing*, pp. 379-384, 2006.
3. **S.-P. Kim**, F. Wood, M. Fellows, J.P. Donoghue, and M.J. Black, "Statistical analysis of the non-stationarity of neural population codes," *Proc. of IEEE RAS/EMBS Int'l. Conf. on Biomedical Robotics and Biomechatronics*, pp. 811-816, 2006
4. **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 IEEE EBMS Conf. on Neural Engineering*, pp. 221-224, 2005.
5. 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 IEEE Int'l Joint Conf. on Neural Networks*, Vol. 5, pp. 233-236, 2005.
6. Y. Wang, **S.-P. Kim** and J.C. Principe, "Comparison of TDNN training algorithms in Brain machine interfaces," *Proc of IEEE Int'l Joint Conf. on Neural Networks*, Vol. 4, pp. 2459-2462, 2005.
7. 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 IEEE Int'l Conf. on Acoustic, Speech, and Signal Processing*, Vol. 2, pp. 473-476, 2005.
8. **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 IEEE Int'l Workshop on Machine Learning for Signal Processing*, pp. 123-132, 2004.

9. 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 Int'l Conf. on the IEEE EMBS*, Vol. 3, pp. 2160-2163, 2003.
10. **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.
11. 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 IEEE/RSJ Int'l Conf. on Intelligent Robots and Systems*, Vol. 4, pp. 3612-3617, 2003.
12. **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 IEEE Int'l Joint Conf. on Neural Networks*, Vol. 1, pp. 66-70, 2003.
13. 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, 2002.

### **In review or preparation**

1. **S.-P. Kim**, J.D. Simeral, L.R. Hochberg, J.P. Donoghue, G.M. Friehs and M.J. Black, "Point-and-click cursor control with an intracortical neural interface system in humans with tetraplegia," in preparation.

### **Abstracts**

1. **S.-P. Kim**, J.D. Simeral, L.R. Hochberg, W. Truccolo, J.P. Donoghue, G.M. Friehs and M.J. Black, "Tuning analysis of motor cortical neurons in a person with paralysis during performance of visually instructed cursor control tasks," *2008 Neuroscience Meeting*, Washington D.C.: Society for Neuroscience, 2008.
2. J.P. Donoghue, J.D. Simeral, M.J. Black, **S.-P. Kim**, W. Truccolo and L.R. Hochberg, "Neural activity in the motor cortex of humans with tetraplegia," *AREADNE*, 2008.
3. J.D. Simeral, **S.-P. Kim**, M.J. Black, J.P. Donoghue and L.R. Hochberg, "Ensemble spiking activity as a source of cortical control signals in individuals with tetraplegia," *BMES Annual Meeting*. 2007.
4. **S.-P. Kim**, J.D. Simeral, L.R. Hochberg, G.M. Friehs, J.P. Donoghue and M.J. Black, "Point-and-click cursor control by a person with tetraplegia using an intracortical neural interface system," *2007 Neuroscience Meeting Planner*. San Diego, CA: Society for Neuroscience, 2007
5. **S.-P. Kim**, J.D. Simeral, O.C. Jenkins, J.P. Donoghue, and M.J. Black, "Finding directional movement representations in motor cortical neural populations using nonlinear manifold learning," *World Congress on Medical Physics and Biomedical Engineering*, Seoul, Korea, 2006
6. **S.-P. Kim**, J.D. 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," *2006 Neuroscience Meeting Planner*. Atlanta, GA: Society for Neuroscience, 2007

### **PRESENTATIONS**

#### **Workshop on Computation Approaches for Brain Machine Interfaces, IEEE IJCNN'07**

Aug. 2007, Orlando, FL, "Cortical cursor control by humans with tetraplegia using a direct intracortical neural interface systems"

#### **Conference on Systems Analysis, Data Mining and Optimization in Biomedicine**

Feb. 2005, University of Florida, Gainesville, FL, "Real time neuronal subset selection in BMIs"

## AWARDS

**Assoc. of Korean Neuroscientists Award for Excellence in Research**, San Diego, CA, 2007

**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

## CURRENT RESEARCH INTERESTS

- Improving neural cursor speed control using nonlinear decoding models
- Decoding 3D prosthetic control signals from human motor cortex
- Developing a probabilistic mixture of local cursor trajectory models
- Finding nonlinear manifolds in neural data with the spatio-temporal Isomap
- Statistical feature extraction for neural decoding using least angle regression

## PROFESSIONAL ACTIVITIES

**Reviewer:** IEEE Trans. on Neural Systems and Rehabilitation Engineering, IEEE Trans. on Biomedical Engineering, IEEE Trans. on Neural Networks, IEEE International Joint Conference on Neural Networks, Neural Information Processing Systems.

**Member:** IEEE EMBS, Society for Neuroscience