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Research interests

- Computational modeling of human movement control, learning, and memory
- Neuroscientific approach to augmentation and optimization of human learning
- Brain inspired artificial intelligence (Reverse engineering the brain to understand learning and memory)
- Cognitive and neural mechanisms underlying decision making in the framework of reinforcement learning

Education

2009-2013	Ph.D., Neuroscience, University of Southern California, Los Angeles, California, USA (Thesis advisor: Nicolas Schweighofer)
2005-2008	M.S., Biomedical Engineering, Duke University, Durham, North Carolina, USA
2003-2005	M.S., Electrical & Computer Engineering, Seoul National University, Seoul, Korea (Thesis advisor: Sung June Kim)
1998-2003	B.S., Electrical & Computer Engineering, Seoul National University, Seoul, Korea
1998-2003	B.S., Chemical Engineering, Seoul National University, Seoul, Korea

Training

2015-2017	Postdoctoral Fellow, Northwestern University, Chicago, Illinois (PI: Joel L Voss)
2014-2015	Postdoctoral Fellow, University of Chicago, Chicago, Illinois (PI: Sliman J Bensmaia)
2013	Visiting Scholar, Max Planck Institute for Intelligent Systems, Tuebingen, Germany (PI: Stefan Schaal)
2009-2013	Visiting Student, Advanced Telecommunications Research Institute International, Kyoto, Japan
2008-2009	Research Assistant, Image Computing Systems Laboratory in University of Washington, Seattle, Washington
2007-2008	Research Assistant, Optical Coherence Tomography Lab in Duke University, Durham, North Carolina
2004-2005	Research Assistant, Nanobio Electronics & Systems Center, Seoul, Korea
2004	Research Engineer, Nurobiosis Corp., Seoul, Korea

Academic Appointments

2020-Present	Assistant Professor School of Intelligence Computing, Department of Cognitive Sciences, Hanyang University, Seoul Korea Participating Professor Center for Neuroscience Imaging Research, Institute of Basic Sciences, Suwon, Korea
2017-2020	Research Assistant Professor (Principal Investigator/Non-tenure Track)

Sungkyunkwan University, Suwon, Korea
2017-2020 Young Scientist Fellow
Center for Neuroscience Imaging Research, Institute of Basic Sciences, Suwon, Korea

Honors and Awards

2019 *Postdoctoral travel Award, Annual Meeting of Cognitive Neuroscience Society, San Francisco, California, USA (*eligible for this award as a postdoc with graduation of PhD in 2013 or later)

2018 Selected as a scientist by BRIC with three high-impact papers (Hanbitsa) published in three years

2017 Young Scientist Fellowship, Institute of Basic Sciences, Korea

2013 3rd prize in Neuroscience Symposium at University of Southern California, Los Angeles, California, USA

2009 Graduate student fellowship, University of Southern California, Los Angeles, California, USA

Professional Activities

Research advisor

2019-present Research advisor, Human Plus Fusion Research & Development Challenge, Hanyang (ERICA) University
2017-Present Principal investigator, Computational Learning & Memory Neuroscience Lab, Center for Neuroscience Imaging Research, Institute of Basic Sciences
2018-Present Research advisor, Department of Neurology, Samsung Medical Center, Korea
2016-Present Research advisor, Department of Rehabilitation Medicine, Seoul Bundang Hospital, Sungnam, Korea

Teaching

2021 Spring Neuroscience, Hanyang University
2021 Spring Probability and Statistics, Hanyang University
2020 Fall AI and decision making, Hanyang University
2020 Fall Python programming 2, Hanyang Univerrsity
2018-2019 Instructor, CNIR summer internship training
2018 Guest lecturer for undergraduate course, “Mind Bran and Computer”, Spring and Fall semester
2010-2011 Teaching assistant, Fundamentals of Neuroscience, University of Southern California
2010 Teaching assistant, General Biology, University of Southern California
2003 Teaching assistant, Electrical Engineering Lab, Seoul National University
2003 Teaching assistant, Electronic Circuits, Seoul National University

Trainees

Postdoctoral fellow and researchers

2019-2020 In-gyu Choi, post-master researcher
2018-2020 Emily Yunha Shin, post-master researcher
Yera Choi, post-master researcher
2018-2019 Hyungjung Lee, post-master researcher
2017-2019 Dr. Kyusung Lim, postdoctoral fellow
2017-2018 Heeae Kim, post-master researcher
Yujin Jeong, post-master researcher

Undergraduate/graduate student

2021-present Seojin Yoon, graduate student at Hanyang University

2021-present Sunyoung Jung, graduate student at Hanyang University
2021-present Jonghyuk Lim, graduate student at Hanyang University
2021 Spring Jieun Lee, undergraduate student at University of Southern California
2020 Spring Joonwoo Kang, undergraduate student at Stanford University
2019-present Sungbeen Park, graduate student at Hanyang University
2019-present Jisu Lee, graduate student at Yonsei University
2019 Spring Seung-yeon Lee, undergraduate student at Ewha Womans University
2018 Summer Nayeon Kwon, graduate student at Seoul National University
2018 Summer Mina Kwon, undergraduate student at Seoul National University
2018 Summer Ji-Hyeun Kim, undergraduate student at Kumoh National Institute of Technology
2018 Summer Jihye Hyun, undergraduate student at Kumoh National Institute of Technology

Community service

2020 Special lecture for high school students in Jeonnam Foreign Language High School, Naju, Korea
2019 Career counseling for high school students in Jeonnam Science High School, Naju, Korea
Science SLAM-D, Science talk to the public
2018 Discussion panel, Neuroethics workshop, Seoul, Korea
Grant reviewer, Korean brain research institute neuroethics research service
Special lecturer, Science Day event in Jeonnam Science High School, Naju, Korea

Media

2019 IBS news, “Brain map connecting dots”
Electronic Times, “In search of memory”
2019 Korea Broadcasting System (KBS, Daejun), HomoScience, “Revealing the secret of the brain”
YTN Science, “Story of neuroscience”
2018 TheScientist, “Noninvasive Brain Stimulation Modulates Memory Networks”
JoongAng Daily News, “Movie comes true: Memory jump by magnetic stimulation of the brain”
2015 DongA Science, “Brain region of learning and memory for movement”

Extramural membership

Society for Neuroscience
Cognitive Neuroscience Society

Editorial board member

Frontiers in Neuroscience
Frontiers in Neurology

Ad-hoc reviewer for:

eNeuro
Restorative Neurology and Neuroscience
Scientific reports
Perception
Human Movement Science
Journal of Neuroscience

Grant Awards

Principal Investigator:

2021 Mid-Career Researcher Program, 800,000 kWon in total over 4 years

Role: PI National Research Foundation of Korea (NRF) grant, Ministry of Science and ICT

Title: Investigation of neural mechanisms underlying human motor learning and memory with neuroimaging and non-invasive brain stimulation

2021 Research grant, 77,640 kWon in total

Role: PI REMED Corp., Republic of Korea

Title: Research on efficacy of transcranial magnetic stimulation with cognitive and neuroscientific approach

2020 Hanyang University Faculty Start-up, 20,000 kWon in total

Role: PI Hanyang University, Republic of Korea

Title: Basic and applied research for neuroscientific mechanisms underlying human learning and memory with neuroimaging and neuromodulation

2017-2020 Young Scientist Fellowship, 900,000 kWon in total (over 300,000 kWon /year)

Role: PI Institute of Basic Sciences, Republic of Korea

Title: Computational neuroscience for learning & memory with neuroimaging and neuromodulation

Invited Lectures and Symposium

2020 Invited speaker, 4th Korea-Russia Science Science Day, Seoul, Korea
Title: Motor learning and memory with multiple time scales

Invited speaker, Korea National University of Transportation, Choongju, Korea
Title: When Neuroscience Meets AI

Invited speaker, Future Technologies Research Seminar, Korea Institute of Information Security & Crytology, Seoul, Korea
Title: Neuroscience and AI

Invited speaker, Seoul National University Convergence, Suwon, Korea
Title: Investigation of human learning and memory with fMRI and non-invasive brain stimulation

Invited speaker, Kookmin University, Seoul, Korea
Title: Movement science: Understanding motor learning and memory

2019 Invited speaker, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Korea
Title: Neuroimaging studies of human learning & memory with neuromodulation

Invited speaker, The 6th SNUBH Rehabilitation Science & Technology Symposium, Seongnam, Korea
Title: Sophisticated Neuromodulation Approach to Enhance Cognition Based on Brain Connectivity

Symposium speaker, Fall Conference Korean Society for Human Brain Mapping, Sungkyunkwan University, Suwon, Korea
Title: Neural substrates related to supervised and reinforcement motor learning

Invited speaker, Seminar series for biomedical engineering, Asan Medical Center, Seoul, Korea

Title: Investigation of human learning and memory with fMRI and non-invasive brain stimulation

Symposium speaker, Cognitive Neuroscience Symposium, Sungkyunkwan University, Suwon, Korea
Title: Movement science in fMRI: Neural mechanisms underlying motor learning and memory

Invited speaker, Hanyang University, Ansan, Korea
Title: Investigation of neural mechanisms underlying motor learning and memory

Invited speaker, Chosun University, Gwangju, Korea
Title: Non-invasive stimulation targeting hippocampal-cortical network for improvement of associative memory of humans

Invited speaker, Korea Brain Research Institute (KBRI), Daegu, Korea
Title: Network-targeted non-invasive stimulation for enhancement of human associative memory

2018 Invited speaker, Symposium on Frontiers in Bio-IT Healthcare, Korea Advanced Institute of Science and Technology (KAIST), Daejun, Korea
Title: A recent study using transcranial magnetic stimulation to enhance human associative memory

Invited speaker, Samsung Medical Hospital
Title: In search of 'holy grail' of cognitive neuroscience: Human memory enhancement

Invited speaker, Hokkaido University, Sapporo, Japan
Title: Research on learning & memory with neuromodulation in Computational Learning & Memory Neuroscience (CLMN) Lab in Korea

2017 Invited speaker, Center for Information and Neural Networks, Osaka, Japan
Title: Research on Learning & Memory with Neuromodulation in CLMN lab

Invited speaker, Korea Advanced Institute of Science and Technology (KAIST), Daejun, Korea
Title: Restoring sensorimotor functions through intracortical microstimulation to somatosensory cortex-Next generation of Brain-Machine Interfaces

2016 Invited speaker, Korea Advanced Institute of Science and Technology (KAIST), Daejun, Korea
Title: Cache memory and hard disk in the brain: Combined approach of computational models and neuroimaging techniques

Invited speaker, Kyunghee University, Yongin, Korea
Title: Cache memory and hard disk in the brain: Combined approach of computational models and neuroimaging techniques

Invited speaker, Korea Institute of Science and Technology (KIST), Seoul, Korea
Title: Cache memory and hard disk in the brain: Combined approach of computational models and neuroimaging techniques

2015 Invited speaker, Joint Workshop of Dankuk Wearable Thinking Research Center and National Rehabilitation Center, Seoul, Korea
Title 1: Computational models and model-based fMRI studies in motor learning
Title 2: Restoring sensorimotor functions through intracortical microstimulation to somatosensory cortex – Next generation of Brain-Machine Interfaces

Invited speaker, Daegu-Gyeongbuk Medical Innovation Foundation, Daegu, Korea
Title: The psychometric properties of intracortical microstimulation – restoring touch for brain-machine interface

2014 Invited speaker, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Korea
Title: Computational models and model-based fMRI studies in motor learning

Invited speaker, Korea Institute of Science and Technology (KIST), Seoul, Korea,

Title: Computational models and model-based fMRI studies in motor learning

Invited speaker, Department of Psychology, Korea University, Seoul, Korea,
Title: Computational models and model-based fMRI studies in motor learning

2013 Invited speaker, Ewha Womans University, Seoul, Korea,
Title: Computational models and model-based fMRI studies in motor learning

Symposium speaker, Translational and Computational Motor Control Conference, San Diego, California
Title: Neural correlates of motor memory with multiple time scales in sensorimotor adaptation

Publications (* denotes corresponding authorship)

International Journals

1. Choi Y, Shin EY, **Kim S***. Spatiotemporal dissociation of fMRI activity in the caudate nucleus underlies human *de novo* motor skill learning. *Proceedings of National Academy of Sciences U. S. A.,* Vol. 117, Issue 38, 2020
2. **Kim S***. Bidirectional competitive interactions between motor memory and declarative memory systems during interleaved learning. *Scientific Reports,* Vol. 10, No. 6916, 2020
3. **Kim S***. Competitive interactions between motor and episodic memory systems during interleaved learning. *Preprint in bioRxiv,* 2020
4. Choi Y, Shin EY, **Kim S***. Double dissociation of fMRI activity in the caudate nucleus supports *de novo* motor skill learning. *Preprint in bioRxiv*, 2019
5. **Kim S***, Voss JL. Large-scale network interactions supporting item-context memory formation. *PLoS One,* Vol. 14, Issue 1, 2019
6. **Kim S**[§], Nilakantan AS[§], Hermiller MS, Palumbo R, VanHaerents SA, Voss JL*. Selective and coherent activity increases due to stimulation indicate functional distinctions between episodic memory networks. *Science Advances*, Vol. 4, Issue 8, 2018 ([§]co-first author)
7. **Kim S**, Callier T, Bensmaia SJ*. A computational model that predicts behavioral sensitivity to intracortical microstimulation. *Journal of Neural Engineering,* Vol. 14, Issue 1, 2017
8. Lee JY, Oh Y, **Kim SS**, Scheidt RA, Schweighofer N*. Optimal Schedule in Multi-task Motor Learning. *Neural Computation,* Vol. 28, Issue 4, 2016
9. **Kim S**[§], Ogawa K[§], Lv J, Schweighofer N*, Imamizu H. Neural substrates related to motor memory with multiple time scales in sensorimotor adaptation. *PLoS Biology,* Vol. 13, Issue 12, 2015 ([§]co-first author)
10. **Kim S**, Callier T, Tabot GA, Gaunt RA, Tenore FV, Bensmaia SJ*. Behavioral assessment of sensitivity to intracortical microstimulation of primate somatosensory cortex. *Proceedings of National Academy of Sciences U. S. A.,* Vol. 112, Issue 49, 2015
11. Callier T, Saal HP, Tabot GA, **Kim S**, Bensmaia SJ, "Feeling through a bionic hand, *Journal of the Homeland Defense and Intelligence Analysis Center*, 1, 19-22, 2015
12. Tabot GA, **Kim SS**, Winberry JE, Bensmaia SJ*. Restoring tactile and proprioceptive sensation through a brain interface. *Neurobiology of Disease* Vol. 83, pp. 191-198, 2015
13. **Kim S***, Y. Oh, N. Schweighofer. Between-trial forgetting due to interference and time in motor adaptation. *PLoS One,* Vol. 10, Issue 11, 2015
14. **Kim S**, Callier T, Tabot GA, Tenore FV, Bensmaia SJ*. Sensitivity to microstimulation of somatosensory cortex delivered simultaneously through multiple electrodes. *Frontiers in Systems Neuroscience,* 9: 47, 2015

15. Schweighofer N, Lee JY, Goh HT, Cho Y, **Kim SS**, Stewart JC, Lewthwaite R, Winstein CJ*. Mechanisms of the contextual interference effect in individuals post-stroke. *Journal of Neurophysiology*, Vol. 105, Issue 5, 2011
16. Kim KH*, **Kim SS**, Kim SJ. Superiority of nonlinear mapping in decoding multiple single-unit neuronal spike trains: A simulation study. *Journal of Neuroscience Methods.* Vol. 150, Issue 2, pp. 202-211, 2006
17. Kim KH*, **Kim SS**, Kim SJ. Improvement of spike train decoder under spike detection and classification errors using support vector machine. *Medical & Biological Engineering & Computing,* Vol. 44, pp. 124-130, 2006

Manuscripts under review/preparation

1. Shin EY, Choi Y, Ogawa K, **Kim S***. Dissociation of neural substrates for motor learning and execution in multiple visuomotor mapping. *In preparation*
2. Shin EY, Choi Y, Lee J, **Kim S***. Neural representations of a complex de novo motor skill learning. *In preparation*
3. Jisu Lee, **Kim S***. Neural computations underlying human reinforcement learning in continuous state and choice space*. In preparation*

Conferences

1. Choi Y, Shin EY, Lee H, **Kim S** (2019). Dissociation of fMRI activities in the caudate nucleus supports reinforcement learning of motor skills. *Presented at the annual meeting of the Society for Neuroscience,* Chicago, USA
2. Lee J, **Kim S** (2019). Neural mechanisms underlying human reinforcement learning in a continuous choice space. *Presented at the annual meeting of the Society for Neuroscience,* Chicago, USA
3. Choi Y, Shin EY, Lee H, **Kim S** (2019). Double dissociation of fMRI activity in caudate nucleus supports human de novo motor skill learning. *Presented at IBS Conference on Neuroimaging,* Suwon, Korea
4. Choi Y, Shin EY, Lee H, **Kim S** (2019). Building a cognitive map of a reward-based motor skill learning. *Presented at Organization for Human Brain Mapping*, Rome, Italy
5. Shin EY, Choi Y, Lee H, **Kim S** (2019). Distinct neural correlates of a reward-based motor skill learning in early and advanced stages. *Presented at Organization for Human Brain Mapping*, Rome, Italy
6. **Kim S**, Choi Y, Shin EY (2019). Competitive and independent encoding of episodic versus procedural memory. *Presented at the annual meeting of the Cognitive Neuroscience Society,* San Francisco, California, USA
7. **Kim S**, Lim K (2018). Dissociation of neural substrates for motor planning and execution in learning multiple visuomotor mappings. *Presented at the annual meeting of the Society for Neuroscience,* San Diego, California, USA
8. **Kim S**, Hermiller MS, Palumbo R, Van Haerents SA, Voss JL (2017). Enhanced stimulus-evoked hippocampal-cortical activity during memory formation following network-targeted noninvasive brain stimulation. *Presented at the annual meeting of the Society for Neuroscience,* Washington DC, USA
9. Voss JL, **Kim S** (2017). Dynamic interaction between episodic and motor memory systems. *Presented at the annual meeting of the Society for Neuroscience,* Washington DC, USA

10. Warren KN, **Kim S**, Hermiller MS, Nilakantan AS, O'Neil JT, Palumbo R, Voss JL (2017). Increased functional connectivity during autobiographical memory retrieval. *Presented at the annual meeting of the Cognitive Neuroscience Society*, San Francisco, California, USA
11. **Kim S**, Voss JL (2016). Competitive and independent encoding of episodic versus procedural memory. *Presented at the annual meeting of the Cognitive Neuroscience Society,* San Francisco, California, USA
12. **Kim SS**, Hermiller MS, Voss JL (2016). Hippocampal-cortical fMRI network distinctions between two types of item-context memory. *Presented at the annual meeting of the Society for Neuroscience,* San Diego, California, USA
13. **Kim SS,** Callier T, Tabot GA, Tenore FV, Bensmaia SJ (2014). Discrimination of electrical stimulation to primary somatosensory cortex. *Presented at the annual meeting of the Society for Neuroscience,* Washington DC, USA
14. Sargent BA, **Kim SS**, Schweighofer N, Fetters L (2012). The contribution of exploration to learning in young infants. *Presented at the annual meeting of the Society for Neuroscience,* New Orleans, Louisiana, USA
15. **Kim S. -S**, Schaal S, Scheidt RA, Schweighofer N (2012). Directed exploration during learning of a high dimensional motor task. *Presented at the annual meeting of the Society for Neuroscience,* New Orleans, Louisiana, USA
16. Ogawa K, **Kim SS**, Imamizu H, Schweighofer N (2012). Multiple time constants in sensorimotor adaptation: a model-based fMRI study. *Presented at the annual meeting of the Society for Neuroscience,* New Orleans, Louisiana, USA
17. Oh Y, **Kim S**, Schweighofer N (2012). Optimal spacing effect in motor adaptation. *Presented at the annual meeting of the Society for Neuroscience,* New Orleans, Louisiana, USA
18. **Kim SS**, Scheidt RA, Schaal S, Schweighofer N (2011). Learning a new motor skill with a high dimension motor system: Preliminary results. *Presented at the annual meeting of the Society for Neural Control of Movement,* San Juan, Puerto Rico, USA
19. **Kim SS**, Callan DE, Schaal S, Schweighofer N (2010). Fast reinforcement learning of a motor task via adaptive exploration in humans. *Presented at the annual meeting of the Society for Neuroscience,* San Diego, California, USA
20. **Kim SS**, Lee JY, Schweighofer N (2010). In search of the optimal schedule for multi-task motor adaptation. *Presented at the annual meeting of the Society for Neural Control of Movement,* Naples, Florida, USA
21. Kim KH, **Kim SS**, Kim SJ (2005). Advantage of support vector machine for neural spike train decoding under spike sorting errors. *Presented at IEEE-EMBS, 27th annual international conference, Shanghai, China*
22. **Kim SS**, Kim KH, Kim SJ (2004). Neuronal spike train decoding for the brain-computer interface using nonlinear filter based on support vector machine. *Presented at the 7th Conference on Brain and Neural Science*, Seoul, Korea

Theses

1. **Kim SS** (2013). Computational models and model-based fMRI studies in motor learning. *PhD thesis*, *University of Southern California*, Los Angeles, California, USA
2. **Kim SS** (2005). Performance assessment of motor cortex spike train decoding algorithm. *Master thesis*, *Seoul National University*, Seoul, Korea