TAEKJUN KIM, Ph.D.

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Research Scientist
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Professional Summary

Neuroscientist & Data Scientist with 15+ years of expertise in computational neuroscience and high-density *in vivo* electrophysiology (NHP models). Specialized in developing high-performance neural decoding models to classify visual stimuli and predict behavioral choices from large-scale population activity. Proven track record in building automated, high-throughput pipelines to process TB-scale neural datasets. Now seeking to leverage expertise in closed-loop signal processing to advance **next-generation Brain-Computer Interfaces (BCI)**.

Technical Skills

Neuroscience & BCI Methodologies

- **High-Density Electrophysiology**: Expert in *in vivo* recording (LFP & Spiking activity) within awake, behaving Non-Human Primate (NHP) models.
- **Experimental Control & Visual Psychophysics**: Developed closed-loop paradigms and dynamic, interactive stimuli to strictly synchronize visual inputs with animal behavior and neural acquisition.
- **Eye-Tracking & Behavioral Analytics**: Expert in analyzing high-resolution eye-tracking and sensorimotor data to quantify performance and interpret neural population activity.
- **Surgical & Clinical Management**: Proficient in cranial surgeries (craniotomies) for acute recordings, head-post maintenance, and long-term NHP care.

Data Science & Machine Learning

- **Neural Decoding & Classification**: Developed single-trial decoding pipelines to predict behavioral intent and classify stimulus categories using linear classifiers and unsupervised clustering.
- **Deep Learning & Neural Dynamics**: Applied CNNs to model visual feature selectivity and RNNs for spike train reconstruction. Expert in estimating latent manifolds and inter-areal functional connectivity to characterize large-scale neural circuits using PyTorch.
- **Advanced Signal Processing**: Specialized in spike sorting, spectral analysis, isolating task-relevant signals from noisy data.
- **Statistical Inference & Validation**: Expert in rigorous hypothesis testing, including non-parametric bootstrapping and permutation tests for large-scale datasets.

Software & Data Engineering

- **Languages**: Python & MATLAB (Expert); C/C++ (Technical Maintenance & Debugging).
- **Experimental Infrastructure**: Maintained and optimized Python and C-based experiment control software for real-time stimulus generation and behavioral control.
- **Data Architecture & Pipelines**: Designed data structures and automated pipelines for TB-scale lab data management, transitioning raw acquisition files into structured, analysis-ready formats.
- Proficient in Git, Linux (Bash), and the Python scientific stack (NumPy, SciPy, Pandas, Matplotlib, PyTorch).

Research Experience

Washington National Biomedical Research Center, University of Washington **Seattle, WA**

Supervisors: Prof. Anitha Pasupathy and Prof. Wyeth Bair

Research Scientist | Jun 2025 – Present

- **PFC-V4 Feedback Dynamics**: Investigating prefrontal cortex modulation of V4 feature selectivity via inhibitory feedback mechanisms
- **Prospective Remapping**: Identifying stimulus-selective anticipatory signals in V4, modeling neural response adaptation during saccadic eye movements.

- **Computational Modeling of Visual Crowding**: Extending findings on visual crowding (*J. Neurosci.*, *2024*) to Artificial Neural Networks, comparing biological population dynamics with CNN architectures to identify shared constraints in object recognition

Acting Assistant Professor | Jan 2023 – May 2025
- **Functional Architecture**: Characterized mid-level visual cortex organization using multi-photon imaging and high-density electrophysiology (published in *J. Neurosci.*, *2026*).
- **High-Throughput Pipelines**: Developed Python processing pipelines for neural data acquisition and analysis.

Acting Instructor | Oct 2019 – Dec 2022
- **Neural Correlates of Crowding**: Demonstrated that visual crowding is driven by salience-based competitive mechanisms using NHP electrophysiology (published in *J. Neurosci.*, *2024*).
- **Object Recognition Framework**: Authored two review papers on the joint encoding of object shape and surface properties in the ventral visual pathway, and on the current understanding of primate area V4 function (published in *Curr. Opin. Neurobiol.*, *2019*; *Annu. Rev. Vis. Sci.*, *2020*)
- **Software Engineering**: Upgraded the lab's experimental control software from Python 2 to Python 3 to support modern high-performance libraries; refactored C-level hardware interfaces to integrate control for lasers and eye-tracking systems and optimized Bash scripts for automated system deployment.

Senior Fellow | Oct 2015 – Sep 2019
- **Texture & Shape Tuning**: Identified joint neural tuning for object geometry and surface texture; developed quantitative metrics for natural texture perception (published in *J. Neurosci.*, *2019*, *2022*).
- **Motion Processing**: Characterized the neural representation of object and surface motion using computational analysis of spike-train data (published in *Curr. Biol.*, *2023*).

University of California, Berkeley — Berkeley, CA

Supervisor: Prof. Ralph D. Freeman

Assistance Specialist / Graduate Student Researcher | Aug 2010 – Sep 2015
- **Binocular Integration**: Designed human psychophysics experiments to model how the visual cortex integrates signals across eyes under varying contrast conditions, demonstrating that binocular fusion is robust to substantial interocular differences (published in Eur. J. Neurosci., 2017).
- **Cortical Circuit Dynamics**: Conducted neurophysiological experiments to segregate activity of feedforward, feedback, and horizontal pathways in the visual cortex (published in Neuroscience, 2014).
- **Non-linear Dynamics**: Analyzed cortical neuron databases to quantify direction selectivity non-linearity across different laminae (published in Eur. J. Neurosci., 2016).
- **Neuromodulation (TMS)**: Investigated the effects of TMS on functional tuning properties of visual cortical neurons (published in Brain Stimul., 2015).

Seoul National University — Seoul, Korea

Supervisor: Prof. Choongkil Lee

Research Associate / Graduate Student Researcher | Mar 2006 – Jun 2010
- **Spatiotemporal Selectivity**: Developed MATLAB-based stimulus generation and acquisition systems to study V1 responses to sequential Gabor stimuli (published in PLoS One, 2012, 2015).
- **Psychophysics**: Led human psychophysics studies examining spatial localization errors in visual short-term memory. (published in KCBPA, 2014)

Education

Ph.D. in Vision Science, University of California, Berkeley, CA — Aug 2010 – Dec 2014

M.A. in Biological Psychology, Seoul National University, Korea — Mar 2006 – Aug 2008

B.A. in Psychology, Seoul National University, Korea — Mar 2000 – Feb 2006

Publications

Kim, T., & Pasupathy, A. (2024). Neural correlates of crowding in macaque area V4. *Journal of Neuroscience*, *44(24)*, *e2260232024*.

Bigelow, A. W.*, **Kim, T.***, Namima, T., Bair, W., & Pasupathy, A. (2023). Dissociation in neuronal encoding of object versus surface motion in the primate brain. *Current Biology*, *33(4)*, *711-719*. (*contributed equally)

Kim, T., Bair, W., & Pasupathy, A. (2022). Perceptual Texture Dimensions Modulate Neuronal Response Dynamics in Visual Cortical Area V4. *Journal of Neuroscience*, *42(4)*, *631-642*.

Pasupathy, A., Popovkina, D. V., & **Kim, T.** (2020). Visual functions of primate area V4. *Annual review of vision science*, *6*, *363-385*.

Pasupathy, A., **Kim, T.**, & Popovkina, D. V. (2019). Object shape and surface properties are jointly encoded in mid-level ventral visual cortex. *Current opinion in neurobiology*, *58*, *199-208*.

Kim, T., Bair, W., & Pasupathy, A. (2019). Neural coding for shape and texture in macaque area V4. *Journal of Neuroscience*, *39(24)*, *4760-4774*.

Kim, T., & Freeman, R. D. (2017). Binocular function during unequal monocular input. *European Journal of Neuroscience*, *45(4)*, *601-609*.

Kim, T., & Freeman, R. D. (2016). Direction selectivity of neurons in the visual cortex is non-linear and lamina-dependent. *European Journal of Neuroscience*, *43(10)*, *1389-1399*.

Kim, K., **Kim, T.**, Yoon, T., & Lee, C. (2015). Covariation between spike and LFP modulations revealed with focal and asynchronous stimulation of receptive field surround in monkey primary visual cortex. *PloS one*, *10(12)*, *e0144929*.

Kim, T., Allen, E. A., Pasley, B. N., & Freeman, R. D. (2015). Transcranial magnetic stimulation changes response selectivity of neurons in the visual cortex. *Brain stimulation*, *8(3)*, *613-623*.

Kim, E. Y., **Kim, T.**, & Lee, C. (2014). Repulsive bias in egocentric localization. *The Korean Journal of Cognitive and Biological Psychology*, *26(4)*, *295-316*.

Kim, T., & Freeman, R. D. (2014). Selective stimulation of neurons in visual cortex enables segregation of slow and fast connections. *Neuroscience*, *274*, *170-186*.

Kim, T., Kim, H. R., Kim, K., & Lee, C. (2012). Modulation of V1 spike response by temporal interval of spatiotemporal stimulus sequence. *PloS one*, *7(10)*, *e47543*.

Teaching Experiences

Graduate Student Instructor for **"Geometrical Optics"**	University of California, Berkeley, CA.	Fall 2010 – 2011
Teaching Assistant for **"Neuroscience"**	Seoul National University, Korea	Fall 2006 – 2009
Teaching Assistant for **"Biopsychology"**	Seoul National University, Korea	Spring 2007 – 2009

Extra-Curricular Activities

Military Service in Korea Army	Dec 2001 – Feb 2004

References

Available upon request