

Minjoon Kouh

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Drew University
36 Madison Avenue
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Professional Experiences

Drew University (Madison, NJ): *2009 – Present*
Associate Professor (Physics Department and Neuroscience Program)

pulseData (New York, NY): *2017 – Present*
Data Scientist

The Salk Institute for Biological Studies (La Jolla, CA): *2007 – 2009*
Post-doctoral Research Associate (Computational Neurobiology Laboratory)

California State University (San Marcos, CA): *Fall, 2008*
Adjunct Professor (Physics Department)

PeopleSoft, Inc. (Pleasanton, CA): *1999 – 2001*
Information Technology Consultant

Education

Massachusetts Institute of Technology: Ph.D. (2007) and B.S. (1997) in Physics
Ph.D. Thesis: *Toward a more biologically plausible model of object recognition.*
B.S. Thesis: *Arrays of quantum dots as semiconductors.*

University of California at Berkeley: M.S. in Physics (1999)

Publications

- M. Kouh. “Information maximization explains the sparseness of presynaptic neural response.” *Neural Comp.* 29 (2017).
- B. Hong, S. Weiner, M. Clancy, and M. Kouh. “The interference effect of concurrent working memory task on visual inhibitory control.” *Journal of Eye Movement Research.* 9(3):5 1-5 (2016).
- M. Kouh. “Whole Class Laboratories: More Examples.” *The Physics Teacher*, 56: 539-542 (2016).
- T. Sharpee, M. Kouh, and J. Reynolds. “Trade-off between curvature tuning and position invariance in visual area V4.” *Proc. Natl. Acad. Sci.* 110(28): 11618-11623 (2013).

- M. Kouh and R. Merz. “Light, Brain, and Action: An introductory, interdisciplinary course on optogenetics for undergraduate students.” *Journal of College Science Teaching*, 43(2): 60-64 (2013).
- M. Kouh, D. Holz, A. Kawam, and M. Lamont. “Wiimote experiments: Circular motion.” *The Physics Teacher*, 51: 146-148 (2013).
- M. Eickenberg, R. Rowekamp, M. Kouh, and T. Sharpee. “Characterizing responses of translation-invariant neurons to natural stimuli: Maximally informative invariant dimensions.” *Neural Comp.* 24(9): 2384-2421 (2012).
- A. Kawam and M. Kouh. “Wiimote experiments: 3D inclined plane problem for reinforcing vector concepts.” *The Physics Teacher*, 49: 508-509 (2011).
- M. Kouh and T. Sharpee. “Estimating linear-nonlinear models using Renyi divergences.” *Network*, 20(2): 49-68 (2009).
- M. Kouh and T. Poggio. “A canonical neural circuit for cortical nonlinear operations.” *Neural Comp.* 20(6): 1427-1451 (2008).
- T. Serre, G. Kreiman, M. Kouh, C. Cadieu, U. Knoblich and T. Poggio. “A quantitative theory of immediate visual recognition.” *Prog. Brain Research*, 165: 33-56 (2007).
- D. Zoccolan, M. Kouh, J. DiCarlo and T. Poggio. “Trade-off between object selectivity and tolerance in monkey inferotemporal cortex.” *J. Neurosci.*, 27(45): 12292-307 (2007).
- C. Cadieu, M. Kouh, A. Pasupathy, C. Connor, M. Riesenhuber and T. Poggio. “A model of V4 shape selectivity and invariance.” *J. Neurophys.*, 98(3): 1733-50 (2007).

Contributed Articles (non-peer-reviewed)

- M. Kouh. “A guide for an automated digital signage with a Raspberry Pi.” *American Physical Society Forum on Education Newsletter Spring Issue*: pg. 9-10 (2015).
- M. Kouh. “Learning selectivity and invariance with a spatiotemporal Hebbian plasticity.” [arXiv.org:1404.5373 \[q-bio.NC\]](https://arxiv.org/abs/1404.5373) (2014).
- M. Lamont and M. Kouh. “An intermediate-level physics laboratory: A system of two coupled oscillators with low-cost accelerometers.” [arXiv.org:1210.3694 \[physics.ed-ph\]](https://arxiv.org/abs/1210.3694) (2012). *American Physical Society Forum on Education Newsletter Spring Issue*: pg. 17-18 (2013).

Teaching

Drew University (Madison, NJ)

- PHYS-104: Physics in Modern Medicine
- PHYS-105: Building and Programming Robots
- PHYS-111, 112: Introductory Physics 1, 2
- PHYS-113, 114: General Physics Laboratory 1, 2
- PHYS-250: Modern Physics
- PHYS-321: Mathematical Physics
- PHYS-329: Special Topics in Physics on “Scientific Computing”
- PHYS-332: Thermal Physics
- PHYS-366 / NEURO-366: Computational Modeling of Neural Systems
- NEUR-270: Special Topics in Neuroscience on “New Breakthrough Research Technologies”
- NEUR-368: Theories about Vision
- NEUR-400: Capstone Seminar in Neuroscience

- CSCI-8: Dynamic Data in a Wired World
- Honors Seminar: “Light, Brain, Action! Optogenetic Technique in Neuroscience”
- Study-Aboard Program: Science and Engineering in S. Korea
 - “Building and Programming Robots” (2016 at Hannam University)
 - “Physics in Modern Medicine” (2018 at Kookmin University)
- First-Year Seminar:
 - “Computers and brains”
 - “What can the physical sciences and computer engineering tell us about the brain?”
 - “Physics and computing of the future”
 - “Great discoveries in modern science”
 - “Weapons of Math Destruction: Living with Algorithms”

California State University (San Marcos, CA)

- GES-100: Physical Science Around Us

NJ Governor's School in Sciences

- Team project in computer science: Machine learning in Python (2017, 2018)
- Team project in computer science: Image recognition algorithm (2015)
- Team project in cognitive science: Analysis of eye movements (2013, 2014)
- Team project in computational neuroscience (2011, 2012)

Research Experiences

Drew University (Madison, NJ): *2009 – Present*

- Investigates information-processing mechanisms and principles of the neural systems, using computational and theoretical methods.
- Studies neural plasticity, neural coding, and object recognition process in the brain.
- Conducts gaze-tracking experiments.
- Uses simple robotics to model the interaction between sensory and motor systems.
- Applies accelerometer technology to perform physics experiments.

pulseData (New York, NY): *2017 – Present*

- Analyzed health-care data and built predictive model using machine learning algorithms.

Salk Institute for Biological Studies (La Jolla, CA): *2007 – 2009*

Mentor: Prof. T. Sharpee

- Implemented information-theoretic algorithm for dimensionality reduction.
- Conducted extracellular electrophysiology experiments on primate visual cortical area V4, in collaboration with Reynolds’ laboratory.

MIT Center for Biological and Computational Learning (Cambridge, MA): *2001 – 2007*

Mentor: Prof. T. Poggio

- Developed multi-layer artificial neural network models for image recognition.
- Analyzed neural data from primate cortex (visual areas V1, V4 and IT) in collaboration with physiologists from MIT, Johns Hopkins University and Harvard Medical School.

Other Projects

- **Ford Research Laboratory** (Dearborn, MI): *Summers 1997 and 1998*
Investigated binding and catalytic interactions between metal surface and oxygen atoms, and optimized computational model of oxygen gas sensor, by solving a set of coupled differential equations.
- **MIT Center for Theoretical Physics** with Prof. L. Randall: *1996 – 1997*
Analyzed theoretical model of quantum dot array, by calculating dependence of energy bands on various parameters such as size and spacing of quantum-dots.
- **MIT Biology Department** with Prof. V. Ingram: *1995 – 1996*
Conducted voltage-clamp experiments, and investigated biophysical impact of beta-Amyloid peptides, implicated in Alzheimer's disease, on cultured neurons.

Work Experiences

State Street Associates (Cambridge, MA): *Summer, 2007*

- Developed Matlab-based software for collecting daily financial market data from Oracle database and web.
- Analyzed correlations between stock prices and proprietary market indices.
- Optimized software for simulating performance of asset allocation models.

PeopleSoft, Inc. (Pleasanton, CA): *1999 – 2001*

- Installed, customized, and integrated various components of enterprise e-business applications (HR, ERP, CRM, Employee Portal) for international clients (banking, insurance, consulting, and manufacturing firms).
- Worked with database (Oracle and SQL Server), web, and application servers on UNIX and Microsoft platforms.

Presentations

Talks

- “Tradeoffs in neural computation” Korean Advanced Institute of Science and Technology (Daejeon, Korea. 2018).
- “Computations in the Brain” Kookmin University (Seoul, Korea. 2016), NJ Governor's School in the Sciences at Drew University (Madison, NJ. 2016).
- “Human vs. artificial intelligence in the game of Go” RISE Talk Series at Drew University (Madison, NJ. 2016).
- “Whole class laboratories: More examples.” NJEdge Faculty Showcase at Stevens Institute of Technology (Hoboken, NJ. 2016).
- “Deep learning algorithm.” RISE Talk Series at Drew University (Madison, NJ. 2015).
- “How the brain may be processing visual information.” Physics & Astronomy Seminar at Colgate University (Hamilton, NY. 2014).
- “Characterizing responses of translation-invariant neurons to natural stimuli.” Perceptual Science Talk Series at Rutgers University (Piscataway, NJ. 2013).
- “Learning about what drives a neuron to spike.” Sentience Undergraduate Neuroscience Symposium at Drew University (Madison, NJ. 2011).

- “Computational neuroscience course in a liberal-arts college setting.” American Association of Physics Teachers (Jacksonville, FL. 2011).
- “Computations in the brains: Recognizing patterns.” NJ Governor’s School in the Sciences at Drew University (Madison, NJ. 2010).
- “Computations in the visual cortex.” Frontiers in Science Seminar at California State University (San Marcos, CA. 2008).
- “Toward a more biologically plausible model of object recognition.” Sandia National Laboratory (Albuquerque, NM. 2007), Princeton University (Princeton, NJ. 2007), Albert Einstein College of Medicine (Bronx, NY. 2007).
- “Object recognition in clutter: selectivity and invariance properties in a model of object recognition.” McGovern Institute Retreat (New Port, RI. 2006), NIH-Conte Meeting (Cambridge, MA. 2006).

Posters

- M. Levin, B. Hill, E. Lee, J. Son, M. Kouh, and S Demaria. “Utilizing high-resolution patient data to prevent avoidable harm in the Post-Anesthesia Care Unit.” 28th Health Care Risk Management Conference (NY, NY. 2018).
- M. Kouh. “What scientific computing skills do science students need?” and “Whole class laboratories: More examples.” NJEdge Annual Conference (Princeton, NJ. 2015).
- M. Kouh. “Learning selectivity and invariance through spatiotemporal Hebbian plasticity.” Gordon Research Conference on Neuroethology (West Dover, VT. 2013).
- M. Kouh. “Interdisciplinary approaches in neuroscience research.” Council on Undergraduate Research Conference (The College of New Jersey, Ewing, NJ. 2012).
- M. Lamont and M. Kouh. “Wiimote experiments: A system of two coupled oscillators.” Annual Meeting of New Jersey Academy of Science (Seton Hall University, South Orange, NJ. 2012).
- M. Kouh, M. Eickenberg, R. Rowekamp, and T. Sharpee. “Analyzing neural feature selectivity and invariance properties by finding maximally informative invariant dimensions.” Gordon Research Conference on Eye Movements (Biddeford, ME. 2011).
- A. Kawam and M. Kouh. “Wiimote experiments for reinforcing vector concepts in introductory physics.” American Association of Physics Teachers (Jacksonville, FL. 2011).
- C. Cadieu, M. Kouh, M. Riesenhuber and T. Poggio. “Shape Representation in V4: Investigating Position-Specific Tuning for Boundary Conformation with the Standard Model of Object Recognition.” Vision Sciences Society (Sarasota, FL. 2005).
- M. Kouh and T. Poggio. “Gain Control Circuits Underlie Tuning of Cortical Neurons.” COSYNE (Salt Lake City, UT. 2005).
- M. Kouh, C. Cadieu, M. Riesenhuber and T. Poggio. “Investigating Shape Representation in V4 with a Computational Model.” Society for Neuroscience (San Diego, CA. 2004).

Workshops

NEURON Workshop at UCSD (San Diego, CA): *Summer, 2011*
 “NEURON Simulation Environment”

Marine Biological Laboratory (Woods Hole, MA): *Summer, 2007*
 “Methods in Computational Neuroscience”

Santa Fe Institute (Santa Fe, NM): *Summer, 2003*

“From Neuron to Network: Biologically-based functional models”

PROMYS at Boston University (Boston, MA): *Summers, 1991 – 1993*

“Number Theory”

Services at Drew University

Physics Department (Chair): *2018 - Present*

Academic Computing Advisory Committee: *2014-2016, 2016-2018 (Chair)*

Global Education Faculty Advisory Committee: *2016-2018 (Interim Chair for Spring, 2017)*