

Alexander Belsten

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belsten.github.io

Warren Hall RM. 275, Berkeley, CA 94720

EDUCATION

- **University of California, Berkeley** Berkeley, CA
Ph.D. Candidate in Vision Science; Advisor: Dr. Bruno Olshausen *August 2021 - Present*
- **Rensselaer Polytechnic Institute** Troy, NY
B.S. Computer and Systems Engineering; GPA: 3.78 *August 2016 - December 2020*

SKILLS & INTERESTS

- **Interests:** Computational neuroscience, theoretical neuroscience, vision, color, machine learning
- **Technologies and Frameworks:** C/C++, Python, MATLAB, PyTorch, Tensorflow, L^AT_EX, git, openCV

WORK & RESEARCH EXPERIENCE

- **Redwood Center for Theoretical Neuroscience** Berkeley, CA
Graduate researcher *August 2021 - Present*
 - Building computational models to understand early visual processing with a focus on color.
 - Advisor: Dr. Bruno Olshausen
- **Washington University in St. Louis, Department of Neurosurgery** St. Louis, MO
Research Assistant; Systems Engineer *January 2021 - August 2021*
 - Developed electrophysiology research technologies with a focus on intracranial recording and stimulation.
 - List of contributions: <https://belsten.github.io/research/#contributions-to-bci2000>
 - Advisor: Dr. Peter Brunner
- **Intelligent Structural Systems Laboratory (ISSL)** Troy, NY
Research Assistant *May 2020 - July 2021*
 - Applied time-series deep learning techniques to identify flight states of fly-by-feel aircraft.
 - Advisor: Dr. Fotis Kopsaftopoulos
- **National Center for Adaptive Neurotechnologies (NCAN)** Albany, NY
Research Assistant *May 2018 - August 2021*
 - Improved and maintained BCI2000, a general purpose software for brain-computer interfacing.
 - Advisors: Drs. Gerwin Schalk, Peter Brunner

PAPERS

2025:

- **Sparse coding of chromatic natural images replicates unique hues and universals in color naming**
A. Belsten, P. Frady, B. A. Olshausen *In preperation*, 2025
- **Emergence of strategic cone weighting from efficient coding of spatiochromatic natural images**
A. Belsten, B. A. Olshausen *In review*, 2025

2024:

- **A Novel Theta-Controlled Vibrotactile Brain-Computer Interface To Treat Chronic Pain: A Pilot Study**
P. Demarest, N. Rustamov, J. Swift, T. Xie, M. Adamek, H. Cho, E. Wilson, Z. Han, **A. Belsten**, N. Luczak, P. Brunner, S. Haroutounian, E. C. Leuthardt, *Scientific Reports*, 2024

2022:

- **Cross-Frequency Coupling Increases Memory Capacity in Oscillatory Neural Networks**
C. Bybee, **A. Belsten**, F. T. Sommer, *arxiv*, 2022

- **Towards a Fully Implantable Ecosystem for Adaptive Neuromodulation in Humans: Preliminary Experience with the CorTec BrainInterchange Device in a Canine Model**
G. Schalk, S. Worrell, F. Mivalt, **A. Belsten**, I. Kim, J. M. Morris, D. Hermes, B. T. Klassen, N. Staff, S. Messina, T. Kaufmann, J. Rickert, P. Brunner, G. Worrell and K. J. Miller, *Frontiers in Neuroscience*, 2022

2021:

- **Data-Driven Flight State Identification via Time-Series-Informed Features and Convolutional Neural Network**
A. Belsten, F. Kopsaftopoulos, *AIAA AVIATION Forum*, 2021

2020:

- **Hardware Abstraction to Facilitate the Dissemination and Validation of Electrophysiological Experiments**
A. Belsten, M. Adamek, P. Brunner, *IEEE Engineering in Medicine and Biology Society Conference*, 2020

POSTERS[†] & INVITED TALKS[‡] Presenting Author[§]

2025:

- **Sparse coding of chromatic natural images recovers universals in color naming and unique hues^{†§}**
Vision Sciences Society meeting (VSS)
- **Efficient coding of chromatic natural images reveals unique hues^{†§}**
Computational and Systems Neuroscience (COSYNE)

2024:

- **Emergence of Strategic Cone Sampling from Efficient Coding of Spatiochromatic Natural Images^{†§}**
International Colour Vision Society Meeting (ICVS)

2023:

- **A Model of Cortical Error-correction from Noisy Retinal Ganglion Cell Activity^{†§}**
Society for Neuroscience (SfN)
- **A General-purpose Software Platform for Closed-loop Neuromodulation[†]**
Society for Neuroscience (SfN)

2022:

- **Image Reconstruction from Population Retinal Ganglion Cell Response^{†§}**
Bay Area Vision Research Day (BAVRD)
- **Cross-Frequency Coupling Increases Memory Capacity in Oscillatory Neural Networks[†]**
Computational and Systems Neuroscience (COSYNE)

2021:

- **New Depths in Brain-Computer Interfacing[†]**
Society for Neuroscience (SfN)
- **BIC-BCI2000: A General-Purpose Hardware and Software Platform for Chronic Intracranial Neuromodulation^{†§}**
Society for Neuroscience (SfN)
- **CorTec Brain Interchange in Freely Behaving Canine[†]**
Society for Neuroscience (SfN)
- **BCI2000: Software Resource for Adaptive Neurotechnology Research[†]**
NIH BRAIN Initiative

2020:

- **Overcoming Heterogeneous Hardware to Facilitate Dissemination and Validation of Electrophysiological Experiments^{†§}**
Society for Neuroscience (SfN)
- **Evaluating the Closed-Loop Performance of Clinical Electrophysiology Recording Systems using BCI2000[†]**
Society for Neuroscience (SfN)

GRANTS & AWARDS

- **National Eye Institute Early Career Scientist Travel Grant - 2025**

Awarded to support travel to Vision Sciences Society meeting, St. Pete Beach, Florida

LEADERSHIP & ACTIVITIES

- **Sparse Coding Repository**

Active contributor to repository of performant reference implementations of sparse coding algorithms (www.github.com/rctn/sparsecoding).

- **Bay Area Vision Research Day (BAVRD) Conference - 2022 Speaker Committee**

Organized conference and selected researchers to give talks/poster presentations.

- **Berkeley Vision Science Student Government - 2022, 2023 Social Chair**

- **IEEE-HKN - Beta Nu Chapter, Honor Society for Electrical and Computer Engineers**

2019 President, 2020 Webmaster

TEACHING

- **Neural Computation (Berkeley VS265) graduate student instructor** - Fall 2022
- **Digital Signal Processing (Rensselaer ECSE4530) undergraduate TA** - Fall 2020
- **Data Structures (Rensselaer CSCI1200) undergraduate mentor** - Spring, Fall 2018
- **Foundations of Computer Science (Rensselaer CSCI2200) undergraduate mentor** - Fall 2018

ACADEMIC HONORS

- **Rensselaer Dean's Honor List** - 2016-2020 (8 semesters)
- **Rensselaer Leadership Award** - 2016: Given in recognition of an outstanding record of academic and personal achievements, a strong commitment to excellence, and illustration of intellectual curiosity.