Alexander Belsten

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belsten.github.io

EDUCATION

University of California, Berkeley — Berkeley, CA
Ph.D. Candidate in Vision Science advised by Dr. Bruno A. 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:
Theoretical neuroscience, vision science, machine learning.

Technologies and Frameworks:
C/C++, Python, MATLAB, PyTorch, TensorFlow, LaTeX, Git, OpenCV.

WORK & RESEARCH EXPERIENCE

Redwood Center for Theoretical Neuroscience — Berkeley, CA
Graduate student researcher — August 2021–Present

- Building computational models of early visual processing (retina and V1) with a focus on color.

Washington University in St. Louis, Department of Neurosurgery — St. Louis, MO
Research assistant & systems engineer advised by Dr. Peter Brunner — 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

Intelligent Structural Systems Laboratory — Troy, NY
Research assistant advised by Dr. Fotis Kopsaftopoulos — May 2020–July 2021

- Applied time-series deep learning techniques to identify flight states of fly-by-feel aircraft.

National Center for Adaptive Neurotechnologies — Albany, NY
Research assistant advised by Drs. Gerwin Schalk and Peter Brunner — May 2018–August 2021

- Improved and maintained BCI2000, a general-purpose software for brain-computer interfacing.

PAPERS

2025

- Emergence of Unique Hues from Sparse Coding of Color in Natural Scenes
  A. Belsten, E. P. Frady, B. A. Olshausen, *In preparation*

- Emergence of Strategic Cone Weighting from Efficient Coding of Spatiochromatic Natural Images
  A. Belsten, B. A. Olshausen, *JOSA A*

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*

2022

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

- 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*

2021

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

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*

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

2025

- A Functional Model of V1 Horizontal Connections Based on Denoising Structure in Natural Images[†§]
  Society for Neuroscience (SfN)

- Ocular Drift Transforms Retinal Image Statistics and Spatiotemporal Receptive Field Dynamics[†]
  Society for Neuroscience (SfN)

- Emergence of Unique Hues from Sparse Coding of Color in Natural Scenes[‡§]
  Optica Webinar: Color Data Blast for Early-Career Researchers

- 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 Color 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 in St. Pete Beach, Florida.	
Rensselaer Leadership Award	2016
In recognition of an outstanding record of academic and personal achievements.	

Leadership & Activities

Sparse Coding Repository	2022–Present
Active contributor (www.github.com/rctn/sparsecoding)	
Berkeley Vision Science Student Government	2022–2023
Speaker Committee	
Bay Area Vision Research Day (BAVRD) Conference	2022
Social Chair	
IEEE-HKN (Beta Nu Chapter) – Electrical & Computer Engineering Honor Society	2019–2020
President (2019); Webmaster (2020)	

Teaching

Neural Computation (VS265)	UC Berkeley
Graduate student instructor	Fall 2022
Digital Signal Processing (ECSE4530)	Rensselaer Polytechnic
Undergraduate TA	Fall 2020
Data Structures (CSCI1200)	Rensselaer Polytechnic
Undergraduate mentor	Spring, Fall 2018
Foundations of Computer Science (CSCI2200)	Rensselaer Polytechnic
Undergraduate mentor	Fall 2018

Academic Honors

Rensselaer Dean's Honor List	2016-2020 (8 semesters)