Alexander Belsten

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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, LaTeX, 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 †First Author

- **Sparse coding of chromatic natural images replicates opponent-color theory and results of World Color Survery**
  A. Belsten†, P. Frady, B. A. Olshausen *In preperation*, 2025
- **Emergence of biased cone sampling from efficient coding of spatiochromatic natural images**
  A. Belsten†, B. A. Olshausen *In review*, 2025
- **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
- **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
- **Data-Driven Flight State Identification via Time-Series-Informed Features and Convolutional Neural Network**
  A. Belsten†, F. Kopsaftopoulos, *AIAA AVIATION Forum*, 2021
- **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 †Presenting Author

- **Efficient coding of chromatic natural images reveals unique hues**†
  Computational and Systems Neuroscience (COSYNE) 2025
- **Emergence of Strategic Cone Sampling from Efficient Coding of Spatiochromatic Natural Images**†
  International Colour Vision Society Meeting (ICVS) 2024
- **A Model of Cortical Error-correction from Noisy Retinal Ganglion Cell Activity**†
  Society for Neuroscience (SfN) 2023
- **A General-purpose Software Platform for Closed-loop Neuromodulation**
  Society for Neuroscience (SfN) 2023
- **Image Reconstruction from Population Retinal Ganglion Cell Response**†
  Bay Area Vision Research Day (BAVRD) 2022
- **Cross-Frequency Coupling Increases Memory Capacity in Oscillatory Neural Networks**
  Computational and Systems Neuroscience (COSYNE) 2022
- **New Depths in Brain-Computer Interfacing**
  Society for Neuroscience (SfN) 2021
- **BIC-BCI2000: A General-Purpose Hardware and Software Platform for Chronic Intracranial Neuromodulation**†
  Society for Neuroscience (SfN) 2021
- **CorTec Brain Interchange in Freely Behaving Canine**
  Society for Neuroscience (SfN) 2021
- **BCI2000: Software Resource for Adaptive Neurotechnology Research**
  NIH BRAIN Initiative 2021
- **Overcoming Heterogeneous Hardware to Facilitate Dissemination and Validation of Electrophysiological Experiments**†
  Society for Neuroscience (SfN) 2020
- **Evaluating the Closed-Loop Performance of Clinical Electrophysiology Recording Systems using BCI2000**
  Society for Neuroscience (SfN) 2020

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.