Alexander Belsten

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belsten.github.io

Education

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

Skills & Interests

- **Programming**: C/C++, Python, MATLAB
- **Technologies and Frameworks**: Tensorflow, LTspice, Visual Studio, LaTeX, git, openCV, CMake
- **Interests**: Neuroscience, Machine Learning, Statistical Modeling, Signal Processing

Work & Research Experience

- **National Center for Adaptive Neurotechnologies** — Albany, NY
  Research Assistant — *May 2018 - Present*
  - Improved and maintained BCI2000, a general purpose software for brain-computer interfacing.
  - VA Research Without Compensation (WOC) appointee.
- **RPI, Intelligent Structural Systems Laboratory (ISSL)** — Troy, NY
  Research Assistant — *May 2020 - Present*
  - Applied time series deep learning techniques to identify flight states of fly-by-feel aircraft.
- **Washington University in St. Louis, Department of Neurosurgery** — St. Louis, MO
  Research Assistant; Systems Engineer — *January 2021 - Present*
  - Developed intracranial electrophysiology research technologies. Advisor: Dr. Peter Brunner.

Projects

- **EGI GTEN for Non-Invasive Closed-Loop Stimulation with BCI2000** - Integrated the GTEN EEG/transcranial direct stimulation (tDCS) device with BCI2000, enabling more accessible tDCS research.
- **g.tec g.Estim for Invasive Closed-Loop Cortical Stimulation with BCI2000** - Integrated g.tec cortical stimulator and switching unit, to allow for closed-loop stimulation with automated switching between recording and stimulation channels. Data analysis done to characterize stimulation and switching latency.
- **Fully-Implantable Wireless CNS Device for Laboratory Animals for BCI2000** - Integrated telemetry-based CNS monitor and stimulator for closed loop interaction in small laboratory animals.
- **ActiCHamp Plus Amplifier Integration with BCI2000** - Added support for BCI200 using amplifier's C++ API. Final integration achieved 13 ms latency.
- **Audio and Video Synchronization System for BCI2000** - Aligned biosignals, audio and video data by accounting for latency with OpenCV and PortAudio. Added support to record from multiple webcams.
- **Branched CNN for Flight State Identification** - Designed and implemented a branched, one dimensional CNN for flight state identification. I identified time-series transformations to serve as features, and was able to achieve 90% accuracy on test data set.
- **Deep Neural Network for Handwritten Digit Classification** - Implemented 2-hidden layer neural network for classification of MNIST data set. Exclusively used `numpy` python library to do stochastic gradient descent via backpropagation. Achieved 70% accuracy on test data set.
- **CNN/RNN for UCF11 Video Action Classification** - Implemented CNN for spacial feature identification and RNN for temporal feature identification to do multi-class classification (11 classes) on 30 frame video sequences. Achieved accuracy of 1.0 on training data (N=5,800) and 0.974 on testing data (N=1,472).

Publications †First Author

- A. Belsten†, M. Adamek, P. Brunner, "Hardware Abstraction to Facilitate the Dissemination and Validation of Electrophysiological Experiments." 2020 IEEE Engineering in Medicine and Biology Society Conference
- A. Belsten†, F. Kopsaftopoulos, "Data-Driven Flight State Identification via Time-Series-Informed Features and Convolutional Neural Network." 2021 AIAA AVIATION Conference

Honors

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

Posters and Presentations †Presenting Author

- **2021 BCI2000 Summer Course**
  BCI2000 - Interacting with Peripheral Devices
- **NIH BRAIN Initiative 2021**
  BCI2000: Software Resource for Adaptive Neurotechnology Research
- **Society for Neuroscience (SfN) 2021**
  Overcoming Heterogeneous Hardware to Facilitate Dissemination and Validation of Electrophysiological Experiments†
- **Society for Neuroscience (SfN) 2021**
  Evaluating the Closed-Loop Performance of Clinical Electrophysiology Recording Systems using BCI2000
- **Discussed Framework of BCI2000** - Rensselaer Center for Open Source - Fall 2018

Leadership & Activities

- **HKN - Beta Nu, Honor Society for Electrical and Computer Engineers** - 2019 President - 2020 Webmaster
- **Rensselaer Outing Club Wall Leader** - Organize and run climbing wall hours for Rensselaer community.
- **Troy Bike Rescue** - Assist the local Troy, NY community repair their bicycles.
- **Member of Troy's Tech Valley Center of Gravity** - Woodworking and Machining Projects.

Teaching

- **Undergraduate TA for Digital Signal Processing (ECSE 4530)** - Fall 2020
- **ALAC Mentor for Data Structures** - Spring, Fall 2018
- **ALAC Mentor for Foundations of Computer Science** - Fall 2018