

# JOSHUA A. BOWREN

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## EDUCATION

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### University of Miami

PhD. in Computer Science

Overall GPA: 3.928

*December 2022*

### University of Central Florida

B.S. in Computer Science

Minor in Mathematics

Overall GPA: 3.94

Summa Cum Laude

*May 2018*

## EXPERIENCE

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### Aventusoft

*Machine Learning Engineer*

January 2023 – June 2024

- Main Product: the HEMOTAG, an R&D medical device for assessing cardiac function based on vibrations and electrical activity.
- Trained a convolutional neural network for ECG classification.
- Developed a deep learning signal processing library for processing ECG and SCG signals.

### University of Miami

*Research Assistant*

June 2018 – December 2022

- Advisor: Dr. Odelia Schwartz
- Developed a custom vision model similar to a convolutional neural network based on sparse coding principles.
- Trained Alexnet to reproduce results similar to that of Krizhevsky et al. (2012) and made extensions.
- Investigated sparse coding and ICA as a final V2-like stage in a hierarchical vision model.

### Princeton Neuroscience Institute, Princeton University

*Research Intern*

June 2017 – August 2017

- Advisor: Dr. Jonathan Pillow
- Explored hierarchical sparse coding (Karklin and Lewicki, 2003) capabilities and issues when performed on natural image data.
- Explored non-negative sparse coding.

### University of Central Florida

*Research Assistant*

June 2014 – May 2017

- Advisor: Dr. Kenneth Stanley
- Developed agent simulator and a Real-Time Autoencoder-Augmented Hebbian Network (RAAHN) implementation.
- Found RAAHN to perform better with a novelty-based history buffer.
- Gave oral presentation at ALIFE XV on RAAHN with the novelty-based history buffer.

## PUBLICATIONS

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Bowren, J. (2022) A Sparse Coding Theoretical Framework for Neural Networks. University of Miami.

Bowren, J. (2021) A Sparse Coding Interpretation of Neural Networks. arXiv.

Joshua Bowren, Luis Sanchez-Giraldo, Odelia Schwartz; Inference via Sparse Coding in a Hierarchical Vision Model. Journal of Vision 2022;22(2):19. doi: <https://doi.org/10.1167/jov.22.2.19>.

Bowren J.A., Pugh J.K., and Stanley K.O. (2016). Fully Autonomous Real-Time Autoencoder-Augmented Hebbian Learning through the Collection of Novel Experiences. In Proceedings of the Fifteenth International Conference on the Synthesis and Simulation of Living Systems (ALIFE XV).

## TECHNICAL EXPERIENCE

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<b>Methods</b>	Machine Learning, Deep Learning, Computer Vision, Signal Processing
<b>Programming Languages</b>	C/C++, Python, Java, and C#
<b>APIs and Frameworks</b>	NumPy, Matplotlib, Tensorflow
<b>Models</b>	Linear Regression, Logistic Regression, MLPs, SVMs, K-Means, GMMs, PCA, ICA, Sparse Coding, CNNs, Cross Validation, ROC-AUC Analysis
<b>Misc</b>	GNU/Linux, Git

## SOFTWARE PROJECTS

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**sparsecoding** git: <https://github.com/jbowren/sparsecoding>

- A sparse coding implementation in C++ with OpenCV using iterative soft thresholding (ISTA) to infer sparse coefficients.

**alexnet-custom** git: <https://github.com/jbowren/alexnet-custom>

- Custom alexnet model in python with Tensorflow and Keras for training and testing with ImageNet.

**raahnsimulation** git: <https://gitlab.com/jbowren/raahnsimulation>

- A simulator for conducting research with the Real-time Autoencoder-Augmented Hebbian Network (RAAHN) Algorithm. Written in C# with GTK#.

**libraahn** git: <https://gitlab.com/jbowren/libraahn>

- A RAAHN implementation written in C#.

## FELLOWSHIPS

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**National Science Foundation Graduate Research Fellowship** 2018

- 2000 applicants selected from a pool of 12000