AIWEN XU

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EDUCATION

University of California, Santa Barbara 09/2018 - Present
Ph.D. Candidate in Computer Science GPA: 4.00/4.00
Expected graduation in 06/2024

New York University Shanghai 09/2014 - 05/2018
B.S. in Computer Science (with honors), B.S. in Mathematics GPA: 3.96/4.00

PUBLICATIONS

Aiwen Xu, Yuchen Hou, Cris M. Niell, Michael Beyeler. Multimodal Deep Learning Model Unveils Behavioral Dynamics of V1 Activity in Freely Moving Mice. *NeurIPS 2023: Thirty-seventh Conference on Neural Information Processing Systems.*

Aiwen Xu, Michael Beyeler. Retinal ganglion cells undergo cell type—specific functional changes in a computational model of cone-mediated retinal degeneration. *Frontiers in Neuroscience*, 2023.

Nicole Han, Sudhanshu Srivastava, **Aiwen Xu**, Devi Klein, Michael Beyeler. Deep learning–based scene simplification for bionic vision. *AHs '21: Augmented Humans International Conference*, February 22-24, 2021, online. ACM, New York, NY, USA, 10 pages. **Honorable mention**.

Yi Ding, Brandon Huynh, **Aiwen Xu**, Tom Bullock, Hubert Cecotti, Matthew Turk, Barry Giesbrecht, Tobias Höllerer. Multimodal Classification of EEG During Physical Activity. *ICMI '19: 2019 International Conference on Multimodal Interaction.*

Vrishab Krishna, Yi Ding, **Aiwen Xu**, Tobias Höllerer. Multimodal Biometric Authentication for VR/AR using EEG and Eye Tracking. *ICMI '19: Adjunct of the 2019 International Conference on Multimodal Interaction.*

Ke Xu, Shunan Guo, Nan Cao, David Gotz, **Aiwen Xu**, Huamin Qu, Zhenjie Yao, Yixin Chen. ECGLens: Interactive Visual Exploration of Large Scale ECG Data for Arrhythmia Detection. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 2018.* **Honorable mention**.

CONFERENCE ABSTRACTS

Aiwen Xu, Michael Beyeler. A biophysically detailed model of retinal degeneration. *COSYNE 2023: Computational and Systems Neuroscience.*

Yuchen Hou, **Aiwen Xu**, Dylan Martins, Amirali Vahid, Elliott Abe, Cristopher Niell, Michael Beyeler. Retinal scene statistics for freely moving mice. *COSYNE 2023: Computational and Systems Neuroscience*

Aiwen Xu, Nicole Han, Sudhanshu Srivastava, Devi Klein, Michael Beyeler. Enhancing simulated prosthetic vision with deep learning–based scene simplification strategies. *Vision Sciences Society 2021.*

WORK EXPERIENCE

Google 06/2023 - 09/2023
Software Engineering Intern

· Implemented recitation-based dynamic few-shot prompting in Bard, an AI chat tool based on large language models (PaLM 2)
· Developed a dynamic few-shot prompting recipe in Bard via retrieving examples similar to the current user query from the supervised training mixture, based on cosine similarity of T5 sentence embeddings
· Evaluated Bard performance in different pillars (creativity, factuality, coding, reasoning) and settings (supervised finetuning, retrieval-based few-shot prompting, and a mixture of both)
· Demonstrated that the performance enhancement due to retrieval-based few-shot prompting was strongly correlated with that due to supervised finetuning via automatic side-by-side evaluation

Google 06/2022 - 09/2022
Software Engineering Intern

· Increased the top-1 accuracy of the Universal Vision Transformer (UViT) on ImageNet from 80% to 82% via hyperparameter tuning and distillation
· Reduced the latency of UViT by 15% by identifying a performance bottleneck and reimplementing the multi-head attention layer to remove unnecessary transposes in Keras and Tensorflow
· Performed neural architecture search and quantization to further reduce the latency of the model by 54% compared to the baseline while maintaining similar accuracy

RESEARCH EXPERIENCE

Multimodal Deep Learning Model of V1 Neural Data from Freely Moving Mice 02/2023 - 05/2023
Goal: To build a state-of-the-art deep learning model of freely moving mouse V1 neural activity

- Proposed and implemented in PyTorch a novel deep-learning multimodal model of mouse V1 activity, whose performance surpassed the previous state-of-the-art model by 25% on average in terms of cross correlation
- Analyzed the model with saliency maps to demonstrate the explainability and reveal the widespread presence of behavioral dynamics in mouse V1 activity
- Computed most exciting stimuli using gradient ascent to produce a diverse set of visual receptive fields in mouse V1

A Computational and Spiking Model of the Retina 09/2020 - 12/2022
Goal: To predict retinal prostheses' interaction with the retina and their performance throughout retinal degeneration

- Implemented a detailed 3-dimensional network-level model of the retina (including 11138 neurons from 9 different cell types modeled by dynamical systems) using Python, brian2 and brian2genn
- Introduced anatomical and neurophysiological changes due to retinal degenration to the model systematically
- Fitted generalized linear models in PyTorch to the model retinal ganglion cells to visualize the degradation of the spatiotemporal receptive fields throughout retinal degeneration

Scene Simplification with Deep Learning for Retinal Prostheses 04/2020 - 12/2020
Goal: To evaluate the effectiveness of deep learning and computer vision applications to retinal prostheses

- Created a scene simplification algorithm combining semantic segmentation (Mask-RCNN) and depth cues (CNN-based monocular depth estimation) using PyTorch, scikit-image and OpenCV
- Demonstrated that semantic segmentation could support outdoor scene understanding for retinal prosthesis users significantly better than saliency or depth ($p < 0.001$) via a user study with virtual patients

Deep Learning Classification of EEG 01/2019 - 05/2019
Goal: To categorize different EEG signals when they are mixed with noise resulted from physical activities

- Contributed to the design of a novel multimodal deep neural network for EEG classification under physical activity in PyTorch, which achieved the state-of-the-art accuracy (up to 88.13%) compared to other deep learning methods
- Analyzed the classification performance of the neural network with precision, recall and confusion matrix

AWARDS

NeurIPS 2023 Scholar Award
COSYNE 2023 Presenter's Travel Grant

MENTORSHIP EXPERIENCE

Research Mentorship Program, UC Santa Barbara 05/2021-07/2021
Research Mentor

- Mentored four high school students to conduct research on computer vision and computational modeling applied to retinal prosthesis

Bionic Vision Lab, UC Santa Barbara 05/2021-07/2021
Graduate Student Mentor

- Mentored two undergraduate students to analyze the optic flow of the simulated artificial vision generated by epiretinal implants
- Mentored one undergraduate students to apply computer vision techniques such as dynamic scene targeting to simplify images and videos to enhance the experience of retinal prostheses

LEADERSHIP EXPERIENCE

Women in Computer Science, UC Santa Barbara 01/2019 - 12/2019
Co-president

- Provided support to women in computer science by organizing monthly coffee hour
- Collaborated with career services to connect affiliated members to professional opportunities
- Initiated outreach to prospective women Ph.D. students during campus visit

Computer Science Graduate Admissions Committee, UC Santa Barbara 09/2018 - 05/2019
Graduate Student Representative

- Prescreened 72 applicants and interviewed 1 applicant to the computer science Ph.D. program