

# Caleb Jones Shibu

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## Machine Learning - Software Engineer

*Python • Pytorch • TensorFlow • OpenCV • LLM*

### EXPERIENCE

- **Page Technologies** Boulder, CO  
*Founding Software Engineer* Sep 2025 – Present
  - **AI Product Development:** Design, implement, and deploy end-to-end AI solutions, integrating modern ML/DL models with scalable cloud-based APIs and user interfaces.
  - **Firmware Development:** Develop embedded firmware in C to implement MQTT-based AWS IoT API communication, enabling secure publish/subscribe messaging between on-device applications and cloud services.
- **Computer Connection Wisconsin** Reedsburg, WI  
*Web developer (LLM Engineer)* July 2025 – Present
  - **Web Maintenance:** Maintained and updated multiple CCWIS websites.
  - **RAG Chatbot:** Developed and deployed a CCWIS chatbot to provide customer tech support, with integrated human-agent escalation and a ticket-based support system.
- **Allen Institute** Seattle, WA  
*Software Engineer II (Machine Learning)* March 2024 – March 2025
  - **Cellpose:** Improved Cellpose model performance by 22% (AUC-ROC) for real-time neuron segmentation by implementing PyTorch-based transfer learning, resulting in automated voltage imaging analysis and reduced manual annotation time by 2 hours per week.
  - **iGluSnFR Simulation Pipeline:** Developed a simulation pipeline for iGluSnFR-expressing dendrites, optimizing 12+ parameters to replicate microscope imaging conditions, enabling ground-truth validation of motion correction algorithms.
  - **iGluSnFR Motion Correction:** Engineered a motion correction pipeline for dendritic imaging that maintained subcellular tracking accuracy during extreme motion, outperforming existing methods like Suite2p, CaImAn, and PatchWarp.
  - **iGluSnFR Source Extraction:** Contributed to an OpenCV-based super-resolution microscopy source extraction pipeline to identify synapses within dendrites, advancing iGluSnFR indicator data analysis techniques.
  - **iGluSnFR Image Processing Methods:** Co-authored an upcoming paper detailing novel image processing methods for iGluSnFR indicator data analysis.
- **Biotronics** Ames, IA  
*Machine Learning Engineer* Jan 2024 – Feb 2024
  - **ML Model Explainability:** Enhanced ResNet-50 model interpretability for livestock fat prediction by integrating SHAP (SHapley Additive exPlanations) and Grad-CAM, improving stakeholder trust in predictions by quantifying feature importance.
- **University of Arizona** Tucson, AZ  
*Graduate Research Assistant* Aug 2021 – Dec 2023
  - **Baseline Task:** Developed a PyGame-based finger-tapping and imaging rating application for the baseline task in the Theory of Mind Computer Architecture for Teams (ToMCAT) project.
  - **Data Acquisition:** Built ETL pipelines for acquiring and preprocessing Eye-tracking, fNIRS, and EEG data from over 100 subjects.
  - **Real-Time Physio Visualization:** Developed a PyQt5 tool to plot EEG and fNIRS signals multicasted over network using LSL in real-time.
  - **Data Conversion and Labeling:** Automated conversion of XDF files (EEG, fNIRS, Eye-tracking) into labeled CSV files; implemented channel quality assessment and motion artifact filtering for EEG and fNIRS signals, streamlining analysis preparation.
  - **Conference Paper:** Conducted machine learning-based classification experiments using a multimodal dataset and authored a paper accepted at NeurIPS 2023.

## Sree Chitra Tirunal Institute for Medical Sciences & Technology

Kerala, India

### • Project Scientist

Jan 2021 – July 2021

- **Neurofeedback Game:** Built a neurofeedback game application that filtered fNIRS signals in real-time, predicted brain states using a deep learning model, and incorporated predictions into a PyGame interface, advancing brain-computer interface research.
- **xAI fNIRS System:** Developed an explainable AI application for fNIRS signal classification using DeepSHAP, enhancing interpretability of brain state predictions; published in *Frontiers in Human Neuroscience*.

## • St. Jude Children's Research Hospital

Memphis, TN

### • Research Intern

Sep 2020 – Jan 2021

- **Active vs Passive Brain Activation:** Developed deep learning-based classification of active vs. passive brain state associated with single-trial lower limb motor preparation in stroke patients.

Kerala, India

## • Sree Chitra Tirunal Institute for Medical Sciences & Technology

June 2019 – Sep 2020

### • Research Intern

- **ML Classification of fNIRS Signals:** Created handcrafted features for fNIRS signals using PCA and ICA, improving classification accuracy of SVM and k-NN models.
- **Deep Learning Classification of fNIRS Signals:** Developed CNN and LSTM models using sliding windows to treat fNIRS signals as images, boosting accuracy from 55% to 97%. Addressed data scarcity by augmenting dataset dimensionality. Part of this work was presented at an IEEE conference in Japan.

## ACADEMIC PROJECTS

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- **RL-Bowling:** Developed a reinforcement learning based bowling game using OpenAI Gym environment.(Feb '25)
- **Resume-GPT:** A Streamlit-based chatbot application that utilizes GPT-3.5-turbo, enabling users to interact and ask questions about a person's background based on their resume. (Oct '23)
- **Grocyfy:** A web application, developed using Django and React and deployed on the Google Cloud Platform, enhances the grocery list-making experience and is accessible on both PC and mobile devices. (May '23)
- **ToMCAT-offline-Viz:** PyQt5-based GUI not only visualizes the TOMCAT dataset but also presents detailed views of EEG and fNIRS signals, providing a thorough understanding of brain activities. Moreover, it offers a topological perspective, mapping these neural signals in a spatial context. This enhances the user's comprehension of cognitive processes and aids researchers in observing how team interactions evolve across various tasks and environments. (May '23)
- **Data poisoning in Machine Learning:** Explored an approach to poison a Machine Learning Model by attaching a Trojan Net which makes the model misclassify with high accuracy (Dec '22)
- **Multi-Modal emotion recognition:** Worked on a diffusion-based deep neural network that classifies emotions from a multimodal dataset. (Aug '22 - Dec '23)
- **fNIRS data augmentation with GANs:** Using Python implemented a GAN model which generated synthetic fNIRS data to solve issues related to fNIRS data acquisition and model training. (Nov '21)
- **Explainable medical image classification:** Developed a model which was able to classify Covid19 chest X-ray with an accuracy of 90% and ISIC Skin cancer dataset with an accuracy of 70%. The model classification was explained using LIME, GradCam HeatMap, and Saliency Maps. (Nov '21)

## EDUCATION

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### • University of Arizona

Tucson, Az

#### • Masters in Computer Science (Full Academic Scholarship)

Aug 2021 - Dec 2023

Courses: Advance Topics in Artificial Intelligence, Principles of Machine Learning, Design and Analysis Of Algorithms, Computer Vision, Computer Security, Software engineering, Advanced-Data Visualization

### • Goa University

Goa, India

#### • Bachelor of Computer Science

Aug 2014 - May 2018

## SKILLS SUMMARY

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- **Languages:** (Proficient) Python and MATLAB; (Familiar) C, C++, C#, SQL, Django, PostgreSQL, BASH, TS
- **Tools:** Pytorch, TensorFlow, langchain, Plotly, IPython, Excel, Keras, Scikit-learn, streamlit, pygame, Bash, SSH, GCP, Nextflow, MLflow, OpenAI Gym, AWS

## PUBLICATIONS

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**Caleb Jones Shibu**, Sujesh Sreedharan, Arun KM, and Chandrasekharan Kesavadas. “Comparison of classification performance of handpicked, handcrafted, and automated-features for fNIRS-BCI system”. In: *2020 5th International Conference on Intelligent Informatics and Biomedical Sciences (ICIIBMS)*. IEEE, 2020, pp. 152–157

**Caleb Jones Shibu**, Sujesh Sreedharan, Arun KM, Chandrasekharan Kesavadas, and Ranganatha Sitaram. “Explainable artificial intelligence model to predict brain states from fNIRS signals”. In: *Frontiers in Human Neuroscience Brain-Computer Interfaces* (2023)

Adarsh Pyarelal, Eric Duong, **Caleb Jones Shibu**, Paulo Soares, Savannah Boyd, Payal Khosla, Valeria Pfeifer, Diheng Zhang, Eric S Andrews, Rick Champlin, Vincent Paul Raymond, Meghavarshini Krishnaswamy, Clayton Morrison, Emily Butler, and Kobus Barnard. “The ToMCAT Dataset”. In: *Thirty-seventh Conference on Neural Information Processing Systems Datasets and Benchmarks Track*. 2023. URL: <https://openreview.net/forum?id=ZJWQfgXQb6>

**Caleb Jones Shibu**. “Decoding Emotional Responses: A Comparative Study of fNIRS and EEG Neuroimaging Techniques”. In: (2023). URL: <https://repository.arizona.edu/handle/10150/670846>