

CALEB JONES SHIBU

Machine Learning & Signal Processing Engineer · Founding Engineer, PAGE Technologies

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PROFESSIONAL SUMMARY

Machine-learning engineer specializing in signal processing — building AI systems that turn noisy, real-world sensor data into reliable, deployable intelligence. Six-plus years developing deep-learning methods for complex biomedical and physiological signals (fNIRS/EEG brain-computer interfaces) at St. Jude, SCTIMST, the University of Arizona, and the Allen Institute for Neural Dynamics — the same signal-processing expertise he now applies to U.S. climate and environmental technology. As Founding Engineer at PAGE Technologies, architected the firmware, cloud, and machine-learning stack behind an electrochemical nitrate-sensing platform that won a competitive \$400,000 EPA SBIR Phase II award and is the subject of a U.S. patent application (filed December 2025) on which he is a named co-inventor. First author of peer-reviewed publications, NeurIPS 2023 co-author, invited journal peer reviewer, Frontiers Research-Topic Editor, and Full Member of Sigma Xi.

AREAS OF EXPERTISE

Machine Learning & Deep Learning: CNNs, LSTMs, transfer learning, GANs, explainable AI (DeepSHAP, Grad-CAM, LIME), model calibration, sensor fusion, LLM/RAG systems

Biomedical & Sensor Signal Processing: fNIRS, EEG, eye-tracking, and electrochemical sensor signals — artifact filtering, feature engineering, real-time classification

Embedded / IoT & Cloud: C firmware, MQTT, AWS IoT Core, end-to-end ETL pipelines, real-time streaming (LSL)

Scientific Software & MLOps: Python, PyTorch, TensorFlow, OpenCV, PyQt5, scikit-learn, MLflow, Nextflow, GCP, AWS

SELECTED HONORS, RECOGNITION & SCHOLARLY SERVICE

- **EPA SBIR Phase II Award (\$400,000, 2026)** — technical lead and named co-inventor of the funded nitrate-sensing water-quality platform, PAGE Technologies.
- **Named co-inventor, U.S. patent application (filed Dec 2025)** — “Field-Deployable Automated Sampling, Conditioning and Measurement System for Environmental Monitoring,” PAGE Technologies.
- **Full Member, Sigma Xi** — The Scientific Research Honor Society (elected 2026).
- **Selected 1 of ~300 applicants** — Software Engineer II, Allen Institute for Neural Dynamics (2024).
- **Co-author, NeurIPS 2023** (Datasets & Benchmarks Track), “The ToMCAT Dataset.”
- **Invited Peer Reviewer**, Journal of Neural Engineering (IOP Publishing), 2026.
- **Topic Editor, Frontiers Research Topic** “Computational Approaches to Brain-Computer Interface Development,” 2026.
- **Full Academic Scholarship** — M.S. in Computer Science, University of Arizona.

PROFESSIONAL EXPERIENCE

PAGE Technologies, Inc.

Boulder, CO

Founding Engineer (Machine Learning & Signal Processing)

Aug 2025 – Present

- Sole founding software/AI engineer; owns the full stack that converts the company's printed electrochemical sensors into a deployable, commercial environmental-monitoring platform.
- Designed the machine-learning calibration and sensor-fusion pipeline that turns raw electrochemical signals into accurate real-time nitrate measurements — the core capability behind the company's \$400,000 EPA SBIR Phase II award.
- Engineered embedded C firmware with MQTT-based AWS IoT Core messaging for secure device-to-cloud telemetry, and architected the end-to-end cloud data and analytics infrastructure.
- Named co-inventor on the company's U.S. patent application (filed Dec 2025) for the field-deployable environmental-monitoring platform; established the company's data/ML engineering practice (repositories, model evaluation, field-deployment workflows) from zero.

Computer Connection of Wisconsin (CCWIS)

Reedsburg, WI

Machine Learning / LLM Engineer

Jul 2025 – Aug 2025

- Designed and deployed a retrieval-augmented-generation (RAG) customer-support chatbot (GPT-based) with human-agent escalation and ticket-based support; maintained the company's production web applications.

Allen Institute for Neural Dynamics

Seattle, WA

Software Engineer II (Machine Learning)

Mar 2024 – Mar 2025

- Selected from a pool of roughly 300 applicants for this single Software Engineer II position on the Single-Cell Computation team.
- Improved Cellpose neuron-segmentation performance by 22% (AUC-ROC) via PyTorch transfer learning, enabling automated real-time voltage-imaging analysis used across the lab.
- Built an iGluSnFR motion-correction pipeline that outperformed industry-standard tools (Suite2p, CalmAn, PatchWarp) under extreme motion; contributed improvements upstream to the open-source Cellpose tool.
- Developed simulation and OpenCV super-resolution source-extraction pipelines for ground-truth validation and synapse identification; co-authored an image-processing methods paper.

Biotronics

Ames, IA

Machine Learning Engineer

Jan 2024 – Feb 2024

- Enhanced ResNet-50 interpretability for livestock-fat prediction using SHAP and Grad-CAM to quantify feature importance and build stakeholder trust.

University of Arizona — School of Information & Dept. of Computer Science

Tucson, AZ

Graduate Research Assistant — ToMCAT Project

Aug 2021 – Dec 2023

- Sole fNIRS specialist on a federally supported AI teaming project; architected the multimodal (fNIRS/EEG/eye-tracking) data-acquisition infrastructure and collected high-fidelity data from ~200 participants.
- Developed the core ML pipelines and real-time brain-state prediction models and built the ToMCAT-offline-Viz PyQt5 visualization tool; co-authored “The ToMCAT Dataset,” NeurIPS 2023.

Sree Chitra Tirunal Institute for Medical Sciences & Technology (SCTIMST)

Kerala, India

Project Scientist (2021) · Researcher (2019–2020)

Jun 2019 – Jul 2021

- First at the institute to apply modern deep learning to fNIRS-BCI: sliding-window CNN/LSTM models raised classification accuracy from ~55% to 97%; integrated into a real-time PyGame neurofeedback interface.
- First-authored the resulting IEEE ICIBMS 2020 paper; promoted from Researcher to full-time Project Scientist within an Institution of National Importance.

St. Jude Children's Research Hospital (Sitaram Lab)

Memphis, TN

Researcher — Explainable AI for BCI

Sep 2020 – Jan 2021

- Built an explainable-AI fNIRS classifier (DeepSHAP) that reached 97% accuracy distinguishing active vs. passive brain states in stroke-related motor preparation, mapping predictions to specific cortical channels; first-authored the resulting article in Frontiers in Human Neuroscience (2023).

SELECTED PUBLICATIONS

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- Shibu, C. J., Sreedharan, S., Arun K.M., Kesavadas, C. “Comparison of classification performance of handpicked, handcrafted, and automated-features for fNIRS-BCI system.” 2020 IEEE ICIBMS, pp. 152–157. (First author)
- Shibu, C. J., Sreedharan, S., Arun K.M., Kesavadas, C., Sitaram, R. “Explainable artificial intelligence model to predict brain states from fNIRS signals.” Frontiers in Human Neuroscience, 2023. (First author)
- Pyarelal, A., Duong, E., Shibu, C. J., et al. “The ToMCAT Dataset.” NeurIPS 2023, Datasets & Benchmarks Track.
- Shibu, C. J. “Decoding Emotional Responses: A Comparative Study of fNIRS and EEG Neuroimaging Techniques.” M.S. Thesis, University of Arizona, 2023.

EDUCATION

M.S., Computer Science — University of Arizona Full Academic Scholarship · Aug 2021 – Dec 2023

B.Sc., Computer Science — Goa University, India Aug 2014 – May 2018