Sidharth

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Ann Arbor, Michigan - 48105, USA

Research Interests

Speech & Audio AI · Human–Audio Interaction · Speech Enhancement & Extraction · Representation Learning · Audio Accessibility

Education

- University of Michigan — August 2025 - May 2030
  PhD in Computer Science and Engineering — Ann Arbor, MI, USA
  - Advisor: Dr. Dhruv "DJ" Jain
  - Research Focus: Human-Audio Interaction, Spoken-Language Systems
- University of Washington — September 2023 - June 2025
  MS in Electrical Engineering — Seattle, WA, USA
  - Advisors: Dr. Rajesh Rao, Dr. Jeffrey Herron
  - Research Focus: Artificial Intelligence, Signal Processing.
  - Thesis: "Decoding Pain: Statistical Identification of Biomakers from Electrophysiological Signals"
- College of Engineering Trivandrum — July 2019 - August 2023
  B.Tech in Electronics and Instrumentation Engineering with minor in Mathematics — Trivandrum, KL, INDIA
  - Advisor: Dr. Jerrin Thomas Panachakel
  - Thesis: "Emotion Detection from EEG using Transfer Learning"

Industrial Research Experience

- Skyworks Solutions. — May 2025 - August 2025
  Research Intern — Hillsboro, OR, USA
  - Pioneered a dual-microphone framework fusing in-ear and external signals to boost intelligibility in low-SNR conditions
  - Designed a low-parameter (1.7M), streamable U-Net with cross-attention for real-time two-channel enhancement.
  - Built a real-world dataset using a dummy-head HAT system for robust ecological evaluation.
  - Introduced SpeechDROPBERT, a BERT-based metric to quantify speech-drop effects.
  - Achieved DNSMOS OVRL 2.45 vs. 2.3 and SpeechDROPBERT 0.88 vs. 0.60 beamformer baseline.
- BrainChip Research — June 2024 - March 2025
  Research Intern — Laguna Hills, CA, USA
  - Co-led development of aTENNuate, a real-time deep state-space speech enhancement model
  - Achieved PESQ 3.27 on VB-DMD dataset with only 0.84M parameters, 0.33G MACs, and 46.5 ms latency.
  - Advanced deployment-specific optimization of SSMs via LoRA adaptation, enabling fine-tuning for diverse environments.
  - Led the development of SSM-based TTS system that achieved a MOS of 3.84 in subjective listening tests.

Patents and Publications

C=Conference, W=Workshop, J=Journal, P=Patent, S=In Submission, T=Thesis

[C.1] Y.R.Pei, R. Shrivastava, Sidharth Optimized Real-time Speech Enhancement with Deep SSMs on Raw Audio. In Proc. Interspeech 2025, pp. 51-55. DOI: 10.21437/Interspeech.2025-19

[W.1] Sidharth, Vishwas Sathish, et.al. PainDECOG: Machine Learning-Based Identification of Pain Biomarkers from sEEG Signals. In 2025 AAAI Workshop on Health Intelligence (W3PHIAI-25)

[C.2] Baghel, S., Ramoji, S., Sidharth The DISPLACE Challenge 2023 - DIarization of SPeaker and LAnguage in Conversational Environments. In Proc. Interspeech 2023, pp. 3562-3566. DOI: 10.21437/Interspeech.2023-2367

[P.1] Y.R.Pei, R. Shrivastava, Sidharth. (2025). aTENNuate (Pending) : Edge-optimized state-space-model speech-enhancement framework for hearing-aid and real-time audio application. U.S Patent filed from BrainChip, Inc

[C.3] Sidharth, et.al. Emotion Detection from EEG using Transfer Learning. In 2023 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), pp. 1-4, DOI: 10.1109/EMBC40787.2023.10340389

[C.4] J. T. Panachakel, R. H, S. P. K, S., Sidharth, et.al. CSP- LSTM Based Emotion Recognition from EEG Signals. In 2023 IEEE International Conference on Metrology for eXtended Reality, Artificial Intelligence and Neural Engineering (MetroXRAINE), pp. 289-294, DOI: 10.1109/MetroXRAINE58569.2023.10405666

[C.5] K. Sana Parveen, J. T. Panachakel, H. Ranjana, Sidharth, et.al. EEG-based Emotion Classification - A Theoretical Perusal of Deep Learning Methods. In 2023 2nd International Conference for Innovation in Technology (INOCON), pp. 1-6, DOI: 10.1109/INOCON57975.2023.10101002

Key Projects

- Masked Audio Modeling for Multi-Microphone Speech Reconstruction and Localization March 2024 - May 2024
  Tools: Numpy, PyTorch, Pyroomacoustics [GitHub]
  - Developed a conformer-based masked audio modeling system for reconstructing missing microphone channels.
  - Simulated 4-mic room acoustics with pyroomacoustics, achieving validation MSE of 0.001
  - Built a data pipeline using PyTorch for diverse noisy environments to improve model robustness.
  - Adapted conformers to learn temporal–spatial correlations for source localization..
- HMM-Based Isolated-Phrase Automatic Speech Recognition March 2024
  Tools: Numpy, SciPy, Python [GitHub]
  - Developed a speaker-dependent isolated-phrase ASR system using Hidden Markov Models with Gaussian emissions
  - Implemented Rabiner–Sambur VAD and MFCC + delta feature extraction for robust speech segmentation
  - Created a dataset of 120 recordings (own voice) across 6 phrases with varied acoustic conditions to ensure realistic evaluation
  - Achieved 98.3% mean accuracy via 5-fold cross-validation, demonstrating strong performance on noisy environments
- Diarization of Speaker and Language in Conversational Environments December 2022 - May 2023
  Tools: Praat, Audacity, Python, Numpy [GitHub]
  - Developed diarization systems for multilingual, multi-speaker, code-mixed environments, automating 40 hours of conversational audio annotation.
  - Preprocessed audio, fine-tuned speaker activity detection with x-vectors, and refined segment boundaries using VB-HMM clustering.
  - Achieved DER 28.04 for speaker diarization and DER 37.72 for language diarization on the DISPLACE dataset.
- PainDECOG: Decoding Acute Pain from Intracranial EEG March 2024 - September 2024
  Tools: Python, NumPy, SciPy, Scikit-learn, MNE-Python, Matplotlib [GitHub]
  - Developed machine learning models to classify acute pain states from raw iEEG signals using PIB and coherence features
  - Implemented preprocessing pipeline with notch/bandpass filtering, electrode selection, and 10-sec trial windowing.
  - Created dataset from multi-day iEEG recordings of 3 subjects with synchronized pain ratings for supervised learning.
  - Achieved up to 73% accuracy (RF, subject 3) in binary pain classification, outperforming chance levels.

Skills

- Programming Languages: Python, C++, MATLAB, Bash, SQL
- Data Science & Machine Learning: PyTorch, TensorFlow, Scikit-learn, NumPy, Pandas, Hugging Face Transformers, Pyroomacoustics, gpuRIR
- DevOps & Version Control: Git, GitHub Actions, Slurm
- Specialized Area: Speech Enhancement, Target Speech Extraction, Representation Learning, AI
- Other Tools & Technologies: Librosa, Praat, Triton Inference Server, LaTeX

Honors and Awards

- NSF AAI, ECE DEI, and Weil Neurohub Travel Grant Feb 2025
  National Science Foundation (NSF), ECE/CSE Departments, University of Washington
  - Awarded $2800 to present research paper "Decoding Pain: Statistical Identification of Biomarkers from Electrophysiological Signals" at AAAI 2025 Workshop on Health Intelligence, Philadelphia, USA.
  - Recognized for contributions at the intersection of AI, neuroscience, and health.
- Travel Grant Dec 2023
  College of Engineering, Trivandrum
  - Awarded $500 to present research paper "Emotion Detection from EEG using Transfer Learning" at an international conference in Sydney.
  - Supported for representing institution at a global research venue.
- Winter Research Fellowship Jan 2022
  Indian Institute of Science (IISc), Bangalore
  - Awarded $715 to conduct research on speaker and language diarization in multilingual Indian languages.
  - Enabled early independent research exposure in speech and language processing.

Service and Outreach

- Admissions Committee Member 2025
  ECE MS Admissions Committee, University of Washington
  - Contributed to the review and selection process for incoming MS students.
  - Promoted fairness, diversity, and excellence in graduate admissions.
  - Gained insights into academic evaluation and admissions policies.
- Founder 2021
  MATHLETES CET, College of Engineering Trivandrum, India
  - Established the official math club to encourage problem-solving and academic collaboration.
  - Organized student-led talks, quizzes, and workshops on advanced mathematics topics.
  - Built a platform fostering peer learning, leadership, and community engagement.

References

1. Dr. Dhruv Jain
   Assistant Professor, Department of Computer Science and Engineering
   University of Michigan, Ann Arbor
   Email: profdj@umich.edu
   Relationship: PhD Advisor
2. Dr. Meysam Asgari
   Sr. Principal Electrical Engineer
   AIS Division, Skyworks Solutions.
   Email: Meysam.Asgari@skyworksinc.com
   Relationship: Internship manager, Collaborator
3. Dr. Rajesh P. N. Rao
   Professor, Paul G. Allen School of Computer Science and Engineering
   University of Washington, Seattle
   Email: rao@cs.washington.edu
   Relationship: Masters Advisor
4. Dr. Yan Ru (Rudy) Pei
   Sr. Deep Learning Algorithm Engineer
   NVIDIA
   Email: yanrpei@gmail.com
   Relationship: Internship mentor