

Interdisciplinary researcher and engineer with a track record spanning AI/ML system development, human factors engineering, physiological signal processing, and regulated medical device R&D. Experienced designing and deploying end-to-end intelligent systems that integrate multimodal sensing, LLM-based agents, and rigorous human-subject experimentation to model human behavior and drive real-world product improvements. Bridges deep technical expertise with user-centered design and cross-functional leadership to translate complex data into actionable insights and scalable solutions.

Portfolio Link: <https://adityashanghavi.github.io/ashanghavi/>

INDUSTRY WORK EXPERIENCE

NeuroErgonomics Labs, Madison, Wisconsin – Research Scientist | Technical Program Lead **Jan. 2025 – Current**

Leading development of machine learning algorithms and physiological sensing systems that model human performance and health states using multimodal wearable biosensor data. Direct research programs spanning AI model development, experimental validation, and deployment of health analytics systems.

- Lead development of multimodal AI systems to model human state (fatigue, stress, decision-making) in real-world and simulated environments
- Developed AI-driven interactive environments with LLM-powered agents that improved performance by 15–25%
- Designed and conducted human-subject experiments to study human interaction with intelligent systems, integrating behavioral, physiological, and performance metrics
- Built interactive simulation environments (Unity, Meta Quest) to study decision-making, escalation behavior, and human-AI interaction dynamics
- Spearheaded development of a multimodal fatigue and stress monitoring system integrating ECG, EDA, actigraphy, fNIRS, and eye tracking signals
- Built scalable preprocessing, feature engineering, and ML modeling pipelines from noisy real-world sensor data.
- Investigated model and system behavior in interactive settings, identifying failure cases and mismatches between system outputs and user expectations
- Evaluated whether LLM-generated agent behaviors aligned with designed interaction traits (e.g., emotional tone, cooperation), ensuring consistency between intended system behavior and observed outputs
- Developed evaluation pipelines to analyze behavioral outcomes and support system validation
- Communicated research findings through formal reports and presentations to cross-functional and external stakeholders, influencing system design, model iteration, and long-term research strategy.
- Translated research findings into deployable system improvements in collaboration with engineering and product teams

Purdue University, Biomedical Engineering, West Lafayette, Indiana – Researcher (Doctoral Studies) **Jan. 2020 – Dec 2024**

Led development of machine learning algorithms and wearable sensing methods to objectively detect, differentiate and quantify Parkinson's Disease tremors.

- Developed a wearable inertial sensing system for Parkinson's tremor assessment using wrist-worn IMU sensors and signal processing algorithms.
- Designed signal processing pipelines extracting spectral features from wearable motion data.
- Built machine learning models for tremor classification and severity prediction, enabling objective assessment of Parkinsonian motor symptoms.
- Designed and executed clinical validation studies evaluating model performance, generalization, and diagnostic accuracy using patient datasets.
- Investigated feature representations and model generalization across subjects, contributing to robust human-state inference from wearable sensing data.
- Achieved 9% improvement in diagnostic accuracy compared to previously reported wearable sensor systems.
- Translated clinical insights into algorithm design requirements, performance metrics, and validation protocols.

US Medical Innovations, Takoma Park, Maryland – Project Lead | Regulated Medical Systems **Sept. 2016 – Dec. 2019**

Led R&D of surgical robotics and electrosurgical systems, translating engineering innovations into clinically deployable medical devices within regulated healthcare environments.

- Led design and development of the Canady Robotics SR-70 Surgical System, an \$8M R&D program from concept to verification.
- Contributed to the launch the Canady Plasma XL-1000 Generator, the first to translate Cold Plasma technology from lab research to clinical use.
- Designed and prototyped mechanical components and PCBs, improving reliability, manufacturability, and signal integrity.
- Managed supplier communication to ensure compliance with ISO 13485 and medical-grade component standards.
- Defined user and safety requirements through use-scenario and task analyses, emphasizing intuitive and ergonomic design.
- Authored FDA design control documents including DHF, DMR, risk management (ISO 14971), and V&V reports.
- Supported regulatory testing under IEC 60601 (electrical safety), IEC 62366 (usability), and IEC 62304 (software lifecycle).
- Collaborated with clinicians, engineers, and regulatory teams to refine human-system interfaces and risk mitigations.
- Awarded 5 U.S. patents for innovations in electro-mechanical system design and medical device engineering.

Tupelo Brittany, Remote – Equity Consultant Intern **Jan. 2024 – June 2024**

Conducted data-driven analysis of biotechnology and pharmaceutical markets, translating scientific and clinical data into strategic insights for investment decisions.

- Led data-driven strategy engagements for biotechnology and pharmaceutical clients, delivering actionable insights that informed investment decisions and guided market positioning.
- Synthesized complex scientific data into strategic recommendations, bridging science and business to support client growth.
- Authored sector analysis reports connecting therapeutic innovation with business trends across the biopharma landscape.

INDEPENDENT PROJECTS

- [MedAssist](#) (LLM + RAG System): Built a domain-constrained medical AI assistant integrating retrieval-augmented generation (PubMed), enabling evidence-grounded responses.
 - Designed end-to-end system architecture (FastAPI backend, React frontend)
 - Implemented retrieval pipelines using vector embeddings (ChromaDB, sentence-transformers) to improve response grounding
 - Developed guardrails and domain constraints to reduce unsupported or non-evidence-based outputs
 - Performed qualitative evaluation of model outputs against source literature, identifying inconsistencies and improving response reliability
- [Psychomotor Vigilance Test](#) (Web App): Developed real-time behavioral measurement system for attention and fatigue with millisecond precision analytics.

- SPREE-AI (Multimodal AI Platform): Built computer vision and recommendation system for real-time product interaction in video streams. [Video 1](#) • [Video 2](#).

EDUCATION AND CERTIFICATES

Purdue University, West Lafayette, IN: Doctor of Philosophy in Biomedical Engineering	2024
Purdue University, West Lafayette, IN: Master of Science in Mechanical Engineering	2016
Purdue University, West Lafayette, IN: Bachelor of Science in Mechanical Engineering	2014

TECHNICAL SKILLS

- **AI & Machine Learning:** Deep learning (PyTorch), multimodal learning, time-series modeling, classification, representation learning
- **LLM Systems:** RAG, agent systems, prompt design, grounding strategies
- **Evaluation:** Model behavior analysis, failure mode analysis, human-in-the-loop validation
- **AI Safety:** Output grounding, constraint design, reliability-focused system design
- **Human-Centered AI:** Human-AI interaction (HCI/HRI), behavioral modeling, experimental design, human-subject research
- **Programming:** Python, C++, MATLAB, SQL
- **Systems & Prototyping:** Unity (VR), wearable sensing systems, multimodal data pipelines
- **Data & Infrastructure:** Large-scale data pipelines, AWS (Mechanical Turk), multimodal dataset integration
- **Systems & Prototyping:** Unity (VR / Meta Quest), wearable systems, PCB design (Altium), CAD (SolidWorks), sensor integration
- **Regulatory:** FDA design controls & human factors guidance, IEC 62366, IEC 60601, IEC 62304, ISO 14971, ISO 13485, ISO 9241

TEACHING WORK EXPERIENCE

Purdue University, Biomedical Engineering, West Lafayette, Indiana – Graduate Teaching Assistant	Aug. 2021 – Dec 2024
• Mentored 400+ biomedical engineering students in medical device design and regulatory development • Won the Estus H. and Vashti L. Magoon Award for outstanding instructor in 2023.	

Purdue University, EPICS, West Lafayette, Indiana – Graduate Teaching Assistant	Aug. 2014 – May 2016
• Instructed 160+ students from varying STEM disciplines in electromechanical systems design and fabrication, ethics, and user-centered design. • Awarded Certificate in Practice of College Teaching from the Center for Instructional Excellence at Purdue University	

RESEARCH PUBLICATIONS

- **Shanghavi, A., Jayasuriya, J., Cai, Y., & Mehta, R.** (2025, October 13–17). Pulse rate variability from wearable wristwatches as a surrogate for heart rate variability? We think not yet. ASPIRE 2025: 69th International Annual Meeting of the Human Factors and Ergonomics Society, Chicago, IL.
- **Chen, W., Ruan, W., Pater, K., Shanghavi, A., Mohanty, R., & Mehta, R.** (2025, October 13–17). Human factors evaluation of Gen-AI based NPC interactions in public safety training. ASPIRE 2025: 69th International Annual Meeting of the Human Factors and Ergonomics Society, Chicago, IL.
- **A Shanghavi, R Patil, B S. Duerstock, S Ambike and A B. Sereno.** A data-driven method for detecting, differentiating and scoring Parkinsonian rest and postural tremors. npj Parkinsons Disease. Submitted
- **A Shanghavi, R Patil, B S. Duerstock, S Ambike and A B. Sereno.** A machine-learning method for detecting simulated Parkinsonian tremors in healthy individuals. Advanced Intelligent Systems. Submitted.
- **A Shanghavi, D Larranaga, R Patil, E M. Frazier, S Ambike, B S. Duerstock and A B. Sereno.** A machine-learning method isolating changes in wrist kinematics that identify age-related changes in arm movement. Scientific Reports 14, 9765 (2024). <https://doi.org/10.1038/s41598-024-60286-1>
- **A. Shanghavi, R. Patil, J. Stad, G. Maffei, B. S. Duerstock, A. B. Sereno.** Power Spectral Density Analysis of Kinematic Variables Reveals Age-related Differences in Arm Motion. Program No. PST151.13/BB14. 2023 Neuroscience Meeting Planner. Washington, D.C.: Society for Neuroscience, 2023. Online
- **Sakaleros, J., Shamloo, F., Shanghavi, A., & Sereno, A.** (2021). Detection of Parkinsonian Motor Symptoms Using Non-Invasive Motion Sensing Technology. Proceedings of IMPRS, 4(1).
- **Andersen, D.; Popescu, V.; Cabrera, M.; Shanghavi, A.; Gomez, G.; Marley, S.; Mullis, B. & Wachs, J.** (2016). Medical Telementoring Using an Augmented Reality Transparent Display. Surgery, 159(6), 1646 – 1653.
- **Andersen, D.; Popescu, V.; Cabrera, M.; Shanghavi, A.; Gomez, G.; Marley, S.; Mullis, B. & Wachs, J.** Avoiding Focus Shifts in Surgical Telementoring Using an Augmented Reality Transparent Display. NextMed/MMVR22 Proceedings, 2016.
- **Andersen, D.; Popescu, V.; Cabrera, M.; Shanghavi, A.; Gomez, G.; Marley, S.; Mullis, B. & Wachs, J.** Virtual annotations of the surgical field through an augmented reality transparent display. The Visual Computer, Springer Berlin Heidelberg, 2015, 1-18.
- **Dan Andersen, Voicu Popescu, Maria Eugenia Cabrera, Aditya Shanghavi, Brian Mullis, Sherri Marley, Gerardo Gomez, Juan P. Wachs;** An Augmented Reality-Based Approach for Surgical Telementoring in Austere Environments, Military Medicine, Volume 182, Issue suppl_1, 1 March 2017, Pages 310–315, <https://doi.org/10.7205/MILMED-D-16-00051>
- **Andersen, D., Popescu, V., Lin, C., Cabrera, M. E., Shanghavi, A., & Wachs, J.** (2016). A Hand-Held, Self-Contained Simulated Transparent Display. 2016 IEEE International Symposium on Mixed and Augmented Reality (ISMAR-Adjunct). doi:10.1109/ismar-adjunct.2016.0049

PATENTS

- **Canady, J., O'connell, M., Yan, F., Liu, Z., & Shanghavi, A.** (2020). U.S. Patent Application No. 29/644,182.
- **Canady, J., Canady, C., Zhuang, T., Yan, F., Shanghavi, A., Liu, Z., ... & Pierce, T.** (2022). U.S. Patent No. 11,224,487. Washington, DC: U.S. Patent and Trademark Office.
- **Canady, J., O'connell, M., Yan, F., Liu, Z., & Shanghavi, A.** (2020). U.S. Patent Application No. 29/644,181.
- **Canady, J., Yan, F., Zhuang, T., Shanghavi, A., Ray, L., Sumanasena, B., & Sokolovski, E.** (2023). U.S. Patent Application No. 18/126,799.
- **Canady, J., Yan, F., Zhuang, T., Shanghavi, A., Ray, L., Sumanasena, B., & Sokolovski, E.** (2023). U.S. Patent No. 11,612,425. Washington, DC: U.S. Patent and Trademark Office.