# Closing the Diagnosis Gap: AI-Powered Sleep Apnea Detection from a Wearables.

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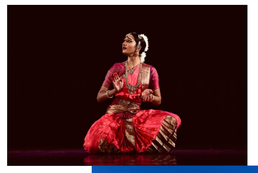
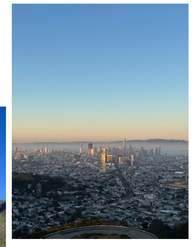
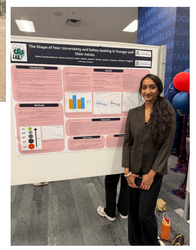
## ABOUT ME

- B.S Neuroscience & Cognitive Science, University of Arizona; Minors in Statistics/Data Science and Entrepreneurship & Innovation.
- Research interests: computational and cognitive neuroscience, digital health, and ML for clinical translation.
- Why LLNL? I wanted to apply machine learning to a real clinical problems at scale — with access to serious computational resources and a rigorous research environment. LLNL gave me both.
- Outside research: I love traveling, spending time with friends ! I love dancing (practicing Bharatanatyam for 15 years!), hiking, reading, and sports. I enjoy going out with friends and exploring the Bay Area.








## SUMMER RESEARCH

### Abstract

- Sleep apnea affects roughly **1 in 6 American adults**, but often goes unnoticed until it's already severe.
- Nearly **80% remain undiagnosed** (AASM, 2024) — by the time symptoms are obvious, damage may already be underway.
- Repeated oxygen deprivation from untreated apnea drives **progressive hippocampal and white matter damage** that worsens the longer it goes undetected (Hu et al., *Sleep*, 2026).
- This project aims to **catch apnea early** — before it escalates — using a wearable and machine learning instead of a costly, hospital-based sleep study.


PSG is the gold standard for sleep science, however it does come with a few disadvantages.

### Dataset and Methods

- We used DREAMT, one of the only public datasets that records a consumer wearable (Empatica E4) and a full hospital sleep study on the same 100 people, overnight.
- Collected at the Duke University Health System Sleep Disorders Lab.
- Captures a clinically realistic population: older adults, high comorbidity burden, and the full spectrum of apnea severity (not a curated healthy sample).

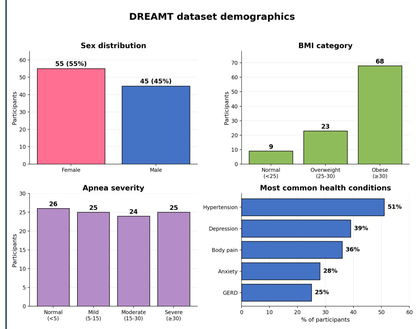



**Figure 1:**Real patients: older, high comorbidity burden, and a full range of apnea severity — not a hand-picked healthy sample.

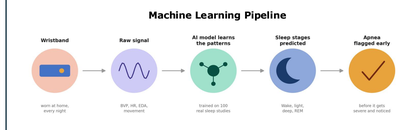
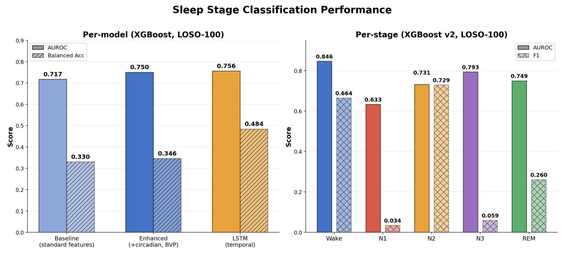


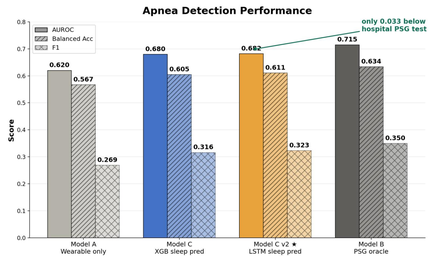

**Figure 2:** Raw wrist signals become 89 engineered features, which feed a sleep-staging model — its predicted stages then act as context for three versions of the apnea detector, each evaluated with leakage-free cross-validation.

### Results *(preliminary)*

Our pipeline demonstrates that wrist-based wearables can detect sleep stages and apnea events with clinically meaningful accuracy — without any hospital equipment.




Two approaches were tested throughout: XGBoost, which reads short snapshots of the signal, and LSTM, which tracks how the signal changes over time.




### Future Directions


## LLF AWARD

**How funds are being used:**

- Housing in Livermore for the full duration of the fellowship — enabled a full summer relocation that wouldn't have been possible on a student budget.
- Daily commute and local transportation between housing and the Lab.
- Groceries and everyday living expenses while working full-time on-site.
- Conference/presentation costs tied to preparing and printing this research poster.

The LLF fund made this fellowship financially accessible from day one — without it, relocating to Livermore for the summer would not have been feasible, and I would have had to turn down this opportunity entirely.

**How this fellowship has impacted me:**

- Built my first end-to-end ML pipeline on real clinical data, from raw wearable signals all the way to rigorous, leakage-free evaluation.
- Gained hands-on experience with HPC systems, batch job scheduling (Flux), and large-scale compute that most undergraduates never get exposure to.
- Learned to think like a researcher — asking hard questions about clinical validity, reporting null findings honestly, and knowing when a result is and isn't meaningful.
- Strengthened my direction toward computational neuroscience and digital health — this summer confirmed that's exactly where I want to build my career.
- Made meaningful connections with mentors and researchers at LLNL that have already shaped how I think about the intersection of engineering and medicine.
- Gained real confidence navigating an unfamiliar research environment independently, from onboarding to a national lab's compute infrastructure to presenting my own results.

**Closing note:**

This fellowship gave me something a classroom never could — the chance to do real research, on real problems, with real stakes. The LLF fund is the reason that door was open to me this summer, and I hope it stays open for the students who come after me. Thank you for investing in undergraduate researchers like me.

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