

Xavier Velez

Chambers/Jones Award
Ph.D. Student, Electrical and Computer Engineering
First Year ARCS Scholar



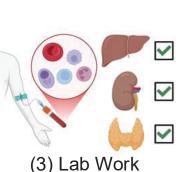
Transfer Learning Frameworks for Diagnosing Neurodegenerative and Psychiatric Conditions

This work hypothesizes that objective physiological measures of neural dysfunction can be revealed during sleep, and that by leveraging deep learning models that analyze sleep patterns, we can detect neurodegenerative and psychiatric conditions with only electroencephalography (EEG), even while the patient is awake.

The average time from symptom onset to a dementia diagnosis is ~3.5 years









(4) Neuroimaging

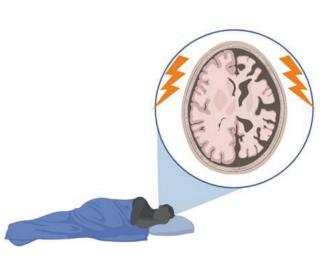
(2) Neuropsychology Testing

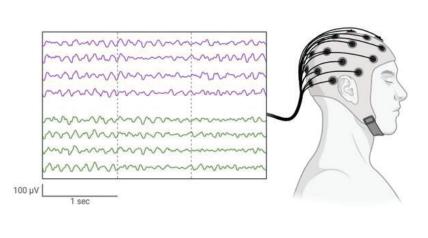


(5) Final Diagnosis

Even with all these procedures, ~18% of Alzheimer's patients are misdiagnosed

Your brain reveals dementia-induced neural dysfunction during sleep

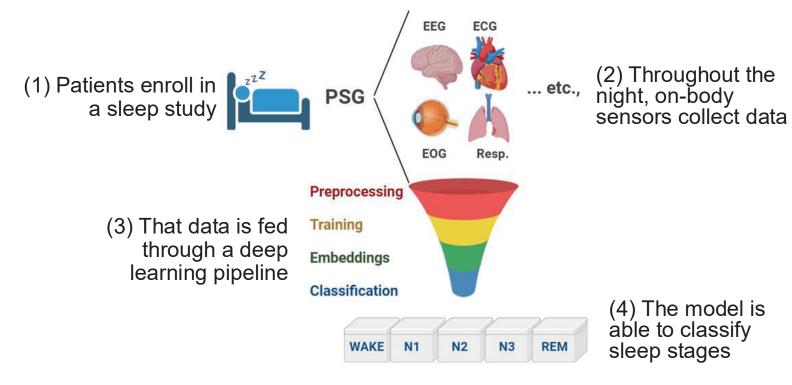




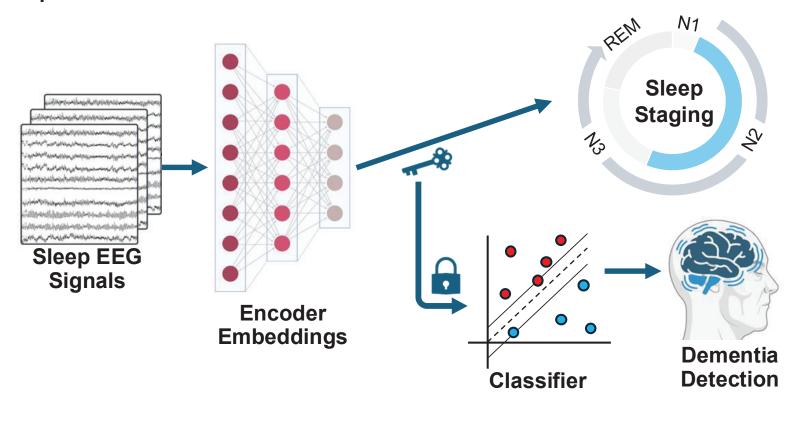
Electrical signals are produced by the brain

These electrical signals can be captured by an electroencephalogram (EEG)

Deep learning models can use on-body sensors for sleep staging



The model embeddings that classify sleep stages also capture information that can be used to detect dementia



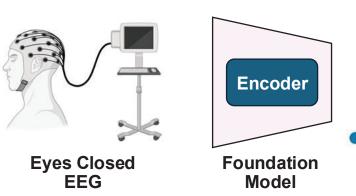
Once these models are trained, they can detect dementia during wakefulness in minutes

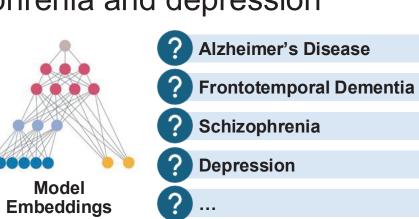
All Bands
Delta Band
Alpha Band
Beta Ba

EfficientNet

Embeddings

We can apply this same technique to psychiatric disorders such as schizophrenia and depression





- Preliminary results show 86% accuracy for Alzheimer's detection and 88% accuracy for frontotemporal dementia detection
- These models struggle to distinguish between different types of dementia
- Early analyses show promising signs (>90%) for schizophrenia detection