JH AITC – ALL COHORTS

Predicting Adverse Events from Sovrinti In-Home ADL Sensing

Johns Hopkins AI & Technology Collaboratory for Aging Research

Sovrinti Data for Daily Living

AREA OF NEED: The need to identify rising health risks in Aging individuals to enable interventions before the issue becomes acute.

OPPORTUNITY: Develop and test, change models that use in-home ADL sensors to identify and predict rising risk of acute conditions in Aging individuals.

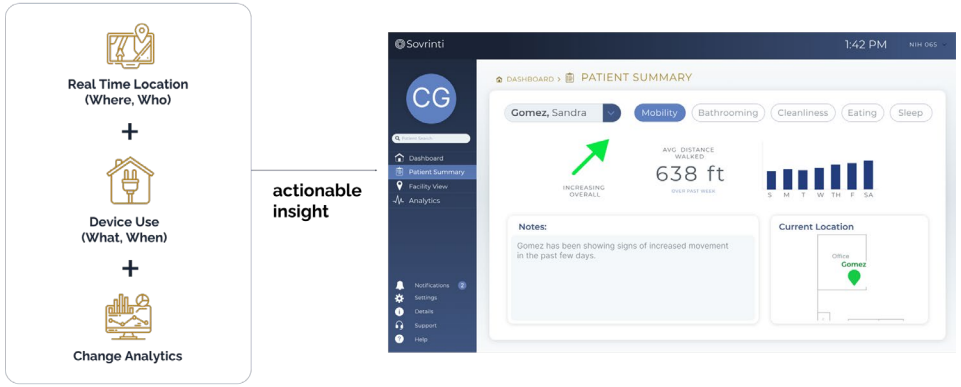
DATA: From recently completed NIA study: 117 ADRD Caregiver-Care recipient dyads with an average of 12 months of in-home sensors data and coincident monthly ADCS surveys and health conditions information. 800 reported health incidents

TECH APPROACH: Leverage real time location and device utilization data to identify behavioral anomalies associated with described incidents. Utilize various ML/AI techniques to develop a predictor of acute conditions from sensor data.

PI(s): John Fitch

COHORT: GY1

AI/ML Based ADL Change Detection



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AI & TECHNOLOGY COLLABORATORY *for* AGING RESEARCH

WAVi Ai: Preventing Age-Related Cognitive Decline

AREA OF NEED: Age-related cognitive decline can be mitigated for many patients with early identification that includes interventional phenotyping.

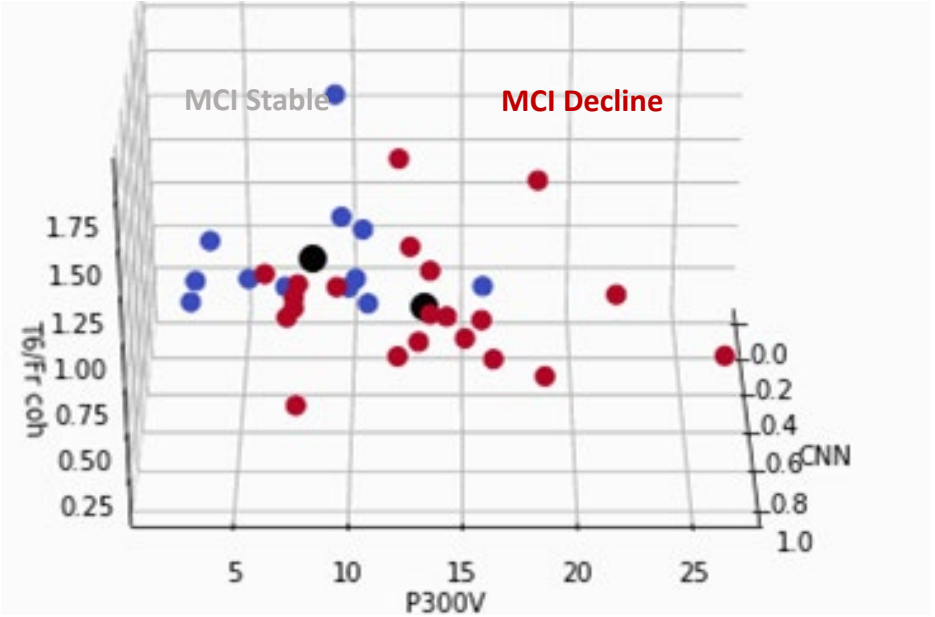
OPPORTUNITY: Create a software product to be added to the existing WAVi EEG/ERP platform intended to be used in the setting of age-related cognitive decline as both a diagnostic aid and to track interventions.

DATA: Analysis will be on Existing WAVi data collected in clinic on patients concerned with or experiencing age-related declines, including longitudinal outcomes.

TECH APPROACH: Add an Ai component to the standard EEG/ERP metrics on a heterogenous data set in order to find common feature sets that both identify early dementia and help predict candidate interventions.

PI(s): Francesca Arese, PhD David Oakley, PhD

COHORT: GY1



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for AGING RESEARCH

RetreatVR – A Senior Wellness Tool

AREA OF NEED: Mitigating senior loneliness through Virtual Reality

OPPORTUNITY: Develop, test, and implement shared immersive experiences to enhance social interaction

DATA: Correlation study analyzing the correlation between the level of engagement with RetreatVR and the level of social engagement

TECH APPROACH: Designed and developed a senor-friendly VR platform that included immersive and interactive 3D experiences to tap memories and encourage social interaction

PI(s): Ellie Giles

COHORT: GY1

Enjoying Immersive experiences

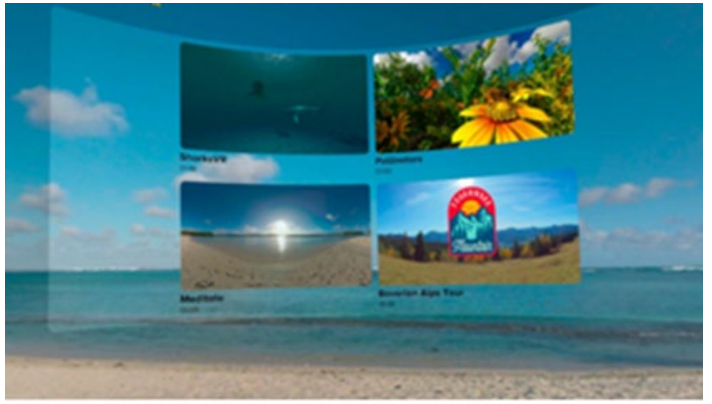

Figure 1: Eye-gaze-activated menu

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Robot + AI-based Facial Expression Analysis to Detect Agitation in Persons with AD/ADRD

Vigorous Mind

AREA OF NEED: Physical and verbal agitation, found in 80% of nursing home residents with AD/ADRD, can pose a major problem for the resident and their family and professional caregivers. The inability to successfully manage dementia behaviors often results in increased burden on caregivers, use of physical restraints, and/or pharmacological interventions. Use of antipsychotic and psychotropics medications increases the risk of death and of falls and fractures in patients with dementia.

OPPORTUNITY: Integrate an AI-based facial expression analysis software on an autonomously navigating robot to test and validate that it can detect agitation in nursing home residents with dementia. The ultimate goal is to use this information and the robot to deliver non-pharmacological interventions to reduce agitation.

DATA: Collecting comprehensive raw data of facial expressions of 10 nursing home residents with dementia known to be agitated during three days of simultaneous observations twice per hour for 13 hours per day by the robot and two research assistants.

TECH APPROACH: Using the ability of the autonomously navigating robot to come to a resident's room in a nursing home as frequently and for as long a time as necessary, and through its video camera capture facial expressions and use the facial expression analysis software to analyze the images and validate that a signal can be seen when a resident is agitated as determined by the research assistants.

PI(s): Yuval Malinsky, MD

COHORT: GY1

Implementing the Emergency Department Dementia Algorithm (EDDA) for Dementia Detection in At-Risk ED Patients

Johns Hopkins AI & Technology Collaboratory for Aging Research

Yale University School of Medicine

AREA OF NEED: The ED is underutilized as an environment where screening and identification of undiagnosed people living with dementia can occur.

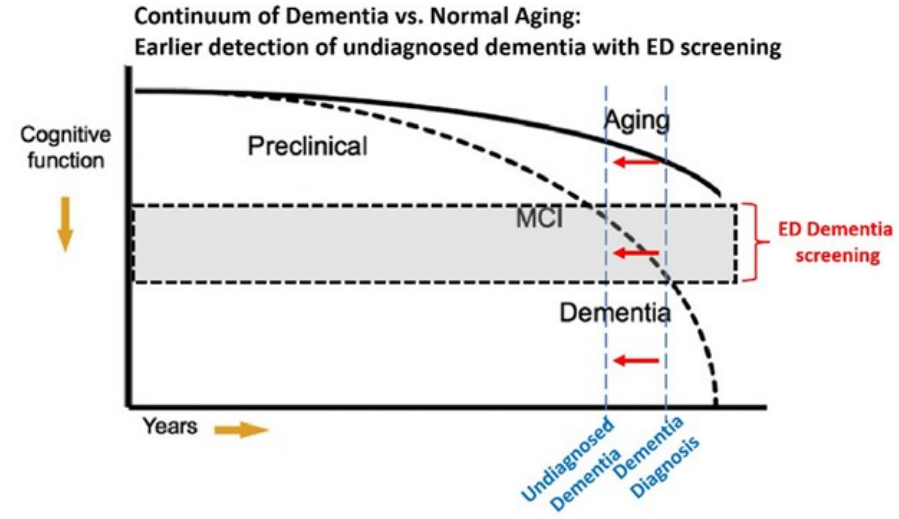
OPPORTUNITY: Train and validate the EDDA machine learning algorithm as a clinical decision support tool that will screen at-risk ED patients for dementia upon visit.

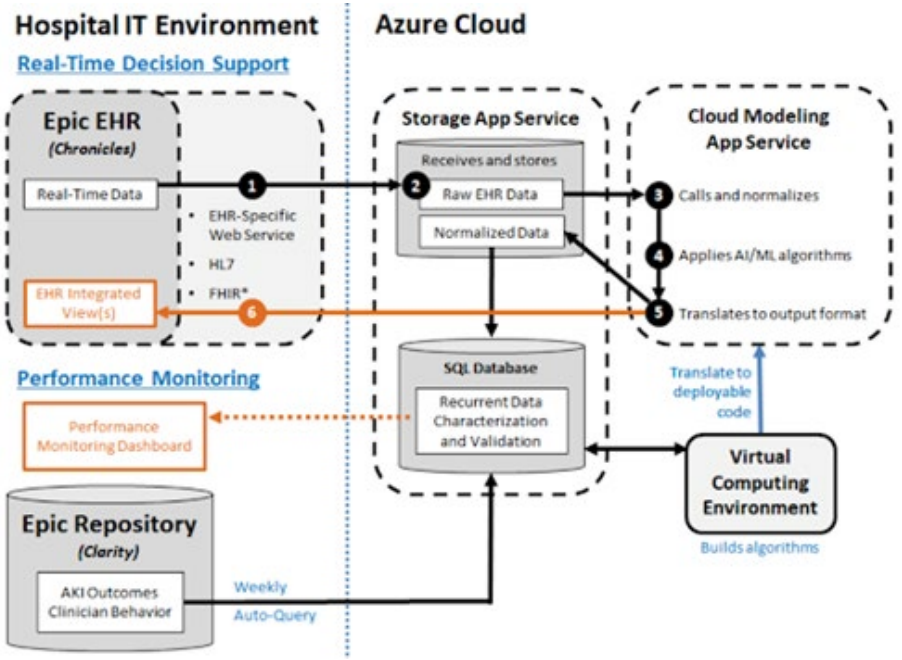
DATA: Demographic, diagnostic, laboratory, procedural, and medication data from all ED patients seen from 2013-2020 in the Yale New Haven Hospital System.

TECH APPROACH: Integrate the EDDA into the EHR to convey real time identification alerts for ED providers, allowing for earlier interventions for undiagnosed persons living with dementia.

PI(s): Ula Hwang MD, MPH
Andrew Taylor MD, MHS

COHORT: GY1





AI Bots and Wearables for Dementia Caregivers to Improve Quality of Life

Johns Hopkins AI & Technology Collaboratory for Aging Research

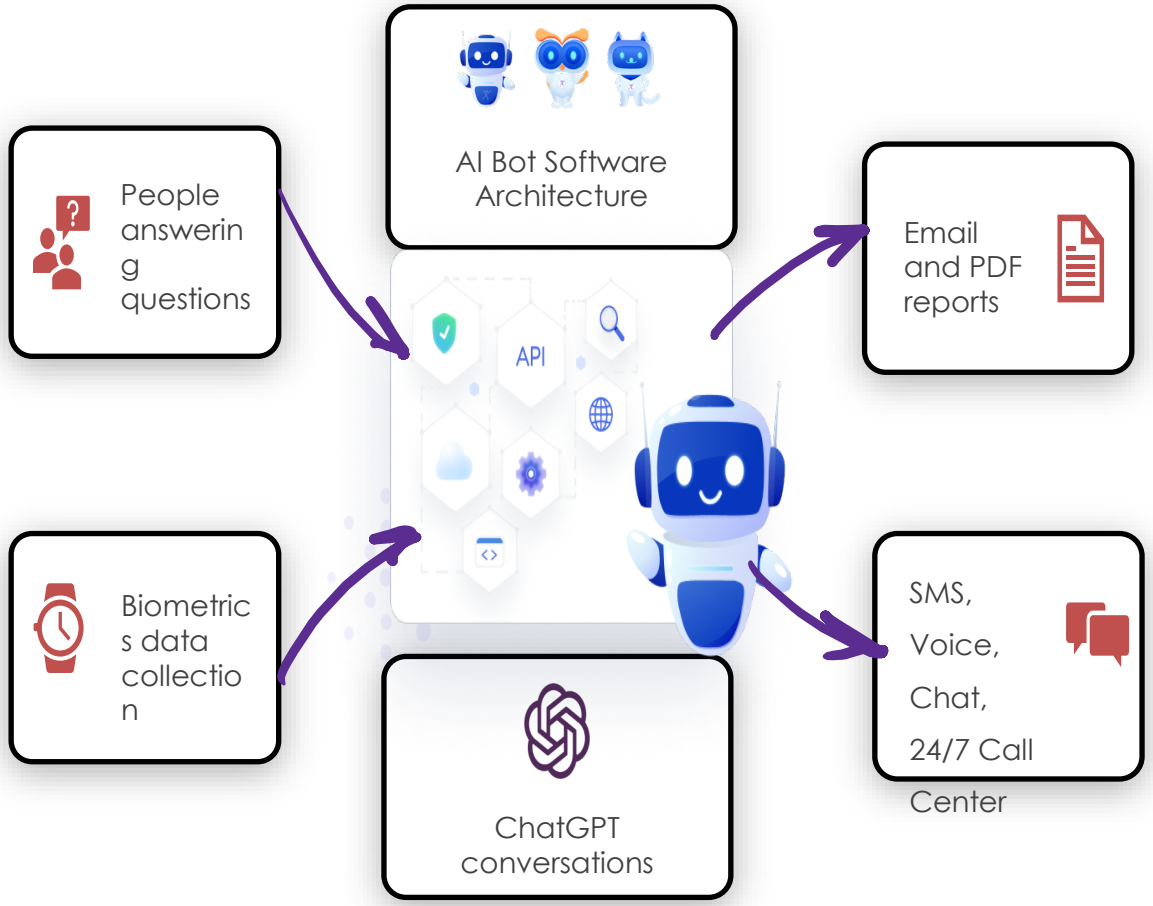
Care Daily

AREA OF NEED: A previous study by People Power Company dba Care Daily, evaluated a sensor-based in-home support system and found a significant decrease in **caregiver anxiety** in the active group as compared to the control group1. Dementia caregivers experience higher levels of anxiety than non-caregivers and anxiety is associated with **suicidal ideation**.

OPPORTUNITY: This improved RCT study substitutes 2 Apple Watches in place of 12 sensors; substitutes a 5-minute weekly voice survey in place of a 90-minute quarterly survey using Qualtrics; and upgrades wellness reports using HIPAA-compliant ChatGPT.
AI Bot Features: Alert on falls, Detect wandering, Alert with GPS location, Monitor sleep quality trends, Monitor fitness, Caregiver blog with wellness tips for caregivers in need

DATA: Participants: Goal of 40 dyads (each with family Cg and PWD). Currently 93 dyads applied, 38 dyads consented. A 4 Month Randomized Controlled Trial (RCT) is underway collecting data from 19 of 20 active caregivers who received 2 Apple Watches (for CG and PWD) and sent 5-minute weekly wellness surveys
The control group with 19 of 20 CGs did not receive Apple Watches but are sent complete 5-minute weekly wellness surveys

TECH APPROACH: Measures: Self-reported CG anxiety, depression, and well-being checked weekly using voice survey and biometrics captured with Apple Watches.
Procedure/Timeline:
July 24 through Dec 31, 2023: RCT conducted
January 2024: Data analysis and reporting



PI: Gene Wang. Contact: www.caredaily.ai

COHORT: CY1

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Balance T to Improve Balance and Reduce Fall Risk

AREA OF NEED: Falls are the leading cause of injury death among adults > 65. The Incidence of Falling is increasing over the last 10 years. Most people fall while turning or walking

OPPORTUNITY: Develop, test, and validate the use of the Balance-T to improve balance skills and reduce risk for falls of older adults at home and in the community.

DATA: Collecting data through functional outcome measures of balance and gait

TECH APPROACH: Implement means to track compliance and motion of both Balance T and body via the user's cell phone and wearable technology (i.e. smart watch).

Balance T is custom fit to each user, for height, shoulder-width, and degree of difficulty (handlebar tilt)

PI(s): Michael Schubert, PT PhD
Yuri Agrawal MD

COHORT: Pre-Frail and Robust Older Adults Community Dwelling

BALANCE EXERCISE

IMPROVE YOUR BALANCE
AND AGILITY

These exercises are designed to improve balance whether you are young, old, injured or healthy

Booklet includes 24 exercises to improve balance

Balance T enables balance training during standing and walking!

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Individualized risk evaluation of cognitive decline in a cognitively normal population

JOHNS HOPKINS
UNIVERSITY & MEDICINE

AREA OF NEED: Subjective cognitive decline (SCD) is a group at high risk for dementia, but there is no method to predict dementia outcomes on an individual basis. There are also no guidelines to prevent conversion from SCD to dementia.

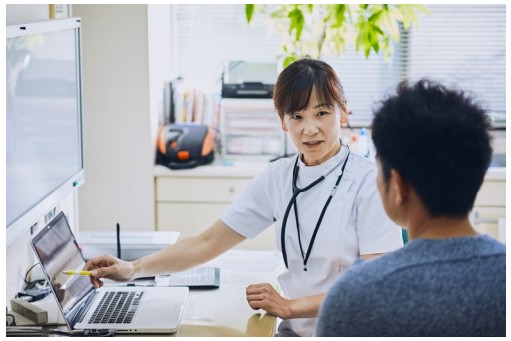
OPPORTUNITY: Develop, test, and validate machine learning models tailored for individuals with SCD to predict potential cognitive decline on a personalized basis, and to pinpoint modifiable risk factors associated with this deterioration.

DATA: Approximately 600 individuals without dementia underwent clinical evaluations, which included cognitive assessments and baseline brain MRI scans, and were subsequently monitored for 2 years.

TECH APPROACH: Measure the local brain volumes from MRI scans, which will then be integrated with clinical data, including the presence of modifiable risk factors associated with the onset of dementia. Identify brain anatomical features and clinical markers linked to cognitive decline over a two-year period. The final model will be tested on real-world clinical data to assess its relevance to a diverse clinical population.

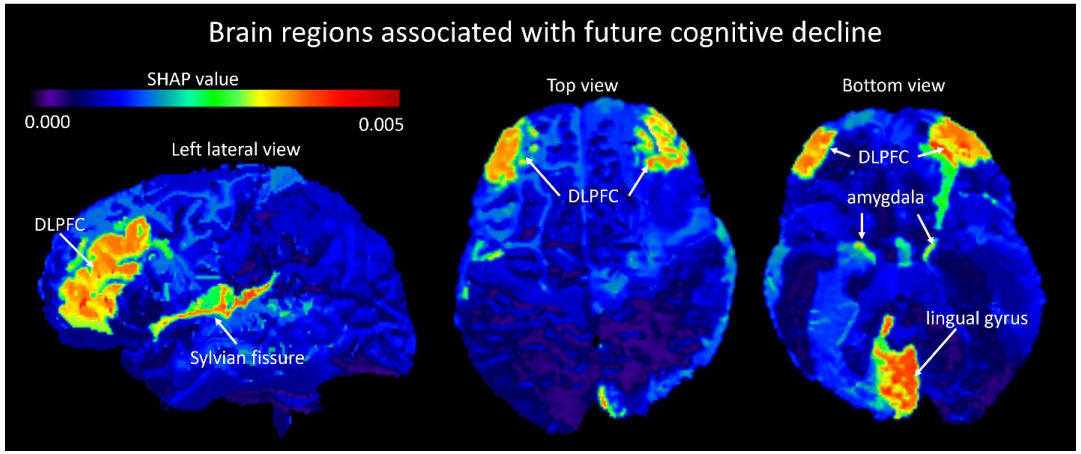
PI(s): Kenichi Oishi, MD, PhD

COHORT: GY1



Building models for risk prediction using existing data

Predicting cognitive decline
Identifying modifiable risks



Leveraging Conversational AI to Detect Cognitive Impairment and Dementia in the Home

Johns Hopkins AI & Technology Collaboratory for Aging Research

WellSaid.ai

AREA OF NEED: Few validated, scalable approaches to early detection of AD/ADRD exist, limiting potential to introduce targeted pharmacologic and lifestyle interventions

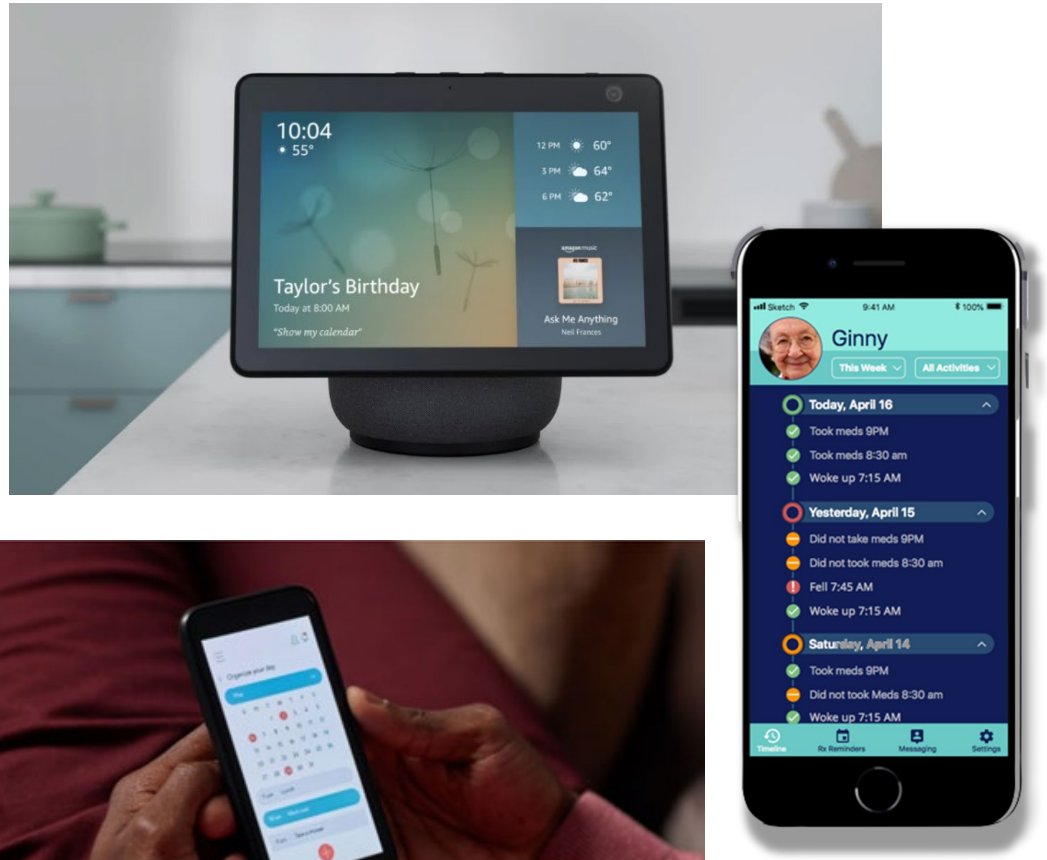
OPPORTUNITY: Develop, test, and validate machine learning models that use conversational AI to identify and accurately predict the cognitive status of older adults at home

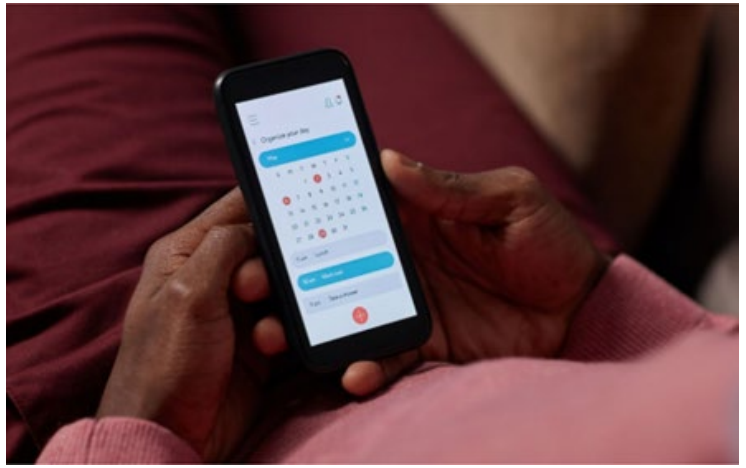
TECH APPROACH: Leverage consumer-friendly voice assistant technologies (e.g., Amazon, Google) equipped with scientifically validated, clinical-grade cognitive assessments and a personalized digital coach to provide and coordinate support

DATA: Collecting comprehensive cognitive assessment data, including raw audio data, from 160 patient-caregiver dyads

PI(s): Randall Williams, MD

COHORT: GY1





Visilant: Equitable Access to Eye Care Through Telemedicine and Artificial Intelligence

AREA OF NEED: Lack of access to cataract screening prevents disadvantaged populations from seeking care, leading to disease progression, functional limitations, and worse outcomes

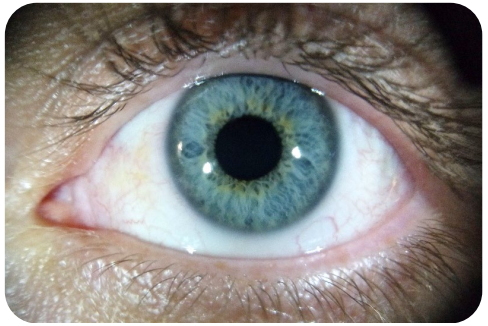
OPPORTUNITY: Develop a simple and inexpensive anterior segment imaging and telemedicine system to allow for remote eye screening facilitated by non-ophthalmologists

DATA: Project will build a database of at least 2,200 images of eyes with no cataract, immature cataract, and mature cataract and validate a diagnostic AI algorithm in 100 patients against a gold-standard exam

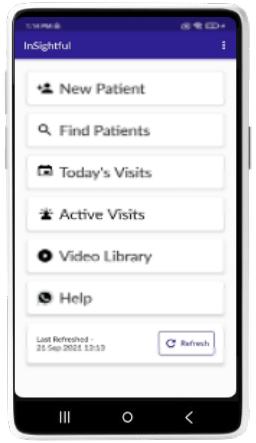
TECH APPROACH: Visilant system includes a mobile app with AI and telemedicine capabilities, a proprietary smartphone attachment for ocular imaging, and a patient management dashboard and provider portal. The ML approach uses eye segmentation, classification with a CNN, and domain adaptation technique to mitigate bias.

PI(s): Kunal Parikh, PhD
Nakul Shekhawat, MD, MPH

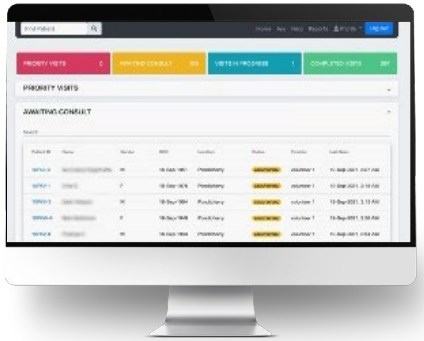
COHORT: GY1



Proprietary smartphone attachment for simple, high quality anterior segment imaging



Mobile app with AI and telemedicine capabilities



Patient management dashboard and provider portal

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COLLABORATORY
for AGING RESEARCH

Enhancing Slow-Wave Sleep in Older Adults

Sequoia

AREA OF NEED: Growing prevalence of dementia in older adults highlights a pressing need for early-stage therapies. Specifically, there's a noticeable gap in therapies targeting the underlying pathology of sleep disruptions in patients experiencing cognitive challenges.

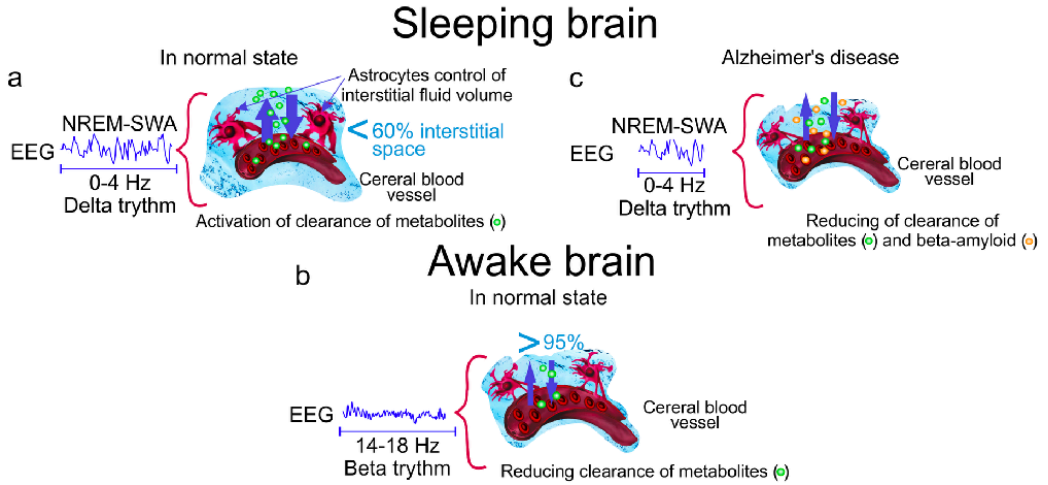
OPPORTUNITY: To take a lab-based technique, which modulates critical brain oscillations, and translate it into a non-invasive wearable technology for everyday at-home use. This technology would focus on enhancing slow wave sleep using closed-loop neuromodulation.

DATA: Collecting comprehensive sleep EEG data, from 20 older adults totaling 150 nights of data.

TECH APPROACH: The key lies in precision. By employing sound as the medium, our closed loop technology is designed to deliver precise stimulation, aiming to optimize oscillations during deep sleep, thereby enhancing its restorative effects on cognition.

PI(s): Joshua Blair, MS
Spencer Shumway, MS
Youseph Yazdi, PhD

COHORT: GY1



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AI Driven Avatar in DevaWorld, a Dementia Friendly Virtual World

mentia

AREA OF NEED: While the benefits of a person-centered care approach for people living with dementia (PLwD) are well documented, few caregivers have the time (staff shortage) or the conversational and relationship skills to fully engage with PLwD on a daily basis.

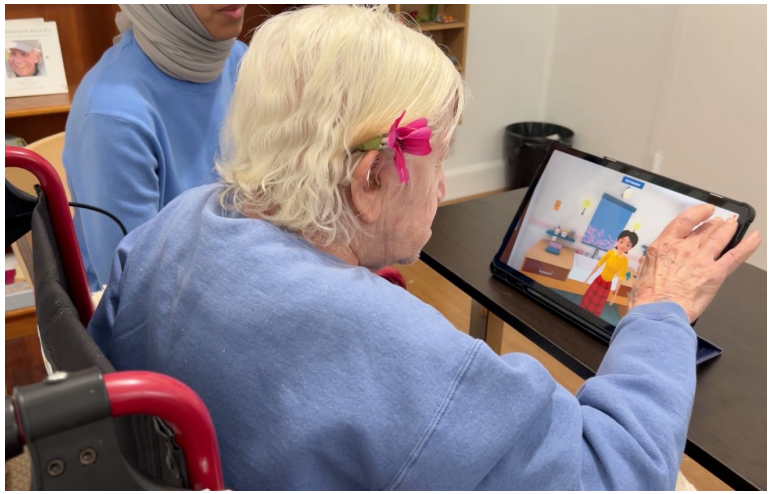
OPPORTUNITY: Develop, test, and validate a conversational AI agent to fully engage with PLwD without adding caregiver burden, nor relying on specialized caregiver skills.

DATA: Video data of PLwD using our AI version of DevaWorld, along with emotion recognition analyses and tapping patterns withing the virtual world.

TECH APPROACH: Use a mix of rule-based, statistical-based and prompt engineering approaches; integrated with speech-to-text (STT), facial and speech emotion recognition.

PI: Algis Leveckis, SM

COHORT: GY1



Artificial Intelligence Algorithm to Improve Palliative Care of Alzheimer's Patients

JOHNS HOPKINS AI & TECHNOLOGY COLLABORATORY for AGING RESEARCH

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH
CENTER FOR POPULATION HEALTH INFORMATION TECHNOLOGY

AREA OF NEED: Providing adequate palliative care for individuals with AD/ADRD presents numerous challenges such as determining a patient's status on the AD/ADRD disease course, creating need for improved methods of identifying patients who would benefit from timely palliative care (PC) in the community.

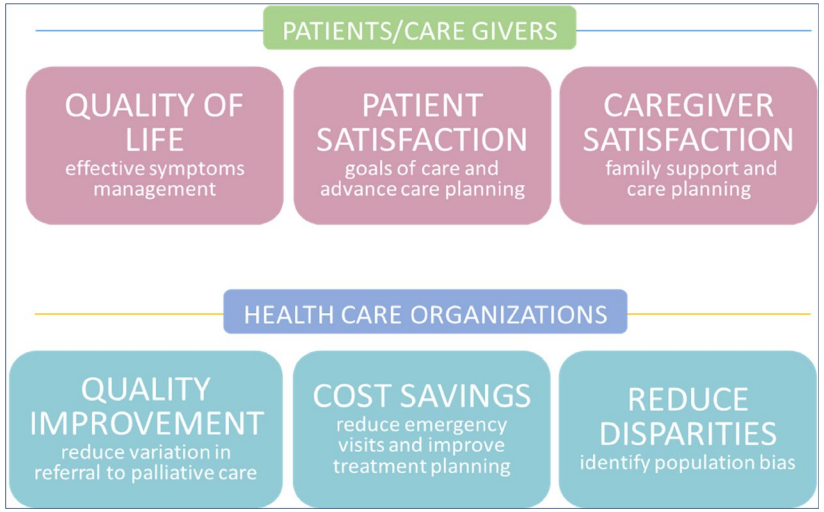
OPPORTUNITY: Develop and validate machine-learning predictive models to identify AD/ADRD patients who are likely to benefit from PC assessment.

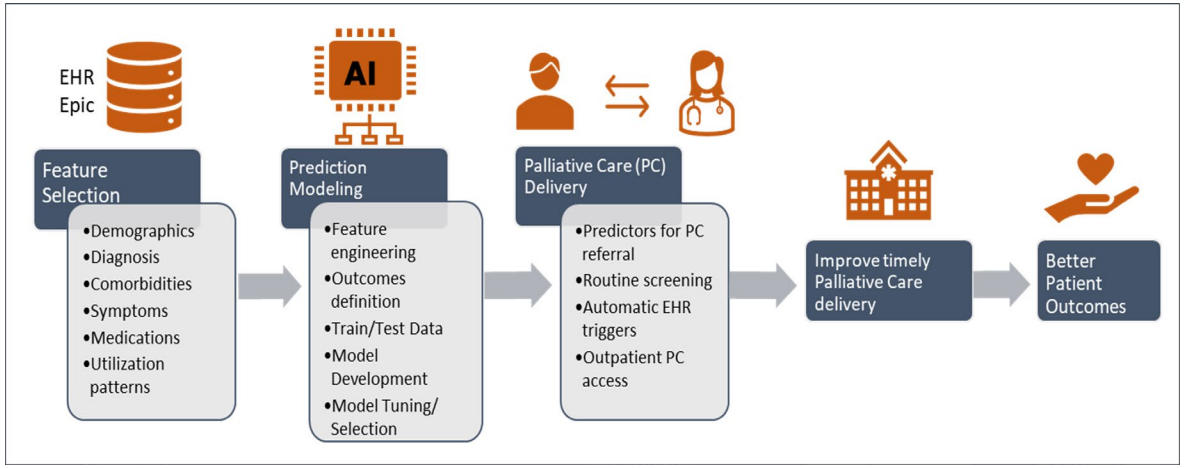
DATA: Electronic health record (EHR) data of patients with AD/ADRD receiving care in the Johns Hopkins Health System over 2017–2021.

TECH APPROACH: ML prediction algorithm incorporating rich clinical information available in EHR data from academic healthcare system to identify persons with AD/ADRD who would most benefit from PC, and its impact on healthcare utilization outcomes and disparities in PC delivery.

PI(s): Chintan J. Pandya MD, PhD
Jonathan Weiner, DrPH

COHORT: GY1





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Quantifying the features and predictors of cognitive fluctuation in Alzheimer's Disease and MCI

AREA OF NEED: Cognitive fluctuations, defined as spontaneous alterations in attention, arousal, and cognition, have been assessed anecdotally. However, the exact features and causes of cognitive fluctuations are still unclear.

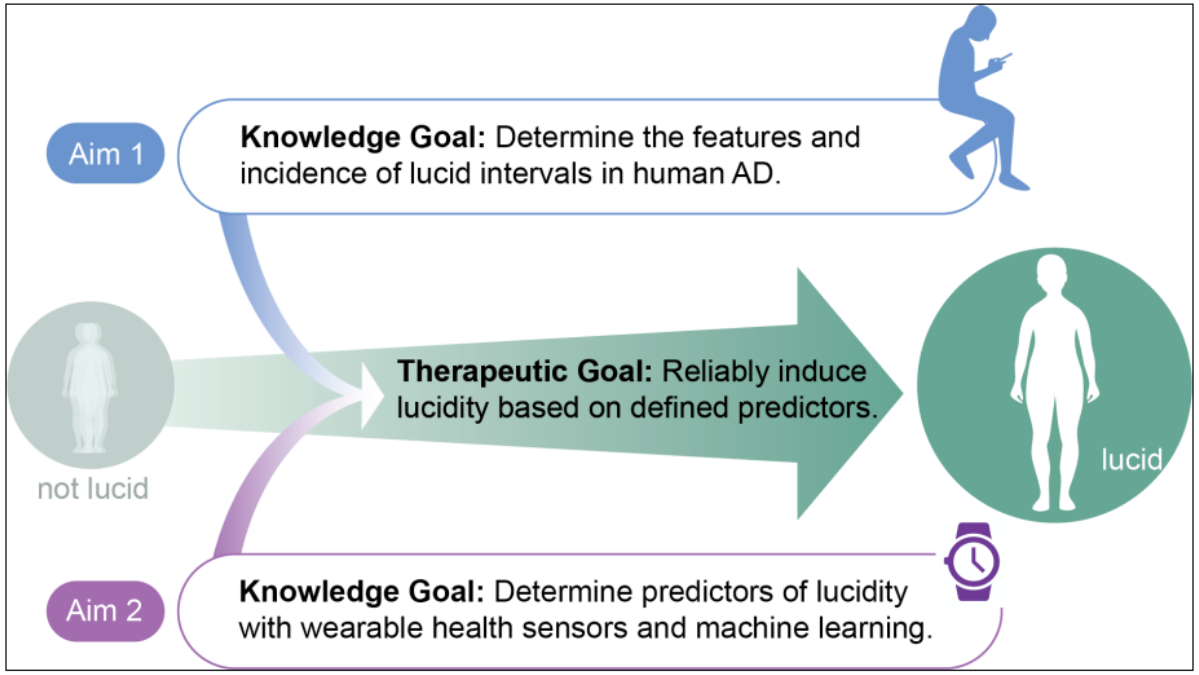
OPPORTUNITY: Ecological momentary assessments is crucial to determining the features of cognitive fluctuations by remotely measuring memory, attention, and other executive functions.

DATA: Collecting comprehensive cognitive assessment data, including raw audio data, from 90 patient-caregiver dyads (30 dementia, 30 MCI, 30 Control)

TECH APPROACH: Utilizing a three-dimensional view of cognition that combines tablet-based cognitive testing and caregiver reports with monitoring of biomarkers with wearables.

PI(s): Kishore Kuchibhotla, Ph.D

COHORT: GY1



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EZ-Aware: Digital Twin for Wearable-Enabled, AI-Supported Detection of Cognitive Impairment

EZ-Aware

AREA OF NEED: "Baby boomers" (55+) make up 30% of the U.S., or 97.5 million people. As this generation ages, the prevalence of Alzheimer's disease (AD) and related dementias (ADRD) in the U.S. is projected to surge to 12.7 million by 2050. Subjective cognitive decline (SCD) is an early ADRD symptom. While 50-80% of those 65+ report decline, fewer than half are confirmed with impairments, highlighting the urgency for accessible and precise MCI screening methods.

OPPORTUNITY: Develop and test an accessible digital health platform supported by digital twin models for monitoring of cognitive and behavioral functions in older adults' everyday environments.

DATA: A 6-week study on 30 older adults, collecting comprehensive active and passive daily life data (using an app connected to a wearable) on cognitive and behavioral functions.

TECH APPROACH: Integrating smart wearables and schedulable cognitive and behavioral assessments at home provides quality of life datasets used for personalized insights on an individuals ongoing cognitive status.

PI(s): Kunal Mankodiya, PhD

COHORT: GY2

Neuroanatomic validation of digital voice

AREA OF NEED: Digital voice recordings offer novel capabilities with great potential for early detection of cognitive and associated functional change.

OPPORTUNITY: For voice technologies to reach wide adoption, one needs to systematically validate them against known markers of disease and identify the settings where they confer benefit over existing modalities.

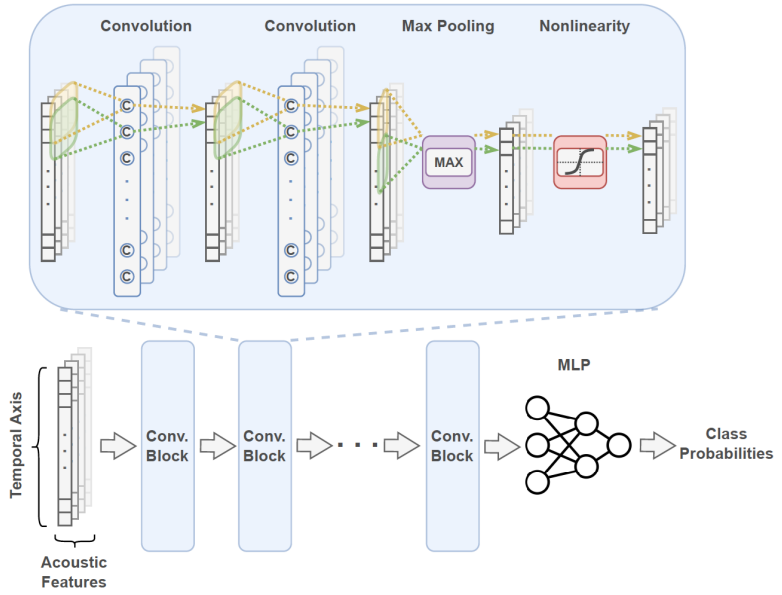
DATA: Our access to thousands of voice recordings, MRI, and pathology data from the Framingham Heart Study puts us in a unique position to build and validate voice-based technologies.

TECH APPROACH:

- We are developing interpretable and generative deep learning approaches to assess cognition from digital voice recordings.
- We have recently formed Vakta.ai, a spin-out from Boston University, which is commercializing our technology.

PI(s): Vijaya B. Kolachalama, PhD
Rhoda Au, PhD

COHORT: GY2



Schematic of our deep learning framework used for assessing cognition on voice recordings.

[1] Karjadi et. al., 2023. Journal of Alzheimer's Disease

VAKTA AI-Driven ASR and NLP platform

transcription	diarization	translation	prediction
high quality speech-to-text conversion with time-stamped words	categorize audio content by identifying different speakers	multi language support for speech-to-text, text-to-text translation	text summarization, sentiment analysis, assessment of cognitive status

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A Novel Insole Solution Used in Daily Life to Identify and Mitigate Falls and Frailty

Walk With Path.

AREA OF NEED: Need for real-time data providing insight in how to treat or track fall risk. Falls are associated with immobility, mortality, and decreased independence; 1 of 4 individuals over 65 years old suffers a fall each year.

OPPORTUNITY: Validate a new portable pressure sensing insole technology, enabling more efficient and effective collection of clinically relevant balance data to predict and treat falls in the elderly.

DATA: Collect gait and balance data from 50 individuals > 50 years old and compare insole data to gold standard. Conduct focus groups to validate usability of data.

TECH APPROACH: AI algorithms will be used to develop fall risk classification models utilizing insole data and gold standard parameters. The data will be utilized to develop a protocol for remote therapeutic monitoring to assist in the prevention of falls.

PI(s): Linda Denney, PT, PhD, MAppSc (Manip)
Dan Peterson, PhD

COHORT: GY2

Geriatric Functional Assessment System Using Passive Wearable Sensing and Deep Learning

JOHNS HOPKINS AI & TECHNOLOGY COLLABORATORY for AGING RESEARCH

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

UMass Boston

AREA OF NEED: Clinics do not routinely assess physical function, and survey assessments that are used by some are subject to recall and measurement bias

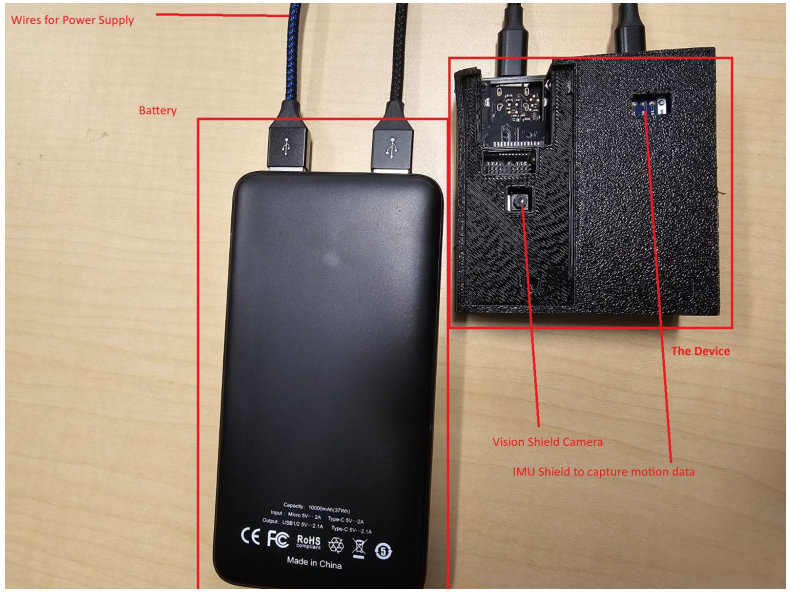
OPPORTUNITY: Develop, test, and validate a wearable device that will accurately assess physical function of older adults

DATA: The device is used to capture video images and collect motion data of an individual as they perform a series of physical function assessments while wearing the device

TECH APPROACH: An Arduino Vision Shield is used to capture images, and an Arduino IMU Shield for collecting motion data

PI(s): John A. Batsis, MD
Xiaohui Liang, PhD

COHORT: GY2



JOHNS HOPKINS AI & TECHNOLOGY COLLABORATORY for AGING RESEARCH

Machine learning to predict post-COVID-19 cognitive decline and dementia

JOHNS HOPKINS SCHOOL of MEDICINE

AREA OF NEED: COVID-19 illness may increase the risk for Alzheimer's Disease. There is a pressing need to develop novel, accessible, sensitive methods of predicting post-COVID-19 cognitive decline and dementia risk in order to allow for early detection and intervention

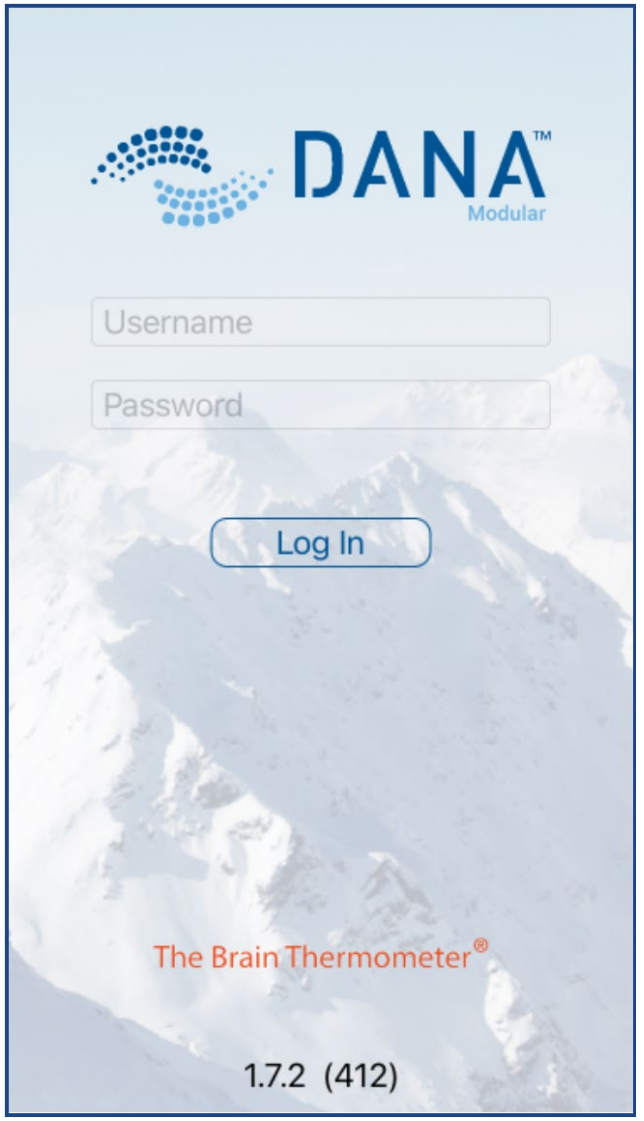
OPPORTUNITY: Utilize remote, app-based measurement of cognition to develop a more accurate, reliable, and accessible method to detect and predict cognitive dysfunction and dementia risk

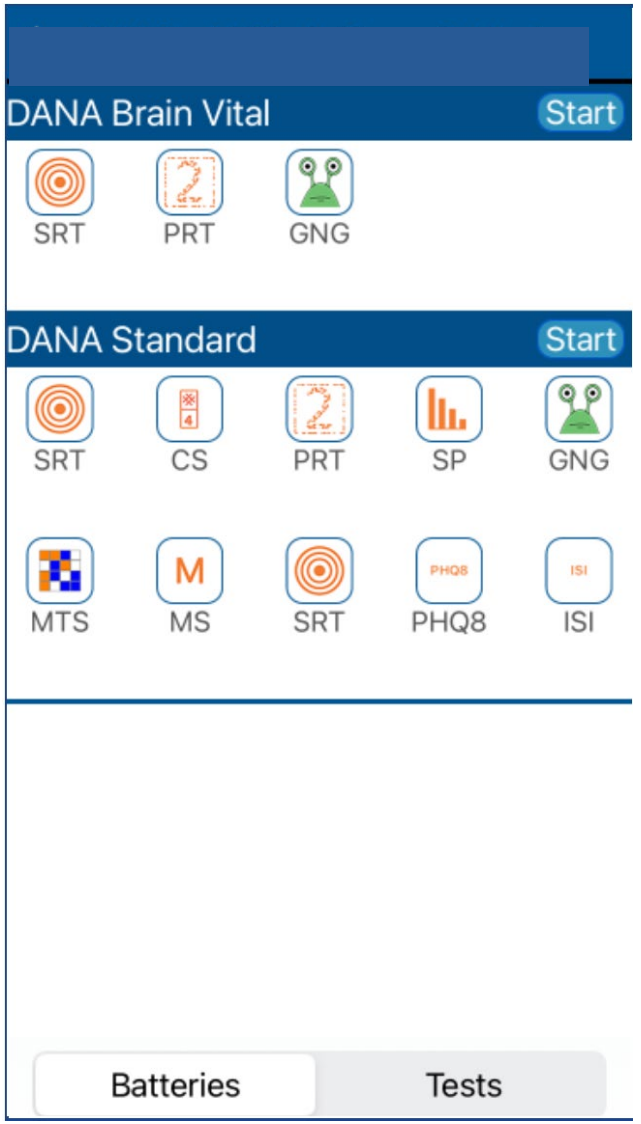
DATA: Collecting (1) longitudinal app-based cognitive data, (2) validated symptom inventories, and (3) electronic medical record data from 120 older adults following COVID-19 illness

TECH APPROACH: Applying machine learning to the DANA app's rich, high-frequency, high-sensitivity data to develop sensitive predictive algorithms

PI(s): Tracy Vannorsdall, PhD

COHORT: GY2





Automatic Assessment of Neuropsychiatric Symptoms Using Non-Intrusive Contactless Ambient Intelligence Technologies

Johns Hopkins AI & Technology Collaboratory for Aging Research

Stanford University

AREA OF NEED: Neuropsychiatric symptoms (NPS) in dementia patients are often missed due to subjective assessments based on clinician observation and caregiver interviews. Accurate methods for assessing and monitoring NPS are urgently needed.

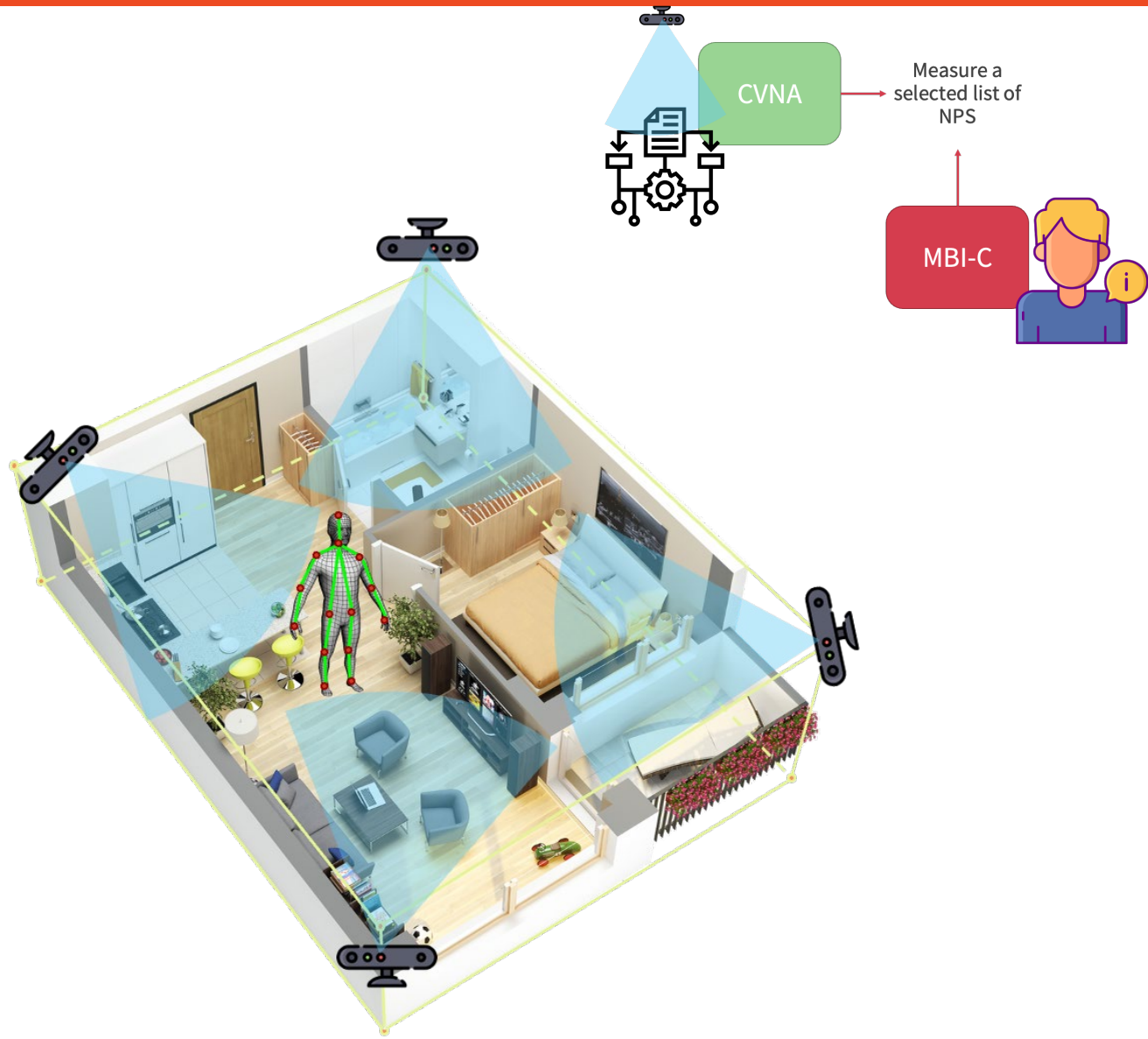
OPPORTUNITY: With better detection of not only NPS, and the more pervasive Mild Behavioral Impairment, there is potential to improve care and optimize the quality of life for patients at risk of MCI and AD.

DATA: We are recruiting participants with a history of behavioral changes and installing sensors in their homes to monitor their NPS for up to 90 days.

TECH APPROACH: We will develop a Computer Vision NPS Assessment (CVNA) system using ambient intelligence to provide objective and personalized detection of NPS subsyndromes across the preclinical and clinical spectrum of dementia. To quantify NPS, we adopt the Mild Behavioral Impairment Checklist (MBI-C).

PI: Ehsan Adeli, PhD
Co-Is: Christine Gold, PhD; Vankee Lin, PhD, RN

COHORT: GY2



EyeControl AI: Detecting and Managing Delirium to Reduce Cognitive Decline in Older ICU Patients

Johns Hopkins AI & Technology Collaboratory for Aging Research

eyecontrol INSPIRING COMMUNICATION

AREA OF NEED: Delirium in ICU patients, especially older adults, is a major problem resulting in poor outcomes including increased mortality, longer hospital stays, higher rates of cognitive decline, and increased healthcare costs. Effective communication and reorientation interventions can help reduce delirium.

OPPORTUNITY: Test the EyeControl communication device and AI platform to detect delirium using an automated CAM-ICU and manage delirium through frequent communication and orientation messages in ICU patients.

DATA: Demographic, clinical, delirium assessment (CAM-ICU), cognition (IQCODE, MoCA), and satisfaction data will be collected on 30 older ICU patients using EyeControl at Johns Hopkins Bayview Medical Center.

TECH APPROACH: The EyeControl wearable eye-tracking device and AI platform will enable ICU patients to answer orientation questions and receive communication interventions. The automated CAM-ICU will be compared to standard assessments to evaluate accuracy. Delirium duration, cognitive outcomes, and satisfaction will be assessed.

PI(s): M. Haroon Burhanullah, MD Paul B Rosenberg, MD

COHORT: GY2

Predicting Fall Risk in Older Adults Using Machine Learning

AREA OF NEED: Early detection of cognitive decline through the use of interventional phenotyping can support preventive action to preserve brain health and mitigate fall risk

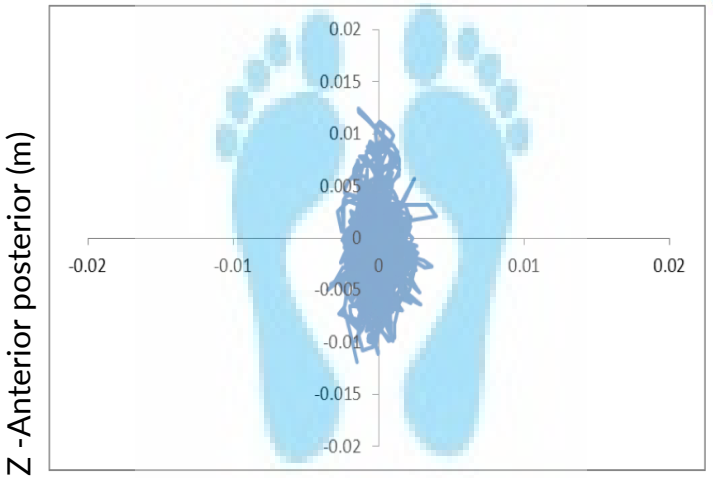
OPPORTUNITY: Use point of care data to create an algorithm to predict falls and provide real time feedback to clinicians

DATA: Balance data with eyes open and closed will be collected while performing intake vitals in the HSC clinic for older adults on all patients to create the predictive algorithm.

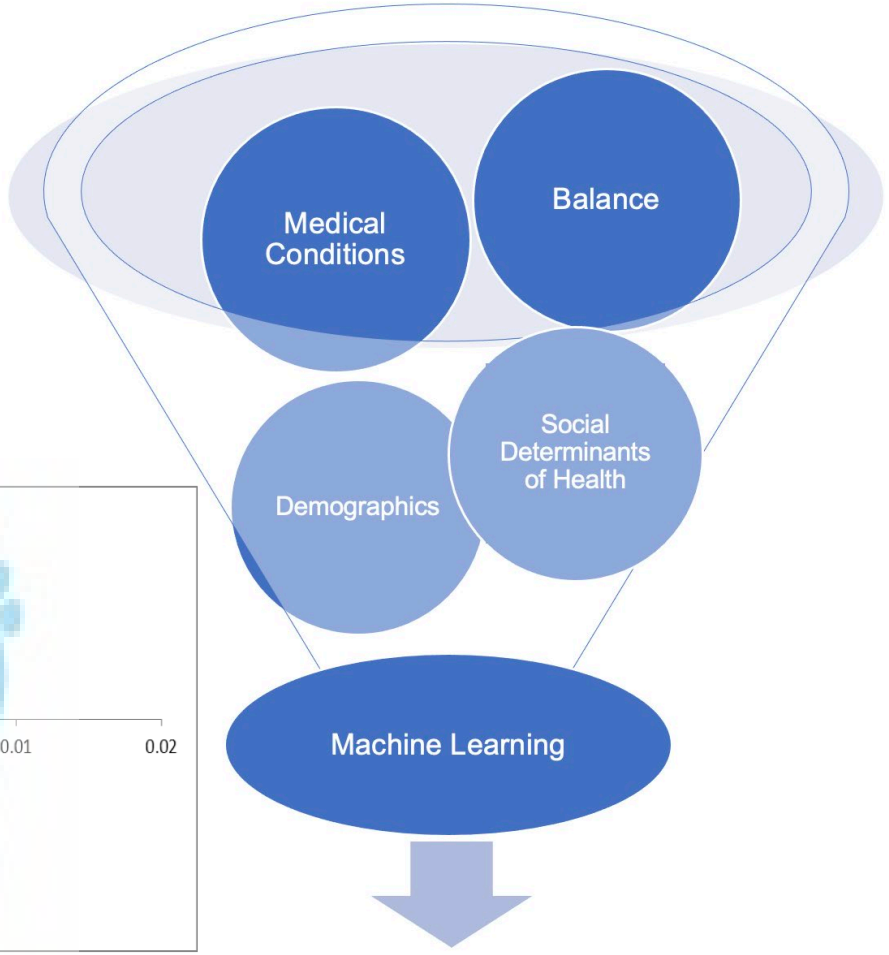
TECH APPROACH: Beyond standard supervised ML predictive models, the data collected will be used to generate an unsupervised autoencoder network that learns statistical relationships between demographics, medical comorbidities, balance variables, and falls that can be used for anomaly detection, missing data inference, and improved prediction using the latent representational learned.

PI(s): Rita M. Patterson, PhD, Mark Albert, PhD., Kathlene Camp, MPT, DPT, Kim Fulda, Dr. P.H., Janice Knebl, DO, MBA.

COHORT: GY2



Quiet standing sway plot



Fall Risk at Point of Care

JOHNS HOPKINS
AI & TECHNOLOGY COLLABORATORY *for* AGING RESEARCH

Picasso Intelligence: Improving Mobility for Dementia Alleviation in Older Adults via AI-Powered Affordable Exosuits

AREA OF NEED: Reduction in physical activity have detrimental effects on the health of older adults as it initiates a cycle of declining health which increases the risk of Alzheimer's disease and related dementias (ADRD)

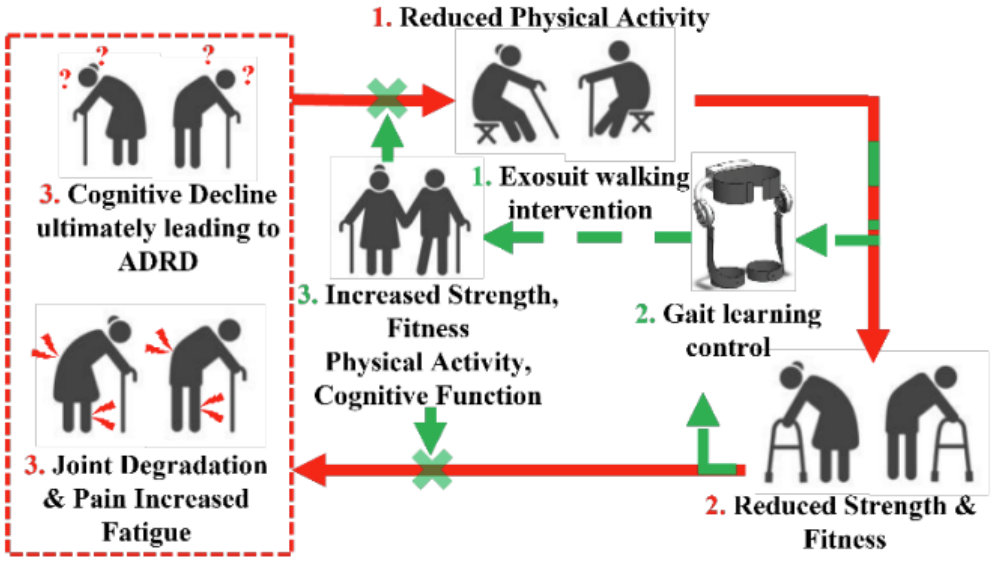
OPPORTUNITY: Leverage lightweight and affordable exosuits in concert with learning-based personalized control to promote physical activities in everyday settings and ultimately decrease the risk of cognitive decline which leads to dementia in older adults.

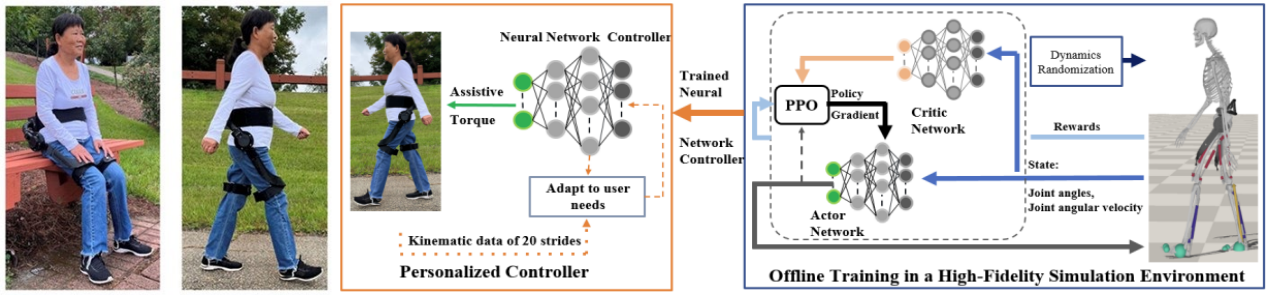
DATA: Analysis will be on data collected in human studies in community settings involving 20 older adults aged 65+ over 9 visits.

TECH APPROACH: Deep reinforcement learning framework with the actor-critic method and high-fidelity musculoskeletal modeling method to automatically train the exosuit controller to generate continuous assistive torque during versatile activities common in community settings

PI(s): Chien-Ming Huang, PhD Hao Su, PhD, Junxin Li, PhD

COHORT: GY2





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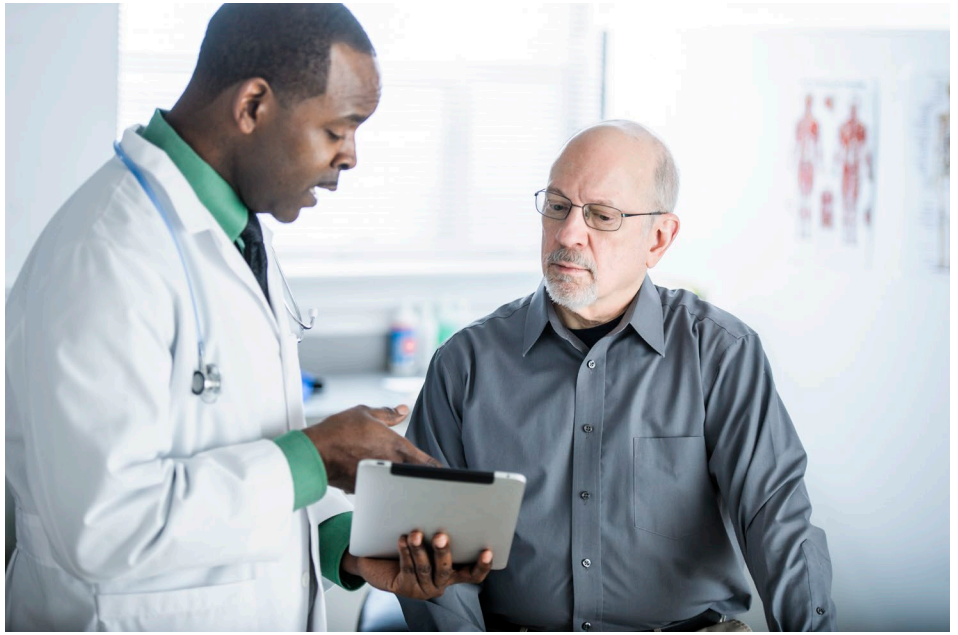
Smart Rep, Smart Automation to Respond to Patient portal messages

AREA OF NEED: GPT is increasingly used in healthcare messaging. Thoughtful application of GPT in messaging related to ADRD may be beneficial, as care partners are neither routinely identified nor well supported.

OPPORTUNITY: Develop and test "Smart Rep", which optimizes responses to patient portal messages to both increase recognition of care partners, and support care partners with vetted content and resources.

DATA: Patient portal messages sent from persons with dementia and their care partners, and qualitative data collected from interviews

TECH APPROACH: Through prompt engineering, guide GPT to a) recognize when a care partner has authored a message on a patient's behalf, and b) draw on vetted ADRD best practices and care resources



PI(s): Kelly T. Gleason, PhD, RN

COHORT: GY3

JOHNS HOPKINS
AI & TECHNOLOGY COLLABORATORY *for* AGING RESEARCH

ADPIE: Deep phenotyping of people with AD using portable integrated equipment

AREA OF NEED: Most digital biomarkers do not leverage the potential complementarity of multiple measures. Also, most approaches are developed in laboratory conditions, ill-suited for deployment to clinical spaces.

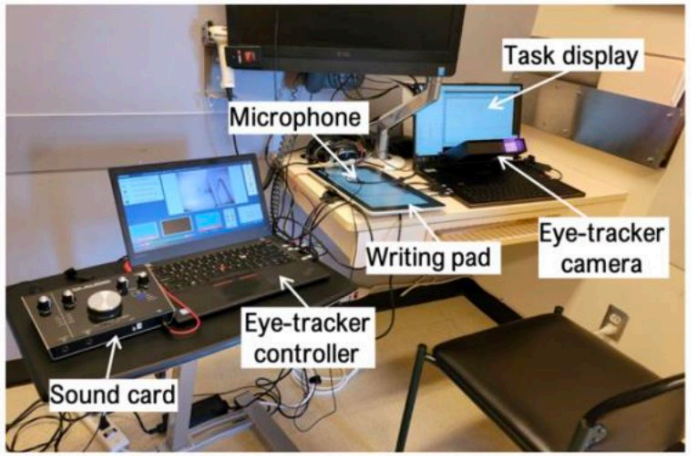
OPPORTUNITY: Validate the feasibility of portable integrated equipment (PIE) to obtain multimodal digital biomarkers of AD.

DATA: Collecting eye movement, speech, and handwriting in PIE and also laboratory conditions, from 120 participants.

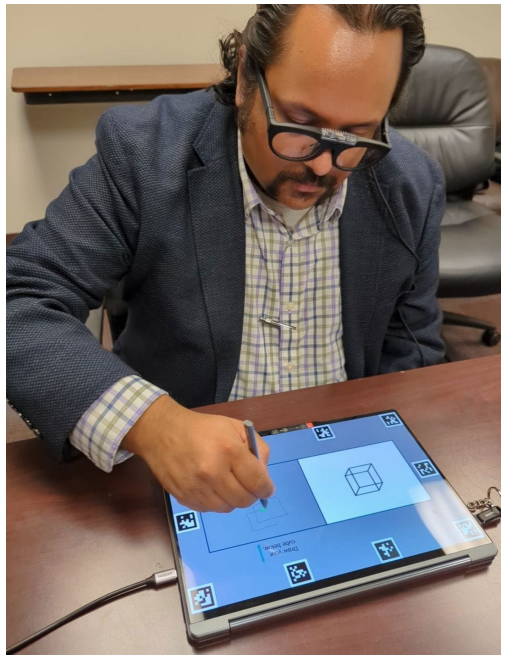
TECH APPROACH: A multimodal platform integrating an eye-tracker, microphone, and digital pad. Multimodal physiological measurements are analyzed after recording to provide digital biomarkers specific of AD.

PI(s): Laureano Moro-Velazquez, PhD

COHORT: GY3



High Precision Equipment



Portable Integrated Equipment

JOHNS HOPKINS
AI & TECHNOLOGY COLLABORATORY *for* AGING RESEARCH

AI Enhanced Scheduling to Enable an Affordable Neighborhood Model for In-Home Caregiving

AREA OF NEED: The number of seniors in need of home care exceeds the workforce of caregivers by 6:1. Current staffing models are inefficient and unaffordable resulting in a growing gap group of 18 million seniors without the ability stay healthy at home and stressing the nation's healthcare finances, private assets, and employers of family caregivers.

OPPORTUNITY: The neighborhood model of home care improves efficiency by enabling a caregiver to assist 15-20 seniors at more affordable costs. By developing the AI optimization models to automate the complex and dynamic scheduling processes, the neighborhood model can be scaled repeatedly to help more seniors and facilitate mobile connectivity for the entire caregiving team, including family and professionals.

DATA: Analyze a sampling of de-identified data about routes and tasks for a hypothetical neighborhood of seniors. Develop optimization models to increase the efficiency of care by minimizing travel and downtime.

TECH APPROACH: Develop mixed-integer optimization models, test and validate the optimized model vs. the hypothetical model and identify the magnitude of improvement and reduction of cost. Embed the automation into the digitized process of scheduling and dynamic capacity management to make operating a neighborhood consistently replicable.

PI(s): Dew-Anne Langcaon, CEO Vivia Cares
Kimia Ghobadi, PhD Johns Hopkins

COHORT: GY3

Vivia

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AI for predicting adverse health events in the elderly population using wearable devices

MTN

AREA OF NEED: Limited ability to continuously monitor and predict adverse health events in elderly patients, particularly in resource-constrained acute care settings, leading to delayed interventions and suboptimal outcomes.

OPPORTUNITY: Develop and validate AI-driven monitoring solutions that can continuously assess patient status and predict adverse events, enabling early intervention and improved care management for elderly patients.

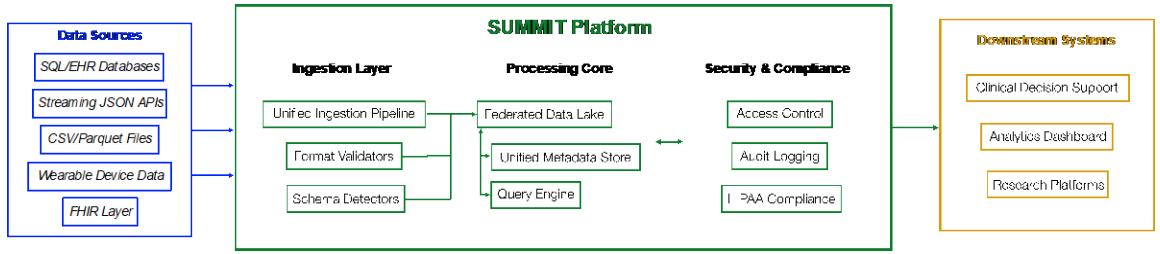
DATA: Leveraging our SUMMIT data engine to process real wearable device data and simulated wearable data and develop machine learning models for real-time health monitoring and prediction, with focus on multimodal integration of various data types (waveforms, tables, clinical notes).

TECH APPROACH: Working with MIMIC III waveform dataset, simulated data, and planning to collect additional data at two pilot sites, focusing on continuous physiological signals and clinical events. Using simulated data to augment data during training and evaluate foundation models for adaptation to physiological time series.

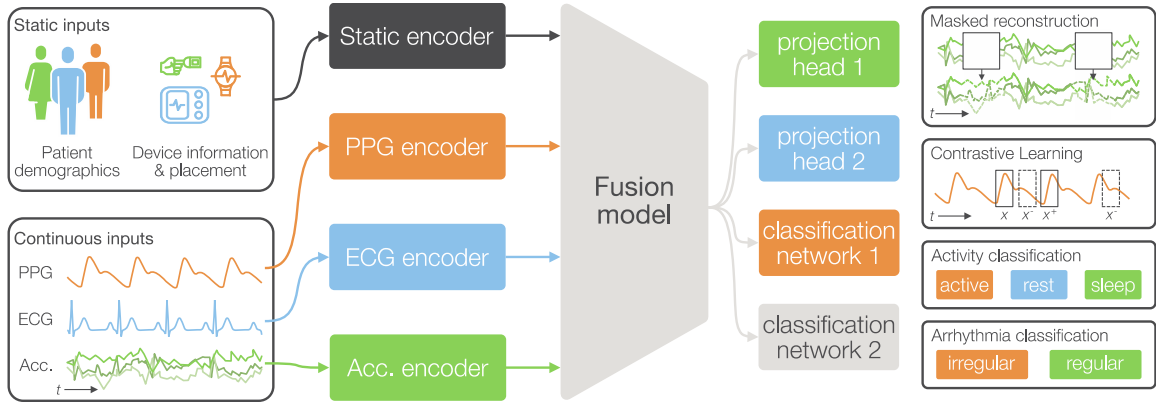
PI(s): Matthias Christenson, PhD

COHORT: GY3

MTN SUMMIT STACK



TRAINING APPROACH



Characterizing and Stratifying Cognitive Impairment Using Cognitive and Speech AI

Johns Hopkins AI & Technology Collaboratory for Aging Research

Mass General Brigham McLean

AREA OF NEED: Diagnostic approaches for characterizing AD/ADRDs rely on dichotomous “mild” versus “major” neurocognitive disorder categories, limiting the ability to capture subtle individual differences and develop more nuanced stratification of AD/ADRDs.

OPPORTUNITY: Develop precise, scalable methods to capture baseline cognitive abilities using “gold standard” neuropsychological tests and remote digital tools to capture fluctuations in cognitive status.

DATA: Collect baseline neuropsychological data at a single timepoint, along with cognitive and speech EMA, and actigraphy monitoring 6 times over 1 month.

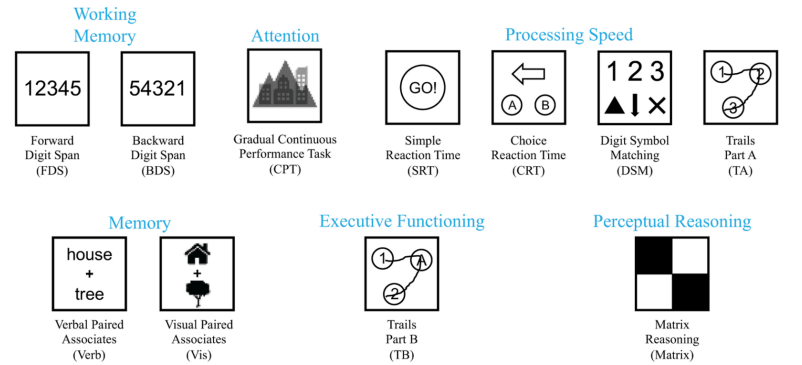
TECH APPROACH: Combine gold standard neuropsychological testing with real-time digital assessments to capture within- and between-person variability, leveraging AI/ML/NLP algorithms (IBM Digital Health) to refine diagnostic accuracy and support clinical decision-making.

PI(s): Shifali Singh, Ph.D.

COHORT: GY3

Cognitive EMA

Using TestMyBrain



Speech EMA

Please click the microphone button and then say:
"The quick brown fox jumps over the lazy dog."
You may press the Stop button if you finish before the timer runs out.

00:10

Smartphone-Based Fall Prevention Therapy and Monitoring for Older Adults

Johns Hopkins AI & Technology Collaboratory for Aging Research

Beth Israel Lahey Health Beth Israel Deaconess Medical Center

brightway

AREA OF NEED: Falls are among the greatest threats to healthy aging. Fall-prevention physical therapy programs may be effective, but suffer from limits in accessibility, scalability, and personalization.

OPPORTUNITY: Develop, validate, and test automated delivery of balance assessments and fall prevention exercises using the Brightway PT mobile application.

DATA: Collecting movement data for balance assessments and fall prevention exercises, as well stakeholder input and user testing.

TECH APPROACH: Leverage computer vision models on the Brightway PT platform, validate with laboratory-grade motion analysis, and prototype personalized real-time feedback for automated support to users.

PI(s): Dennis Anderson, PhD (BIDMC)
Yannick Coehn (Brightway Health)

COHORT: GY3

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YayaGuide: AI-Enabled Personalized Training for Caregivers of Elders with ADRD

AREA OF NEED: The demand both for skilled caregivers and for upskilling family caregivers is at an all-time high

OPPORTUNITY: The mission of YayaGuide by CareYaya is to expand access to quality care by empowering caregivers of those living with dementia.

DATA:

TECH APPROACH: YayaGuide addresses this critical unmet need by harnessing the power of AI and micro-learning to provide personalized, engaging training at caregivers' fingertips – essentially, creating the "Duolingo of dementia care training". Coupled with conversational agents and machine learning for personalization, micro-learning can make training highly accessible for time-strapped caregivers. It also promotes knowledge retention versus traditional learning formats.

PI(s): Neal Shah

COHORT: GY3

JOHNS HOPKINS
AI & TECHNOLOGY COLLABORATORY *for* AGING RESEARCH

Frailty subtyping to identify paths to healthy aging

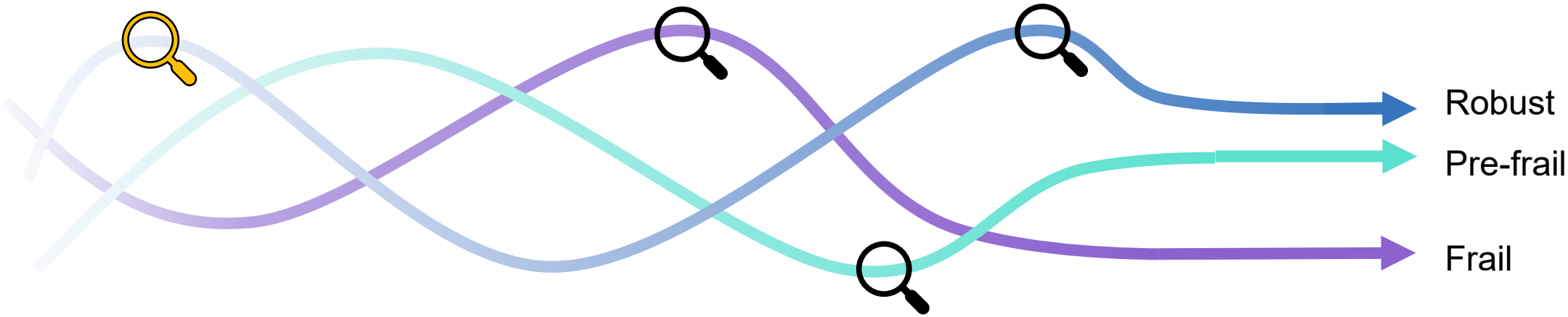
Area of Need: Everyone experiences aging uniquely, however we model frailty uniformally. A tailored approach to modeling frailty will facilitate the identification of personalized interventions to promote healthy aging.

Opportunity: In collaboration with the Rush Alzheimer's Disease Center, we have access to longitudinal data on over 5,000 individuals capturing aspects of their physical, cognitive, and social wellbeing over time.

Approach: We will develop an AI model to identify and predict frailty subtypes and characterize them macroscopically and molecularly. Clinicians may use our model to guide people toward a healthier state.

PI: Dr. Rebecca Keener

Cohort: GY4



Early prediction of frailty risk

Critical points of subtype determination

JOHNS HOPKINS
AI & TECHNOLOGY COLLABORATORY *for* AGING RESEARCH

In-Home Assessment of Muscle Deterioration with AI-Enhanced Smartphone Sonometry

AREA OF NEED: Sarcopenia affects 6-22% of older adults, leading to muscle loss, falls, and hospitalizations. Current assessments are infrequent, require clinical visits, and miss early signs of deterioration.

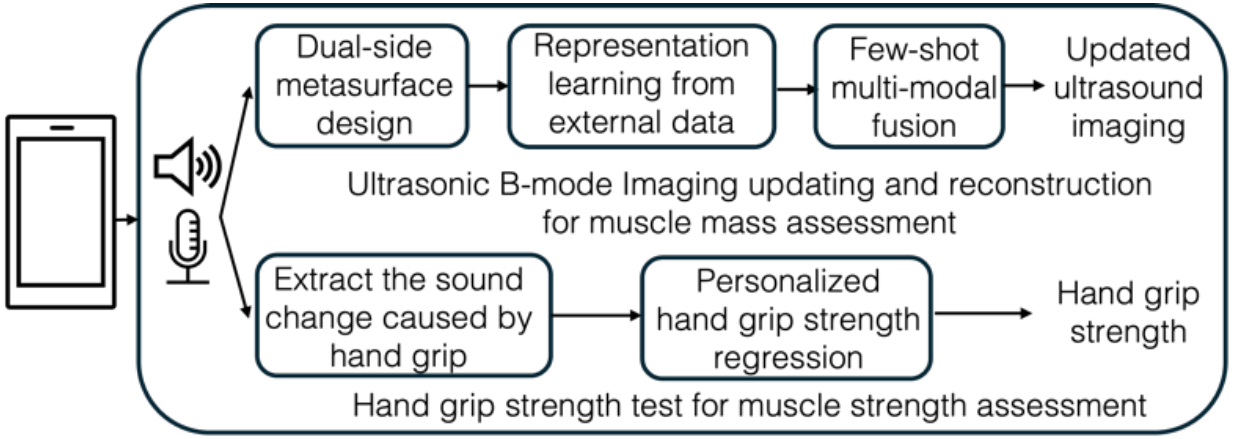
OPPORTUNITY: MusTrack enables in-home, frequent, and cost-effective muscle assessments. It allows early detection, longitudinal monitoring, and reduces healthcare costs by eliminating the need for specialized equipment.

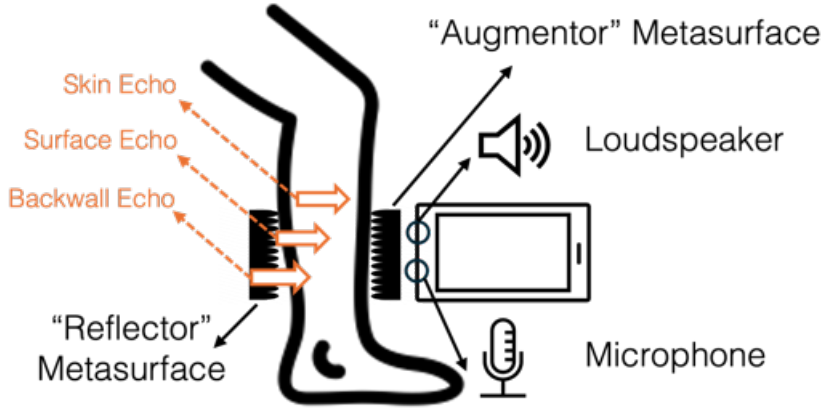
DATA: Collecting ultrasound B-mode imaging and smartphone ultrasound sonometry for muscle assessments

TECH APPROACH: AI-enhanced smartphone sonometry uses metasurfaces and 3D printed cases for ultrasound sonometry. CycleGAN updates outdated B-mode imaging, while personalized models adapt handgrip strength tests to different users and devices.

PI(s): Renjie Zhao, PhD (JHU)
Xinyu Zhang, PhD (UCSD)

COHORT: GY4





Expanding Epigenetic Analysis of Aging and AD/ADRD through Machine Learning

AREA OF NEED: Due to technical challenges, histone modifications are typically not experimentally profiled or considered in cohort-based studies of aging and AD/ADRD

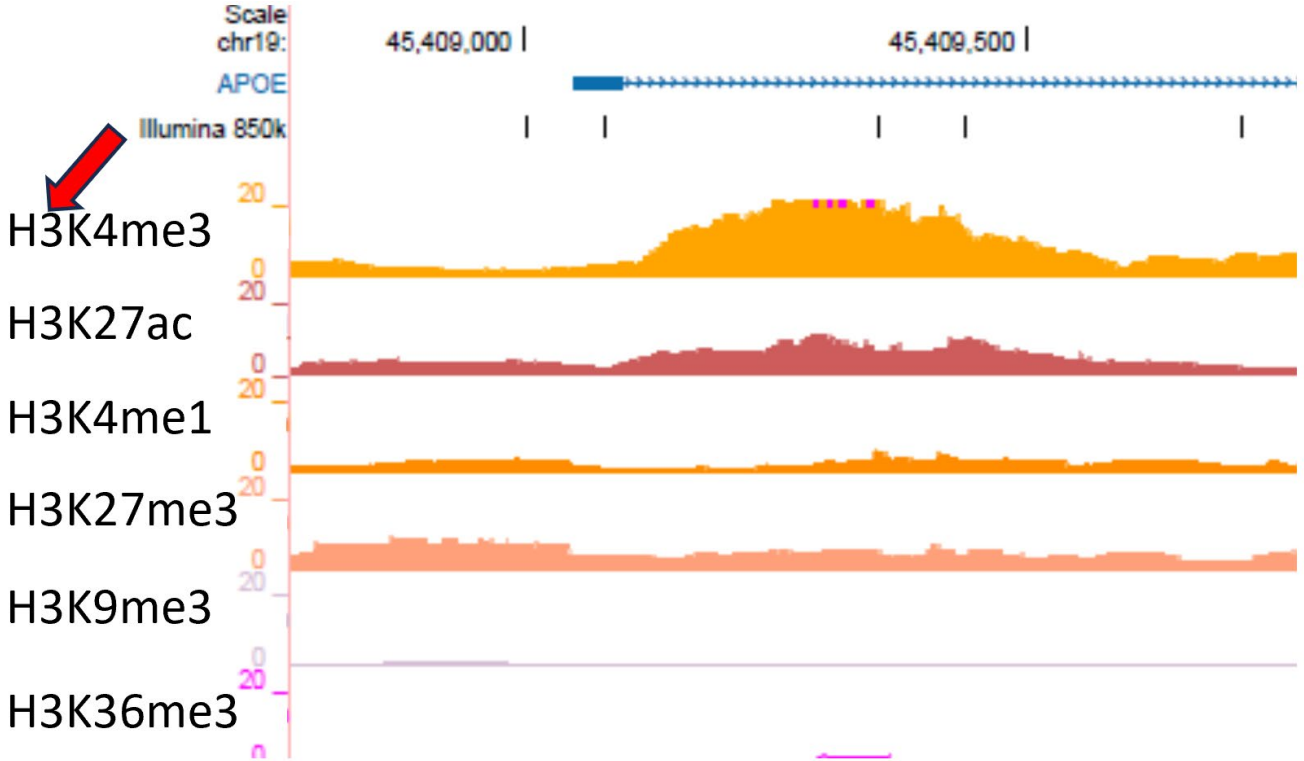
OPPORTUNITY: There is the opportunity to computationally impute histone modification maps based on cohort DNA methylation array data and reference epigenomic data to study the biology of aging and AD/ADRD

DATA: We will leverage reference epigenomic data from the International Human Epigenome Consortium and cohort methylation array data focused on aging and AD/ADRD

TECH APPROACH: We will investigate multiple machine learning strategies to impute histone modification maps from array DNA methylation. We will conduct histone wide association study and epigenetic clock analyses based on the imputed data

PI(s): Jason Ernst, PhD (UCLA)

COHORT: GY4



Feasibility and Acceptability of a Robotic Assistant for Early-Stage ADRD Care

Johns Hopkins AI & Technology Collaboratory for Aging Research

Case Western Reserve University Weatherhead School of Management

AREA OF NEED: The aging population and increasing prevalence of Alzheimer's Disease and Related Dementias (ADRD) pose challenges for caregiving, as staffing shortages and costs limit access to consistent, high-quality support. Robotic assistants may help by enhancing safety, independence, and social engagement for older adults living alone, whether in private residences or within assisted-living settings.

PROJECT GOAL: Evaluate feasibility and acceptability of a prototype robotic aid from NaviGAIT Inc. for individuals with early-stage ADRD through real-world deployments, stakeholder input, and mixed-methods analysis.

METHODS: Gathering qualitative and quantitative data through focus groups, supervised short visits, and extended overnight placements of the robotic assistant in residents' homes, along with insights from family caregivers and professional staff.

IMPACT: Assessing robotic capabilities in real-world environments, including monitoring, reminders, and social engagement. Developing an evaluation framework to guide the design of robotic technologies that support aging in place.

INVESTIGATORS: Philip A. Cola, Peter Whitehouse, and Stefan Agamanolis

COHORT: GY4

JOHNS HOPKINS
AI & TECHNOLOGY COLLABORATORY *for* AGING RESEARCH

An Automated Non-Invasive Diagnostic Tool in Hydrocephalus Patients

AREA OF NEED: One of the most common problems in neurosurgery is hydrocephalus: an accumulation of cerebrospinal fluid (CSF) causing elevated intracranial pressure. This occurs in many different forms but remains poorly understood. Tools are needed for improved, non-invasive diagnosis and guidance during management.

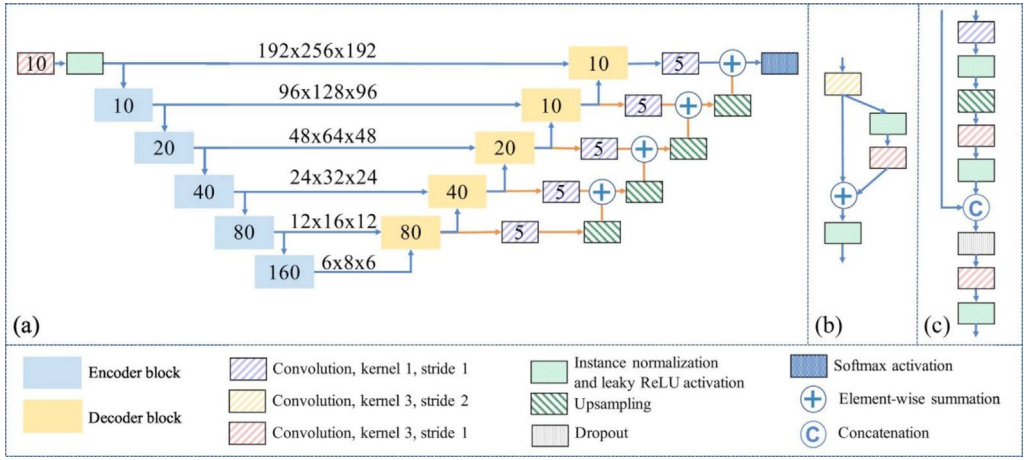
OPPORTUNITY: Develop and validate an automated deep learning-based approach for ventricular and subarachnoid space segmentation with parcellation and quantitation applicable to NPH and non-NPH patients over the age of 60.

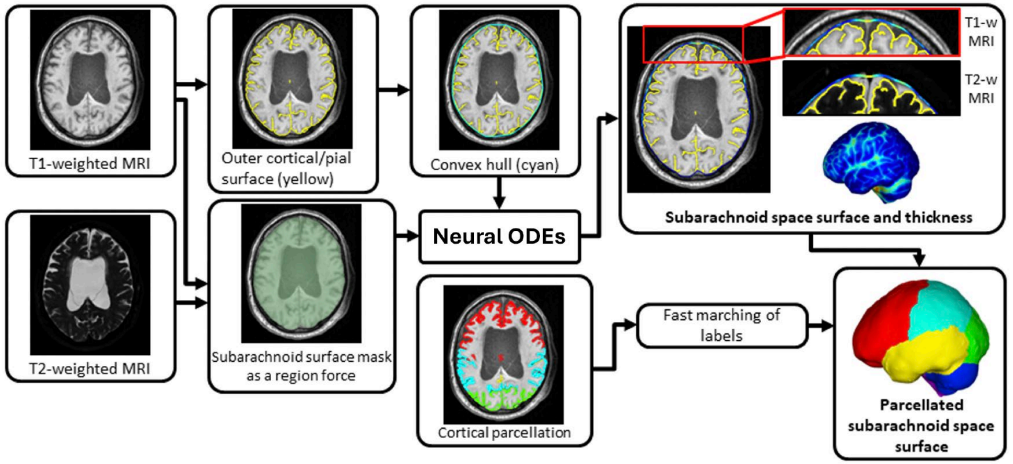
DATA: Acquire retrospective multi-contrast magnetic resonance imaging data from an internal cohort of ~800 NPH and suspected NPH patients.

TECH APPROACH: Optimize and train VParNet, a previously developed deep network for ventricular segmentation. Improve and optimize our subarachnoid space segmentation method using deep networks, conventional deformable models, neural ordinary differential equations, and physics-inspired neural networks.

PI(s): Jerry Prince, PhD (JHU)
Mark Luciano, MD, PhD (JHMI)

COHORT: GY4





AI-Driven Cognitive Enhancement and Assessment Program for Adults at Risk for Alzheimer's Disease

Johns Hopkins AI & Technology Collaboratory for Aging Research

UVA School of Nursing

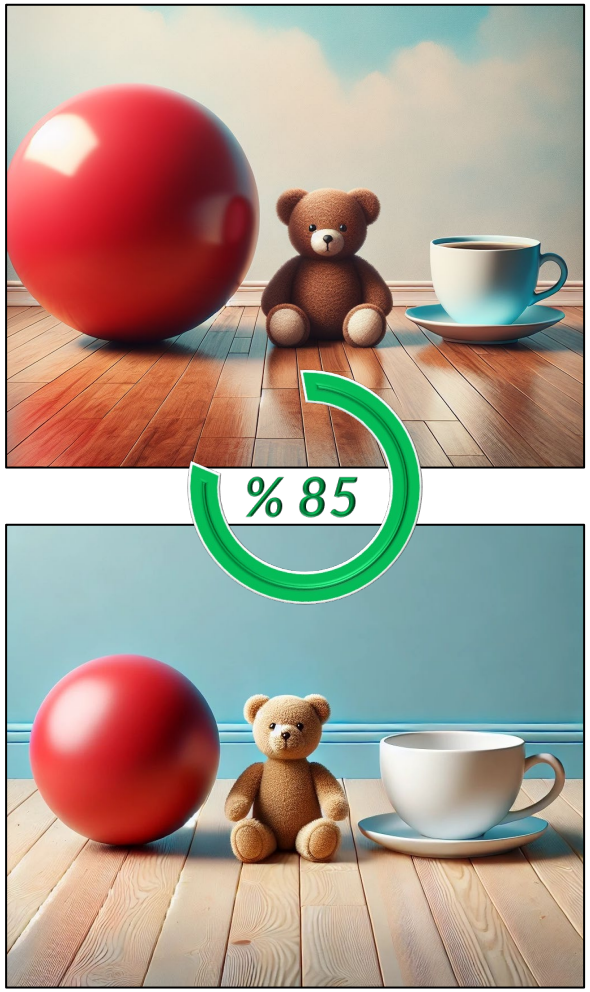
Calbium AI

AREA OF NEED: The increasing prevalence of Alzheimer's disease and other dementias is a growing concern. While pharmacologic treatments are emerging, there remains a need for engaging, accessible, and low-risk interventions that can be used at home.

OPPORTUNITY: Validate and test LookAlikes, a web-based cognitive enhancement game where participants describe an image and receive immediate feedback to promote cognitive functions like memory, flexibility, and planning.

DATA: Collecting verbal image descriptions, user engagement metrics, and survey feedback from older adults with subjective memory concerns, along with data to validate the accuracy between image and verbal descriptions.

TECH APPROACH: Use speech-to-text and image generation AI tools (Google Cloud API and DALL·E), combined with image similarity scoring using a VGG16 model, to offer real-time feedback and monitor cognitive function over time.



PIs: Meghan Mattos, PhD, RN (UVA)
Serkan Sandikcioglu, MS (Calbium AI)

COHORT: GY4

MRI-based body composition to assess biological age and frailty

Johns Hopkins AI & Technology Collaboratory for Aging Research

Massachusetts General Hospital
Founding Member, Mass General Brigham

Harvard Medical School

AREA OF NEED: Chronologic age is widely used in medical decision making but is a crude measure of aging. Better measures of "biologic aging" can improve clinical decisions and help researchers study how individuals age.

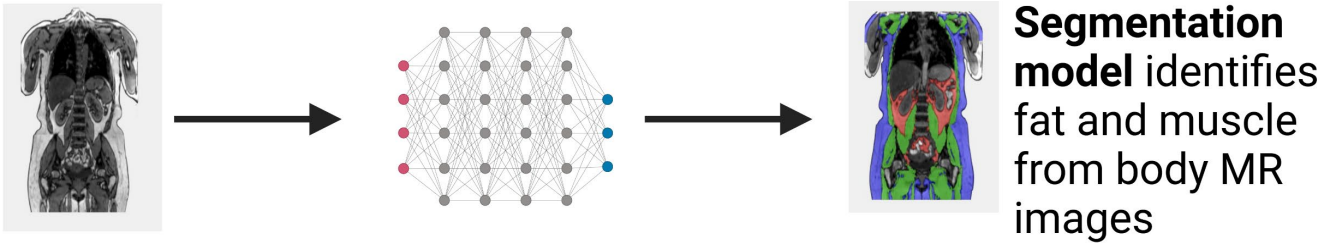
OPPORTUNITY: Develop and test whether a tool can accurately predict biologic age based on body composition from MR images.

DATA: Secondary analysis of >80,000 individuals with body MR imaging including the UK Biobank, the German National Cohort and Mass General Brigham patients.

TECH APPROACH: Develop 3D computer vision models to identify muscle and fat regions and subsequently predict biologic age. Validate whether this predicted age is 1) associated with aging-related disease, 2) can be used to better understand how aging affects body composition.

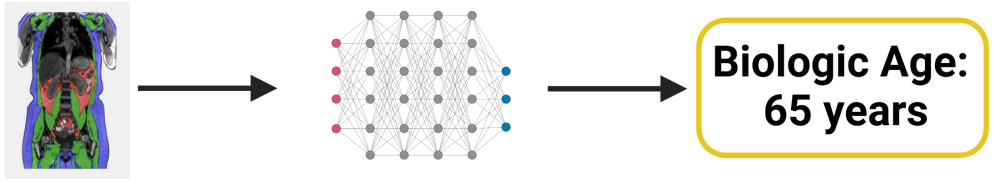
PI(s): Vineet K Raghu, PhD

COHORT: GY4



Segmentation model identifies fat and muscle from body MR images

MRI-Age model estimates biologic age from segmented muscle and fat regions

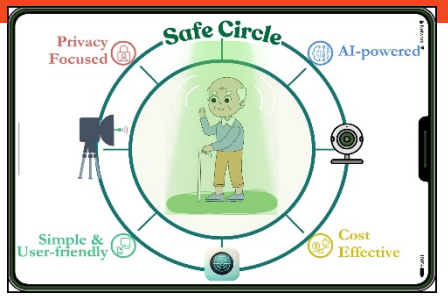


Biologic Age: 65 years

Johns Hopkins AI & Technology Collaboratory for Aging Research

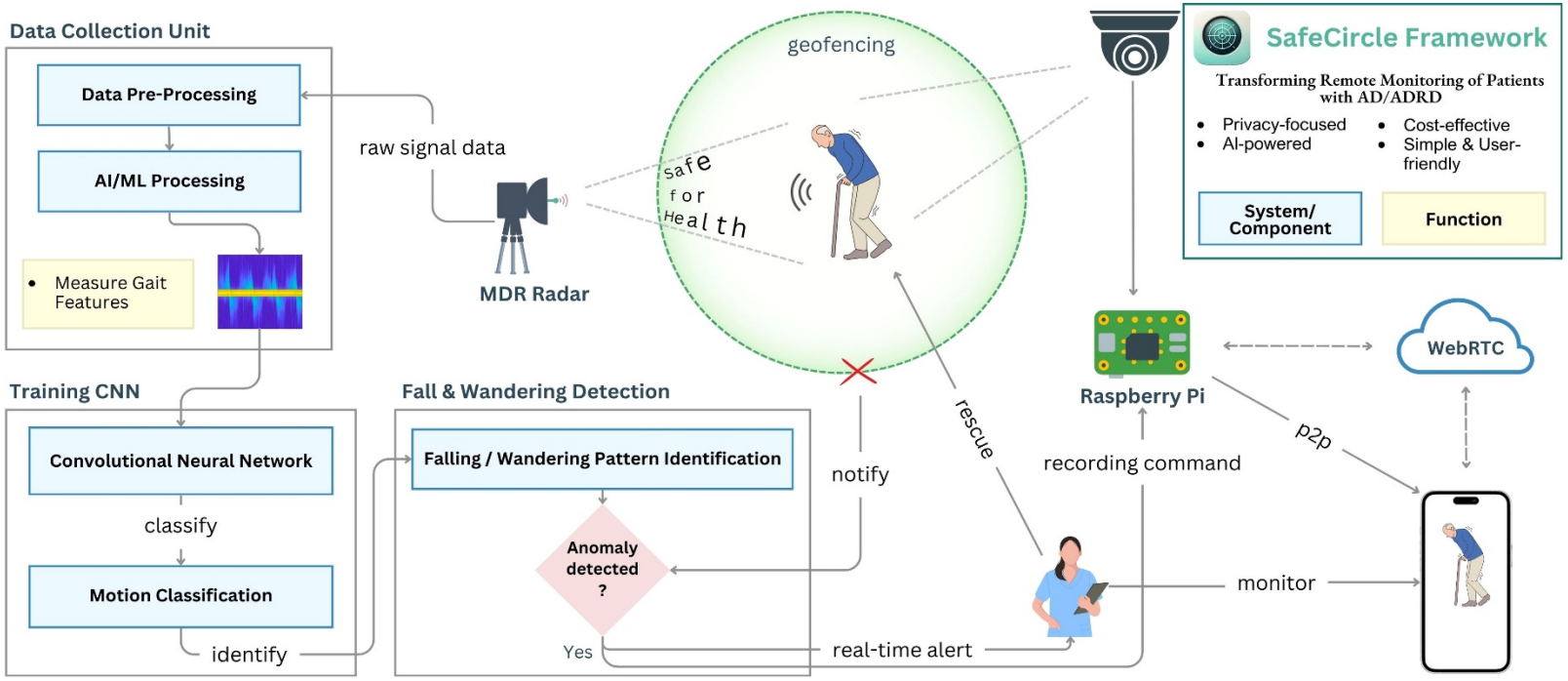
Safe Circle:
AI and Micro-radar-based Remote Monitoring for Patients with AD/ADRD

Kennesaw State University



AREA OF NEED:
SafeCircle addresses the urgent need for privacy-focused, accurate, and affordable remote monitoring for patients with AD/ADRD, tackling high risks of falls and wandering that strain caregivers and healthcare systems.

OPPORTUNITY:
The SafeCircle project aims to develop and evaluate an AI-enabled, micro-radar-based iOS prototype for accurately detecting falls and wandering in AD/ADRD patients, enhancing patient safety and reducing caregiver burden.



DATA:
Leverage non-identifiable micro-radar data capturing spatiotemporal movement patterns and event-triggered video snippets. Data collection follows IRB-approved protocols.

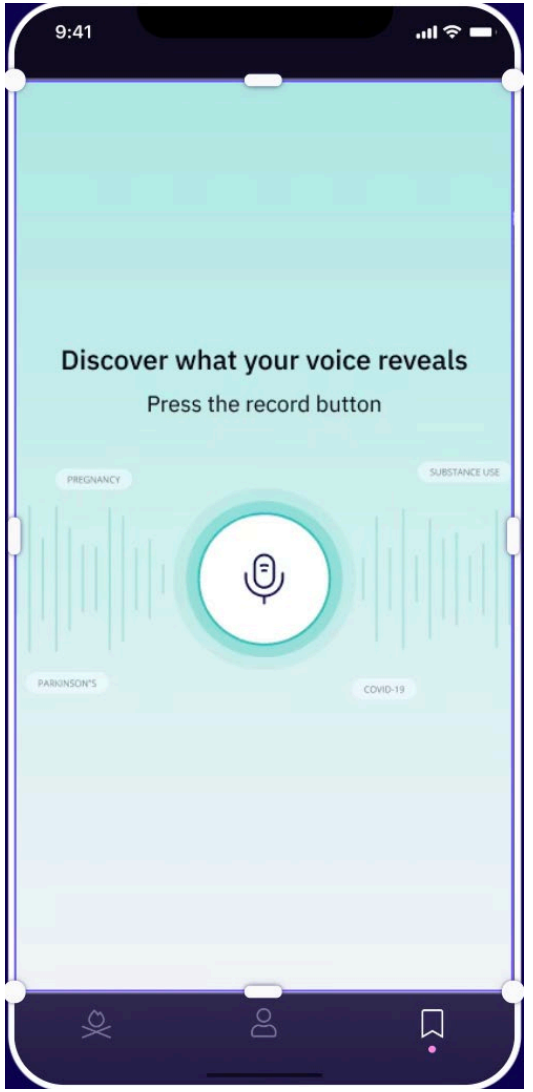
PI(s):
Dr. Nazmus Sakib (KSU)
Dr. Sumit Chakravarty (KSU)

COHORT:
GY4

TECH APPROACH:
It integrates FMCW micro-radar technology with deep learning models for accurate fall and wandering behavior detection, leveraging an Agile Scrum framework for iterative iOS prototype development.

Acceptability of Voice Clones in Agents for Aging Adult Wellness Monitoring

AREA OF NEED:	Familiarity in caring for the elderly population is of paramount importance. The ability to provide consistent interaction results in improved outcomes, but time is limited for most caregivers.
OPPORTUNITY:	The goal of this study is to understand how Virtual Agents, including Voice Clones, can enhance digital interactions for older adults.
DATA:	Collect survey data from participant who experience interactions with voice clones of someone close to them with a reflection on their well being
TECH APPROACH:	Utilize generative AI technologies to create voice clones of caregivers/loved ones to study impact on participants.
PI(s):	Amit Mehta, MD Camille Noufi, PhD
COHORT:	



Patient-centered precision medicine lab result communication for older adults

Johns Hopkins AI & Technology Collaboratory for Aging Research

UCLA Health | David Geffen School of Medicine

AREA OF NEED: The status quo of lab result reporting fails to provide older adults with personalized information that they can understand and use to make informed decisions about their healthcare and health behaviors.

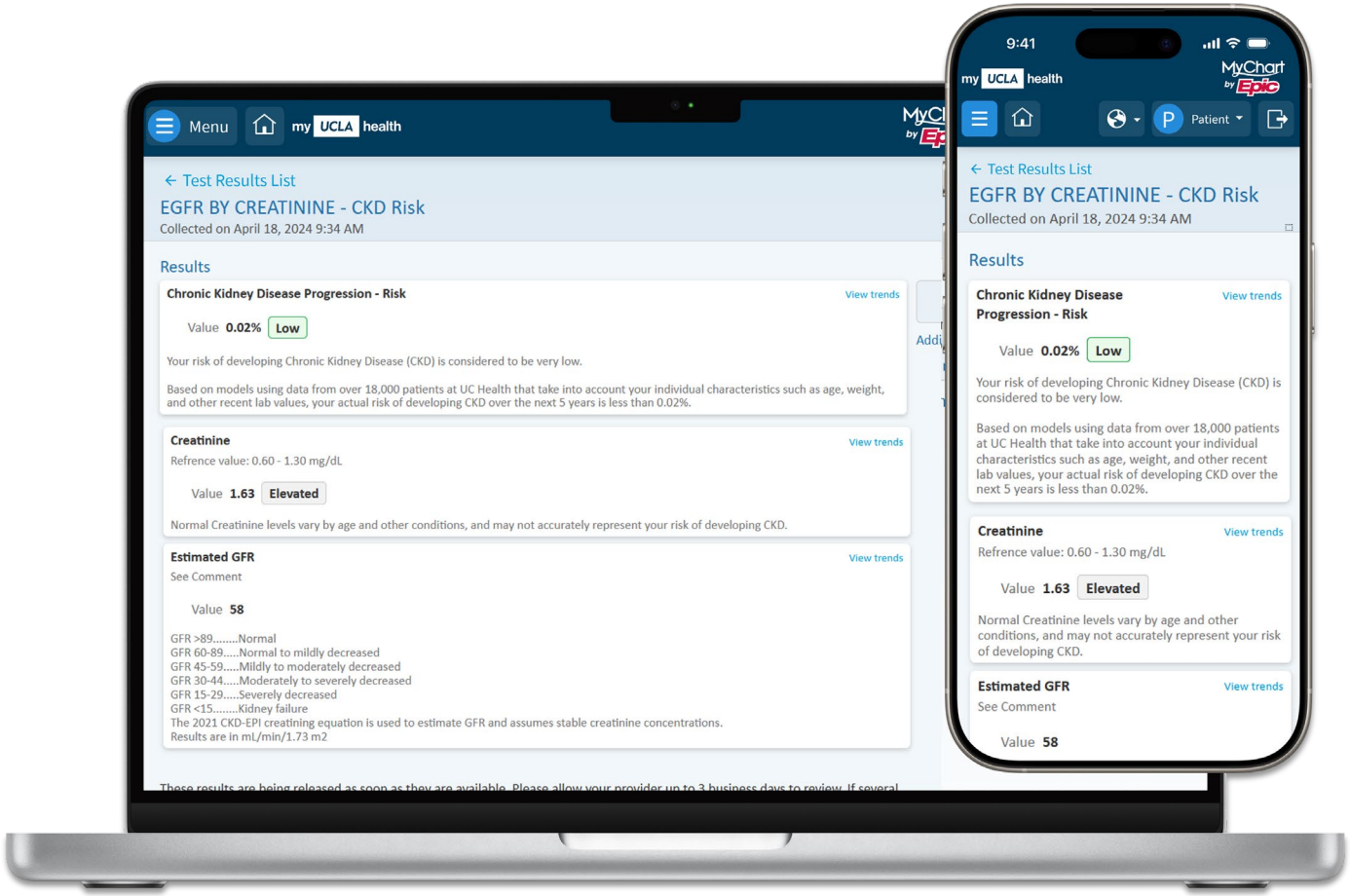
OPPORTUNITY: Create models to predict and communicate the individualized 2- and 5-year risk of developing ESKD for adults aged 65 years and older.

DATA: The model will be trained on UC Health patient data, with the implementation guided by usability testing and stakeholder engagement.

TECH APPROACH: Leverage machine learning models to calculate risk from EHR records and communicate these personalized risks as part of existing lab workflows and processes.

PI(s): Catherine Sarkisian, MD, MSHS (UCLA)

COHORT: GY4



Developing & Testing an Evidence-based, AI Dementia Care Navigation Assistant

JOHNS HOPKINS AI & TECHNOLOGY COLLABORATORY for AGING RESEARCH

JOHNS HOPKINS MEDICINE

CRANIOMETRIX

AREA OF NEED: One of the best ways to improve outcomes and reduce costs in dementia is with high-quality care navigation to keep the patient at home. However, we have a shortage of care navigators.

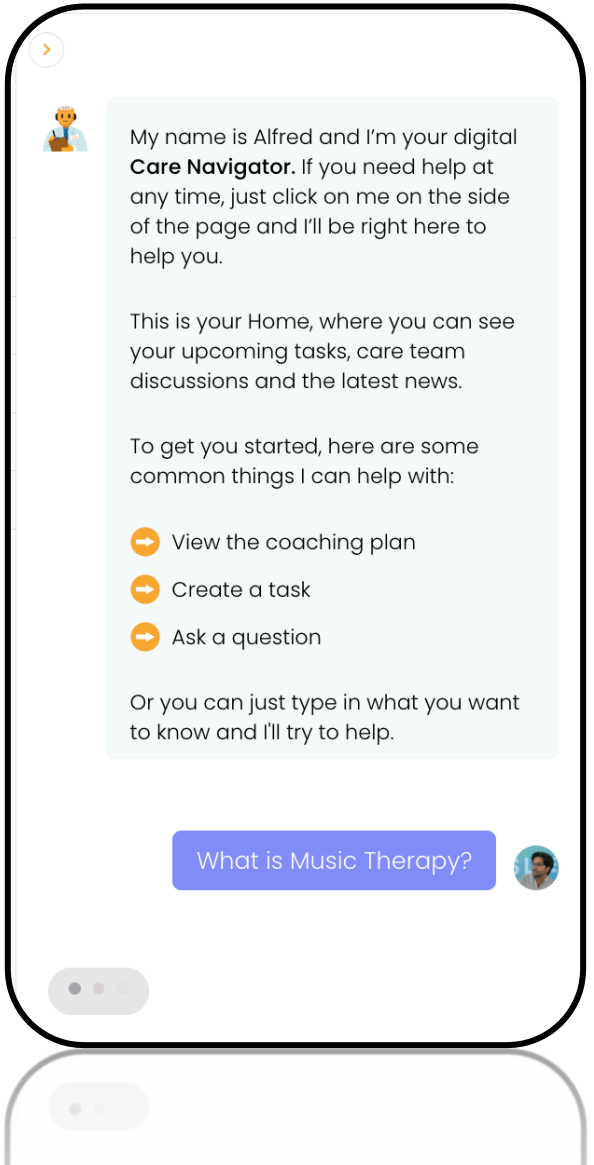
OPPORTUNITY: Develop, validate, and test a care navigator support bot leveraging the Johns Hopkins MIND at Home program and the Craniometrix chatbot.

DATA: Pre-created training data from the MIND at Home program, and training feedback from care navigators leveraging the bot.

TECH APPROACH: Leverage Retrieval Augmented Generation techniques to build a high-quality chatbot to support care navigators, preventing hallucinations by requiring referential retrieval.

PI(s): Nikhil Patel (Craniometrix)
Halima Amjad, MD MPH PhD (Hopkins)
Cynthia Fields, MD (Hopkins)

COHORT: GY4



Using Retitrack+AI to Explore Novel Eye Biomarkers in Patients with Cognitive Impairment

Johns Hopkins AI & Technology Collaboratory for Aging Research

Renown Health

AREA OF NEED: Current AD/MCI diagnostics are invasive, costly, and lack early sensitivity. There's a need for scalable, objective biomarkers.

OPPORTUNITY: Develop, validate, and test automated detection of cognitive decline using high-resolution retinal and pupillary eye movement data captured by the Retitrack™ device.

DATA: Retitrack™ captures FEMs, saccades, and pupillary dynamics. Cognivue Clarity provides cognitive performance metrics. All data is de-identified and securely stored for AI analysis.

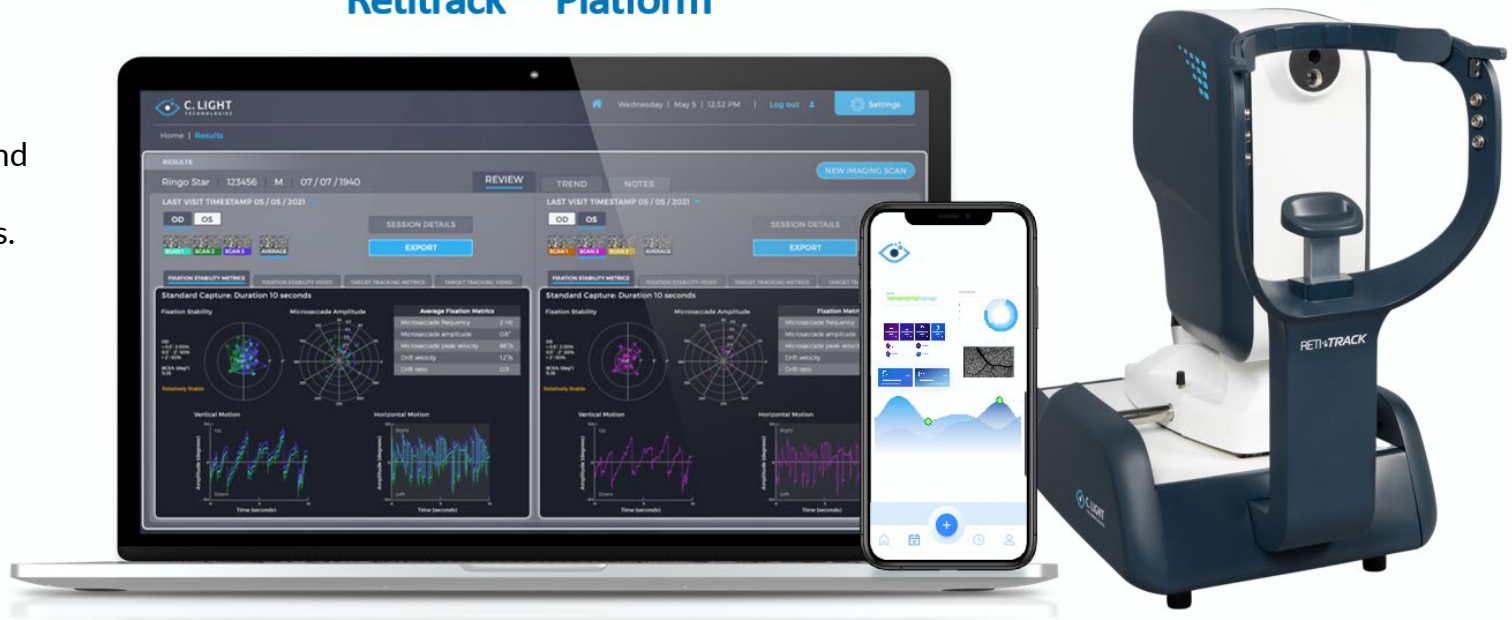
TECH APPROACH: Train a Transformer-based model on synchronized eye movement data to identify early signs of MCI/AD.

PI: Dr. Jon Artz (Renown Health)

COHORT: 104 adults with MCI or early dementia from Renown Health Neurology Clinic
Inclusion: Age 55-90, English-speaking, VA ≥20/40, confirmed diagnosis
Exclusion: Other dementias, metabolic issues, TBI

FDA CLEARED

Retitrack ™ Platform



C. LIGHT TECHNOLOGIES

www.clighttechnologies.com

Machine learning to identify dermatoporosis in older adults

AREA OF NEED: Dermatoporosis, or skin frailty, affects over 30% of adults age 65 years old or older and leads to easy bruising and skin tearing. It is associated other conditions such as bone health or skin cancer. However, older adults may not recognize their dermatoporosis and need for in-person care

OPPORTUNITY: Develop, validate, and test automated assessments for dermatoporosis

DATA: Collect digital images from smartphones for dermatoporosis assessments, as well stakeholder input and user testing.

TECH APPROACH: Leverage machine learning technologies to train, validate and test skin images that have been labeled by dermatologists with skin frailty scores. Identify path forward so this tech can be accessible and empower older adults with skin frailty to seek in-person healthcare.

PI(s): Anne Lynn S. Chang MD
Professor of Dermatology
Stanford University School of Medicine

COHORT: GY4

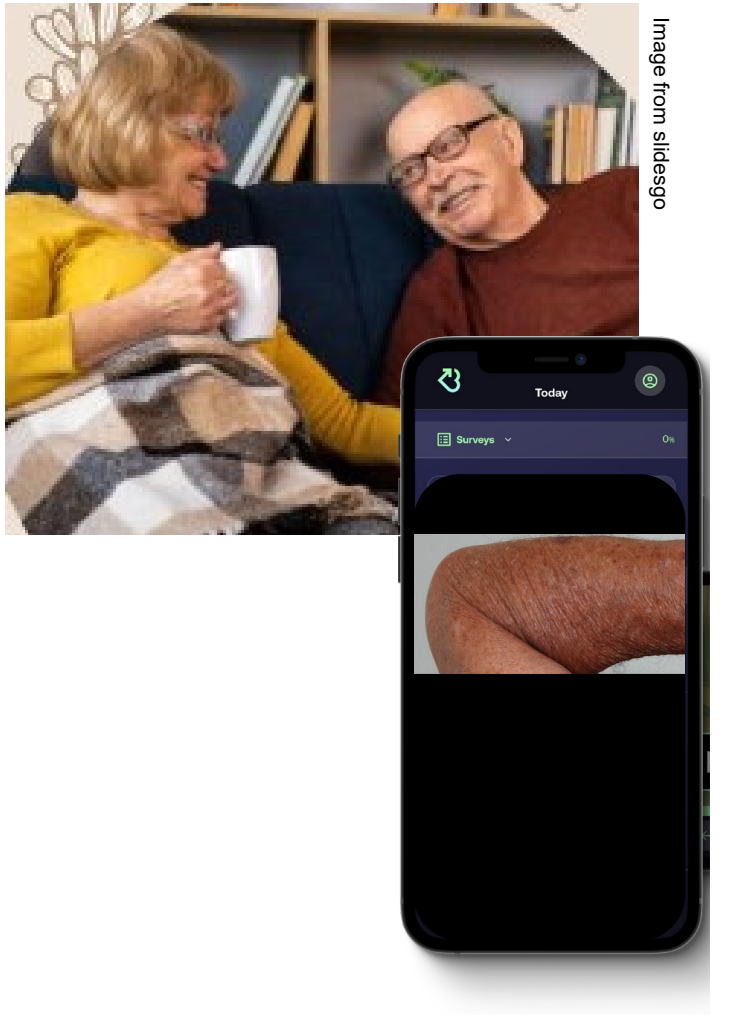


Image from slidesgo

Stanford MEDICINE
School of Medicine

A Personalized Evolvable AI Tool for Real-Time Testing and Intervening AD/ADRD

Johns Hopkins AI & Technology Collaboratory for Aging Research

University of Illinois Urbana-Champaign

University of Minnesota

AREA OF NEED: Alzheimer's Disease (AD) and dementia resulting from it affect millions of people. Early diagnosis of AD is important but challenging. It can also be expensive, not always accessible, and costly.

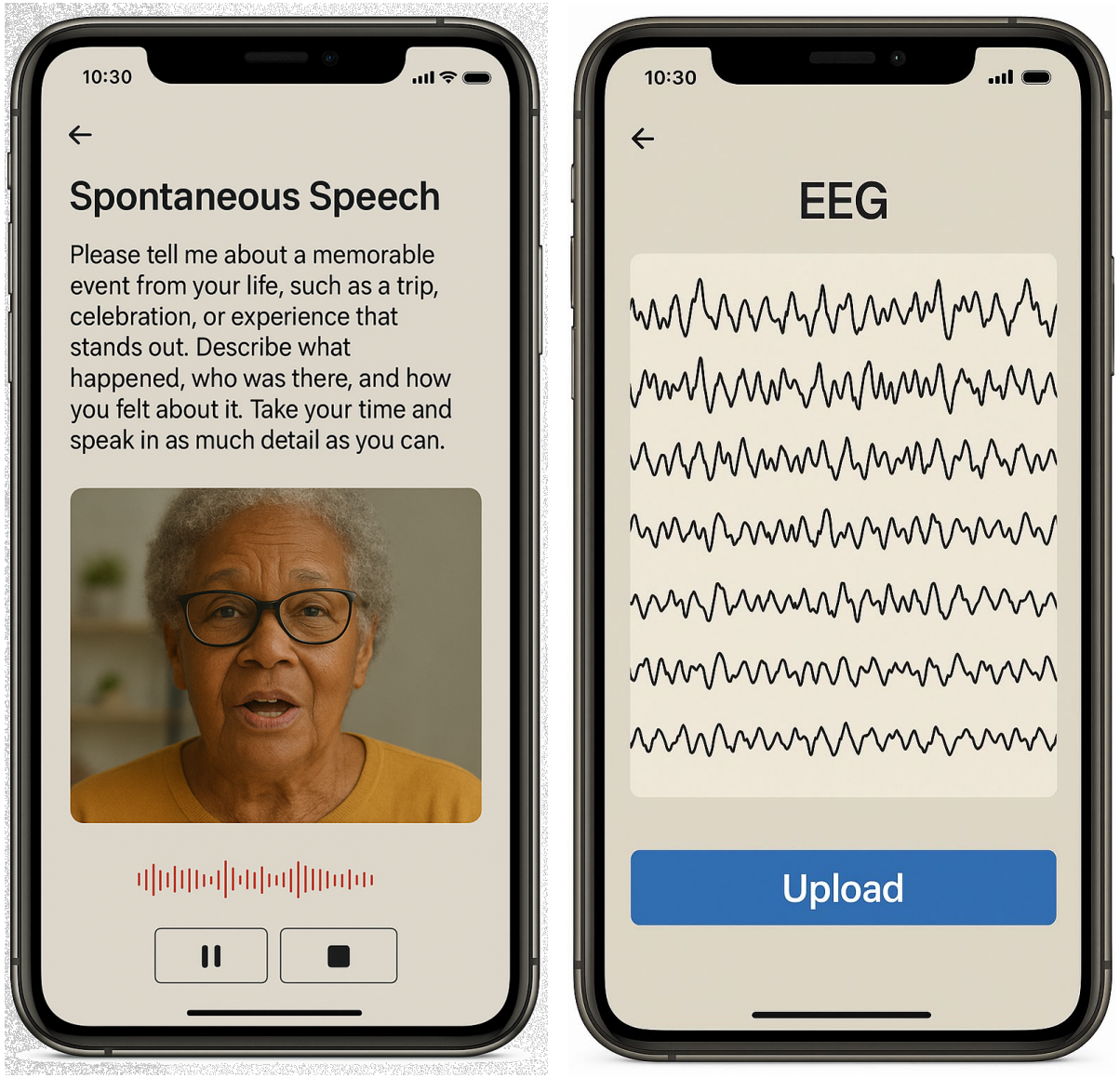
OPPORTUNITY: Develop, validate and test reliable self-administered personalized assessments of the progression of AD based on easily available data through a mobile application.

DATA: Relatively cheaper data like cognitive tests based on activities of daily living, speech, and optionally more expensive data such as MRI images.

TECH APPROACH: Pre-trained AI models equipped with learning on-the-go to personalize the assessment. The cognitive tests are derived from everyday activities. Medical images and lab results are optionally used to enrich the prediction. Ensemble methods combine the predictions to improve performance.

PI(s): Chung-Yi Chiu, PhD, ChengXiang Zhai, PhD (UIUC), Yogatheesan Varatharajah, PhD (UMN)

COHORT: GY4



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for AGING RESEARCH

Wearable in-shoe Sensors for Gait Monitoring in Normal Pressure Hydrocephalus (NPH)

- University of California, Irvine
- Johns Hopkins
- University of Florida

AREA OF NEED: Falls are among the greatest threats to healthy aging. This is particularly problematic in patients with NPH where gait instability is a cardinal feature. Early detection can lead to early neurosurgical treatment that can be transformative.

OPPORTUNITY: Develop, validate, and test in shoe sensors to find pressure and gait patterns specific for NPH at its early stages. The shoe sensors may be used to track improvement after surgery.

DATA: Collecting data from in-shoe sensors to characterize the walk of NPH patients. We are looking for specific pressure point data and stride/pace characteristics that may lead to early identification of NPH patients.

TECH APPROACH: Leverage Artificial Intelligence/Machine Learning models to analyze the large number of data points for gait derived from the in-shoe sensors. Analysis of changes in gait disorders over time with or without surgery will be used to develop a predictive model of gait dysfunction in NPH.

PI(s): Jefferson Chen, MD, PhD (UCI)
Vadim Zipunnikov, PhD (JHU)
Nikolay Bliznyuk, PhD (UF)