Penn
University of Pennsylvania
Artificial Intelligence and Technology Collaboratory for Healthy Aging

PILOT AWARDEES

https://www.pennaitech.org
funded by the National Institute on Aging Grant Nr. P30AG073105

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PILOT AWARDEES YR5
2026

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FSU
FLORIDA STATE
UNIVERSITY

DEVELOPING A MULTI-AGENT AI SYSTEM FOR EXPLAINING LAB RESULTS TO OLDER ADULTS

Zhe He, PhD, FIAHSI, FAMIA

Older adults and caregivers increasingly rely on patient portals to access laboratory results, yet these results are often presented without sufficient context—posing challenges for those with low health literacy, cognitive impairment, or limited clinical background. This problem is particularly critical for caregivers of persons living with Alzheimer's disease and related dementias (ADRD), who must interpret complex clinical data to make timely care decisions. To address this gap, our team has developed *LabGenie*, a web-based tool that provides tailored visualizations and helps patients generate questions for their providers. Building upon this foundation, the proposed A2 Pilot project will design and evaluate *Lab-Agent*, a novel multi-agent generative AI system integrated into *LabGenie* to deliver personalized, contextualized explanations of lab results for older adults and their caregivers. The system will comprise three components: a Patient-AI Agent that simulates diverse caregiver profiles to generate representative questions, a Clinical-AI Agent that uses retrieval-augmented generation (RAG) and knowledge graphs to produce context-aware explanations, and a Grader-AI Agent that performs quality assurance on factuality, readability, and clinical accuracy. Aim 1 develops and validates the multi-agent architecture using simulated clinical datasets and expert review. Aim 2 evaluates the system's acceptability, perceived trustworthiness, and usability through participatory design workshops, online experiments, and formative usability testing with ADRD and MCI caregivers. This project will advance responsible, caregiver-centered AI to enhance lab result comprehension, support informed decision-making, and promote aging in place—laying the groundwork for scalable integration with electronic health records and caregiver support platforms.

https://sites.google.com/view/labgeniefsu/ PennAITech YouTube Feature

Duke

counterforce health

COUNTERFORCE HEALTH: AI-POWERED HEALTH INSURANCE APPEALS GENERATOR

Kathryn I. Pollak, PhD

Every year, millions of Americans receive insurance denial letters for healthcare services, often due to missing information or coding errors. While half of these denials are eventually overturned, very few patients (just 0.2%) attempt to appeal. Many lack the time, knowledge, or confidence to navigate the complex appeals process, which can lead to worse health outcomes and reduced trust in the healthcare system.

Counterforce Health is an innovative tool designed to change that. Using artificial intelligence, it helps patients create strong, personalized insurance appeals by analyzing denial letters and guiding users through the process. The tool incorporates medical details, generates downloadable appeal documents, and offers coaching on next steps. Future versions will include phone-based support and automated follow-ups.

Currently in use at more than 20 clinics, Counterforce Health has shown promising results, with users reporting about 40% of appeals succeeding. A pilot study at Duke Health will evaluate the tool's accuracy, usability, and effectiveness through expert reviews, patient testing, and real-world outcomes.

By simplifying a complex process, Counterforce Health aims to empower patients, reduce financial stress, and improve access to care—one appeal at a time.

https://www.counterforcehealth.org/ PennAITech YouTube Feature

WISE Connect

WISE CONNECT AI: PERSONALIZED LOCAL SUPPORT FOR AGING IN PLACE

Marie Brodsky

This study aims to develop and evaluate an AI recommendation tool designed to connect older adults (65+) aging in place with local services and resources that support healthy, independent, and engaged living. The tool will be integrated into WISE Connect, a free and accessible web platform that aggregates community programs for older adults.

For this survey-based study, a broad cohort of up to 75 older adults aging in the community in the DC Metro area will be recruited and asked to share their residential circumstances, health priorities, disabilities, transportation access, primarily language, family proximity, income level, social engagement, tech confidence, and more. Then, each participant will be shown fictitious local resources and asked to rank and evaluate them based on their perceived value.

This data will be anonymized, supplemented with existing national data, and used to train several AI models to provide relevant suggestions. The models will be trained and refined over three 3-month cycles, and the highest-performing model will be integrated into WISE Connect.

The study will result in a custom AI recommendation model tailored to the needs of older adults aging in place. This model is expected to enable personalized recommendations that improve awareness and access to relevant local resources with minimal user effort.

http://www.wiseconnect.us

PennAITech YouTube Feature

Brandeis UNIVERSITY

EFFECTIVE DATA CURATION FOR ACCURATELY AND FAIRLY PREDICTING READMISSION FOR OLDER ADULTS

Hongfu Liu, PhD

Hospital readmissions—when patients return to the hospital within 30 days after discharge—are common among older adults and often preventable. These readmissions can disrupt recovery, reduce quality of life, and contribute to billions of dollars in healthcare costs each year. While artificial intelligence (AI) has shown promise in predicting which patients are at high risk, current models are often inaccurate, difficult to use in real-world settings, and may unintentionally reinforce health disparities across different populations. This project aims to improve how we predict hospital readmissions by focusing not just on the AI models themselves, but on the quality and selection of the data used to train them. Using large and diverse health datasets, including electronic health records and national research data, we will develop advanced AI tools that identify older adults at high risk of readmission.

A key innovation of this work is a "data-centric" approach that evaluates how individual pieces of data affect both prediction accuracy and fairness. This allows us to prioritize the most informative data while reducing bias that could disadvantage certain racial, ethnic, or socioeconomic groups. We will also design new training methods that balance accuracy and fairness more effectively than current approaches. By enabling earlier and more equitable identification of at-risk patients, this project has the potential to support better care planning, reduce unnecessary hospital visits, lower healthcare costs, and improve health outcomes for older adults.

https://scholarworks.brandeis.edu/esploro/profile/hongfu_liu/overview

PennAITech YouTube Feature

University of Massachusetts Amherst

CONVERSATIONAL AI AGENTS TO SUPPORT MENTAL WELLBEING OF AD/ADRD CAREGIVERS

Ravi Karkar, PhD

This research project aims to develop, deploy, and evaluate Carey, an AI conversational agent designed to support the mental wellbeing of caregivers for people living with Alzheimer's disease and related dementias (AD/ADRD). The significance of this work stems from the substantial burden faced by 11.5 million AD/ADRD caregivers who provided an estimated 18.4 billion hours of unpaid care in 2023, with 74% concerned about maintaining their own health and at least one in three suffering from clinical depression. Building on formative research that analyzed online communities, evaluated AI chatbot effectiveness, and interviewed family caregivers, the team has identified key opportunities for technology to support caregivers' mental wellbeing through caregiving responsibilities, information resources, social connections, and emotional support. The platform integrates theory-driven design with evidence-based practice through three main features: interactive journaling grounded in therapeutic approaches (CBT, ACT, DBT), guided scenario-driven information addressing eight critical caregiver concerns, and persona-driven conversations incorporating real caregiver stories. The innovation lies in providing verified information through small language models built using trusted sources, combining evidence-based mental health practices with AI-powered design, and seamlessly integrating support into caregivers' daily routines. Through a six-week deployment with 35-50 caregivers, the project will assess feasibility and benefits of Carey for providing instant, accurate informational support and enhancing mental wellbeing by focusing on affect, anxiety, and loneliness. Data collection will include validated measures of acceptability (SUS, CSQ-8, IAM), potential benefits (PANAS-X, PHQ-8, GAD-7, UCLA Loneliness, RCWBS), and qualitative interviews for deeper insights. The technical approach will employ specialized Small Language Models (SLMs) for each of eight critical mental wellbeing concerns, using a mixture-of-experts architecture to classify queries and route them to appropriate expert models. The project team brings complementary expertise in human-computer interaction, computational social science, human-centered design, and clinical-community psychology, with established connections to recruitment pipelines through healthcare systems and community organizations. Upon completion, plans for translation include transitioning the app to a production environment, collaborating with healthcare partners, and making the platform publicly available to support the substantial population of AD/ADRD caregivers.

https://people.cs.umass.edu/~rkarkar/ PennAITech YouTube Feature

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A GENERATIVE AI CLINICAL CHATBOT TO SUPPORT APOE TESTING (GRACE)

Angela Bradbury, MD

Amyloid-targeted therapies are now available for patients with Alzheimer's disease (AD) and mild cognitive impairment (MCI). One step in the process of understanding if a patient is a candidate for these new therapies is APOE genotype testing. The APOE results can help providers and patients consider potential risks of treatment, but these results can also have an impact on relatives and could determine their risk for AD. While genetic testing has typically been performed with genetic professionals, known as genetic counselors (GCs), this could delay or prevent patient access to treatment. Thus, healthcare providers are sending APOE testing and returning results on their own and referring patients to GCs when a patient and family have additional questions. To address this important gap in access to genetic education, we have developed patient-centered clinical chatbots for patients and their relatives, to help them understand APOE testing and their results. In this pilot grant, we will be developing methods to use generative artificial intelligence (AI) to improve our chatbots ability to answer individual patient questions with the expectation that this will increase engagement, the user experience and increasing awareness and understanding in families impacted by AD. Through the national Penn Telegenetics program and community clinical settings, these tools will be applicable and designed for diverse real-world patients of varying health literacy and community practices in the US.

https://pc3i.upenn.edu/people/angela-bradbury/ PennAITech YouTube Feature

DexTech

STEPAHEAD: BREAKING FREE FROM FREEZING OF GAIT WITH AUGMENTED REALITY

Nipun Chopra, PhD

Freezing of gait (FoG) is a debilitating symptom of Parkinson's Disease (PD) that causes sudden, brief episodes where individuals are unable to move their feet, often resulting in falls, injuries, and reduced quality of life. Despite its prevalence—impacting nearly 70% of people with advanced PD—there are few effective tools to detect and prevent FoG in real-world settings.

Our project aims to create a non-invasive, wearable software platform that uses augmented reality (AR) to detect and reduce freezing episodes. Through smart glasses equipped with spatial mapping and visual cueing, the system will identify when a person is at risk of freezing and provide real-time visual prompts to help them keep moving safely.

We will begin by refining our detection system in a laboratory and outdoor setting with healthy volunteers, simulating movements known to trigger FoG. Then, we will capture detailed walking patterns from individuals living with FoG to fine-tune our predictive models. Finally, we will test the system in a real-world assisted living facility to ensure usability, comfort, and effectiveness.

This project integrates lived experience with cutting-edge science and engineering. Our goal is to improve independence, mobility, and safety for people with Parkinson's. If successful, our approach could become a low-cost, accessible tool to support millions affected by this disabling symptom—at home or in care facilities.

https://dextechcorp.com/technologies/ PennAITech YouTube Feature

NEW YORK UNIVERSITY

TAILORED NUTRITION - AI NUTRITION SUPPORT FOR PERSONS LIVING WITH DEMENTIA IN ADULT DAY CENTERS

Tina Sadarangani, PhD, RN, ANP-BC, GNP-BC, FAAN, FGSA

Malnutrition is a major but often overlooked issue among people living with dementia who attend adult day centers (ADCs). The meal or meals served at the center may be the only ones eaten in a given day for many of these older adults, making it imperative that they are nutritionally rich. Yet, most centers currently serve the same meal to all their clients, regardless of individual dietary needs or challenges. This one-size-fits-all approach can be especially problematic for people with dementia, who often require more tailored nutrition to maintain their health and well-being.

To help address this, our team is developing a new AI-powered nutrition platform that uses photos of meals to estimate what someone eats and provide personalized dietary suggestions. The platform will be integrated into CareMobi, a free mobile app designed to help families, healthcare providers, and adult day center staff coordinate care.

We will develop and test the accuracy of the platform, and then conduct a six-week study to see how feasible it is for adult day center staff to use this new platform in their day-to-day work. Staff will complete a brief survey to share feedback on how easy it was to use and whether they believe it could help them plan more nutritious, personalized meals for their clients in the future.

https://nursing.nyu.edu/w/caremobi

PennAITech YouTube Feature

WashU Medicine

A SYNTHETIC DATA APPROACH TO CATALYZING INNOVATION IN DEMENTIA CAREGIVER SUPPORT

Karla T. Washington, PhD

Millions of Americans care for an aging family member or friend with Alzheimer's disease or a related dementia. These caregivers manage a wide range of responsibilities, from everyday tasks like cooking and paying bills, to complex medical care, such as administering medications, monitoring symptoms, and coordinating treatment across healthcare teams. Although caregiving can be meaningful, it is also demanding and can negatively affect caregivers' emotional and physical well-being.

To help, our team developed PISCES (Problem-Solving Intervention to Support Caregivers in Everyday Situations), a structured, evidence-based program that teaches caregivers practical problem-solving skills. Multiple clinical trials have shown that PISCES reduces caregivers' distress and improves their quality of life. To date, we have recorded hundreds of PISCES sessions between trained interventionists and caregivers. These recordings are an invaluable resource for training new providers and developing digital tools to expand access to effective caregiver support. However, privacy laws prevent us from sharing this real-world data outside of our research team.

In this pilot project, we will test the feasibility of creating a synthetic version of the PISCES dataset consisting of computer-generated text conversations that reflect the content and tone of real PISCES sessions but include no identifying information. Using advanced natural language processing and other artificial intelligence techniques, we will analyze real session data to detect key patterns and use those patterns to generate realistic synthetic examples. This project represents an important first step toward safely expanding access to evidence-based caregiver support while maintaining the highest standards of privacy and data protection.

https://medicine.washu.edu/

PennAITech YouTube Feature

UNIVERSITY OF DENVER

AI-INTEGRATED NANOWELL BIOSENSORS FOR MULTIMODAL DETECTION OF NPD BIOMARKERS

Reza Mahmoodi, PhD

Early detection of cognitive impairment, including dementia, is beneficial for patients and their families because it helps them access needed care supports. Screenings for many health conditions are done in primary care, but it is difficult to do screenings for cognitive impairment in this setting. This is because the time required to do a cognitive screen can be challenging to fit into a typical primary care appointment. The goal of this project is to make it easier for primary care providers to detect early signs of cognitive impairment in real-time. We aim to develop a prediction model that uses data from the electronic health record (EHR) and video and audio from the primary care visit to estimate a patient's risk of having undetected cognitive impairment. We will build off an existing cognitive impairment prediction model called the EHR Risk of Alzheimer's and Dementia Assessment Rule (eRADAR). We will use this model to recruit Penn Medicine primary care patients to participate in a recorded research visit, where we will conduct a cognitive and physical exam. Video and audio data from these visits will be combined with the EHR data to generate new predictive models. We aim to see if the addition of video and audio data to the prediction model improves detection of conditions such as Alzheimer's disease and related dementias. This will build the basis for future work aiming to integrate the new predictive model into primary care clinics and test its effectiveness in promoting early detection of cognitive impairment.

https://ritchieschool.du.edu/about/people/reza-mahmoodi

PennAITech YouTube Feature

OLD DOMINION UNIVERSITY

KNOWLEDGE-AUGMENTED GENOMICS TRANSFORMERS FOR MECHANISTIC LINKS TO AD DEMENTIA

Hong Qin, PhD

Alzheimer's disease (AD) is a progressive neurodegenerative disorder marked by cognitive decline and heterogeneous, cell-type-specific molecular changes. Extracting mechanistic insights across cohorts from large scale AD genomic data remains difficult. We propose to fine-tune a transformer foundation model for single-cell analysis (scGPT) on >4 million single-nucleus RNA-seq profiles from two deeply characterized AD resources—the Religious Orders Study and Memory and Aging Project (ROSMAP) and the Seattle Alzheimer's Disease Brain Cell Atlas (SEA-AD), while harmonizing cognitive and neuropathology measures to enable integrative modeling. Our approach embeds prior biological knowledge into the model via knowledge-guided attention masks and multimodal fusion (e.g., pathway, GWAS, and perturbation priors). We will pair model explanations (Shapley values, pathway enrichment) with conformal prediction to quantify uncertainty and flag low-confidence calls. To ensure generalizability, we will conduct cross-cohort benchmarking and external validation against classical bioinformatics baselines. The pipeline will emphasize reproducibility (open code, standardized QC, and data harmonization recipes) and deliver interpretable gene- and pathway-level hypotheses for amyloid/tau burden and cognitive impairment.

https://www.odu.edu/directory/hong-qin PennAITech YouTube Feature

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UTHealth Houston

DETECTION OF ADVERSE DRUG EVENT USING NLP AMONG OLDER ADULTS WITH HEART FAILURE

Min Ji Kwak, MD, MS, DrPH

Adverse drug events (ADEs) in older adults with heart failure are a serious public health concern. These drug-related complications can be life-threatening and significantly reduce quality of life. To capture ADEs correctly, doctors need to carefully review a patient's symptoms, medical history, prescription changes, and past records. However, this can be difficult to do thoroughly during a busy clinic visit.

An automatic tool using an Artificial Intelligence tool can help by scanning a patient's past medical records for signs of an ADE. This tool can be built into electronic health records to provide real-time assessments. While current AI models typically handle only one task at a time—like identifying medications—ADE detection requires a more advanced system that can process multiple tasks and make complex decisions.

To address this, we are developing a specialized AI framework called AIDE4HF. This system will leverage existing tools to detect ADEs in older adults taking heart failure medications. Our project has two main goals:

1. Create a high-quality dataset of ADEs related to heart failure medications in older adults.
2. Develop and test a powerful AI system that can accurately detect these ADEs.

This research is a collaboration between UTHealth McGovern Medical School and UTHealth McWilliams School of Biomedical Informatics. By combining expertise from multiple fields, we aim to create a model that closely mimics real clinical decision-making and has the potential to be widely used in medical practice.

https://med.uth.edu/internalmedicine/ PennAITech YouTube Feature

Health Tequity

A NOVEL DIGITAL TWIN FOR CHRONIC CARE COORDINATION AND HEALTHY AGING

Katherine Kim, PhD, MPH, MBA

Chronic illnesses such as diabetes and hypertension challenge goals of healthy aging, with burdens on individuals, family caregivers, and the healthcare system. Uncontrolled chronic illnesses are a risk factor for cognitive decline, Alzheimer's disease and related dementias, and frailty. We need solutions for older adults to age with independence, to lead healthier lives, and to maintain access to their healthcare services when needed. The questions we want to answer are: What are all the possible behavioral, lifestyle, and medical treatment options for people with chronic illness? When and how should those interventions be rolled-out for the best outcomes over time as people age (trajectories)? How could you weigh all the potential scenarios and make the best decisions?

We use data from remote monitoring, clinical care, and healthcare utilization, to develop Health Digital Twins (HDTs) for community-dwelling older adults with diabetes and/or hypertension and insights for both the individual and healthcare providers. Digital twins can be defined as (physical and/or virtual) machines or computer-based models that are simulating or "twinning" the life of a physical entity (an object, process, human, or a human-related feature). We generate HDTs via deep phenotyping and application of two state-of-the-art AI methods to take advantage of the pros and limit the cons of each: a generative model using variational autoencoder and a large language model coupled with retrieval-augmented generation. HDTs leverage population level data across urban and rural settings and combines it with a patient's unique data, to deliver personalized recommendations.

www.HealthTequity.net

PennAITech YouTube Feature

Weill Cornell Medicine

SCALABLE SUBTYPING FOR PERSONALIZED ASSESSMENT OF LATE-LIFE SOCIAL DISCONNECTION

Nili Solomonov, PhD

Social disconnection is a growing public health crisis in the US, with half of adults reporting social isolation. It predicts accelerated brain aging, poor adherence to medical care, and decline in cognition and daily functioning. Still, there are no gold-standard, evidence-based methods to assess social disconnection in healthy older adults, highlighting the need for new approaches.

Here, we propose SOCIAL-Q ("Scalable Online Classification and Individual Assessment for Loneliness Quantification"): a scalable tool for quantification and classification of an individual's social-emotional profile and their risk of social disconnection. This approach will provide a scalable, rapid, and precise assessment of individuals' social-emotional functioning. It will also guide development of scalable interventions to increase social connectedness and improve well-being in healthy older adults.

To achieve this goal, we will leverage exciting developments in machine learning and computer vision including "large language models" (LLMs) for speech tracking and emotion detection from vocal prosody. We will combine these advances with multimodal subtyping methods we developed to design an automated AI-powered tool that will estimate an individual's socio-emotional profile based on a brief multimodal assessment.

Findings from SOCIAL-Q will inform scalable, personalized, interventions aimed at increasing social connectedness that can be delivered in community settings to healthy adults (e.g., senior centers).

https://www.solomonovlab.com

PennAITech YouTube Feature

Penn Nursing
University of Pennsylvania

USING AI TO PREDICT DEPRESSION & BURDEN AD/ADRD CAREGIVING CONVERSATIONS

Nancy A. Hodgson, PhD, RN, FAAN

Clear communication between clinicians and caregivers of people living with dementia (PLWD) is essential to delivering quality dementia care. Objective, empirical assessment of these clinical communications can support the timely evaluation and management of care needs for PLWD and their caregivers but is currently too time-consuming and prone to clinician bias.

This is a secondary analysis of data collected during an implementation study evaluating the translation of an evidence-based dementia program. Conversational speech data from 125 hour-long (on average) sessions between clinicians and dementia caregivers along with repeat assessments of caregiver depression and burden will be leveraged to predict clinically meaningful treatment outcomes (caregiver burden, depression and PLWD healthcare utilization) via a machine learning (ML) model.

The study aims to: 1) use an ML model to identify patterns in clinical conversations linked to dementia caregiver depression and burden, 2) detect patterns predicting PLWD healthcare utilization (e.g., 911 calls, hospitalizations) and 3) analyze ML outputs to enable early, targeted interventions. This third aim will be guided by an advisory group of healthcare providers and dementia caregivers. The results will demonstrate the potential of ML and data science to improve health outcomes for over 11 million U.S. dementia caregivers. The long-term goal is to develop a scalable technology-based intervention to address caregiver depression and burden, reduce costly care, and enhance quality of life.

https://www.nursing.upenn.edu

PennAITech YouTube Feature

BrainCheck

IOWA

AI-DRIVEN CHATBOT TO NAVIGATE COGNITIVE CARE PLAN FOR PERSONS WITH AD/ADRD

Bin Huang, PhD

With the growing cost and care burn of Alzheimer's disease and Alzheimer's disease-related dementias (AD/ADRD), there is an urgent need to provide personalized care support to patients and their caregiver, thereby slowing disease progression, reducing expenses, and improving quality of life. Cognitive care planning (CCP) is a promising approach to systematically assess the needs of patients and caregivers and generate care plans with personalized recommendations to address neuropsychiatric/neurocognitive symptoms and functional limitations, and provide care resources. BrainCheck has developed a digital tool, BrainCheck (BC) Plan, to facilitate the integration of CCP into routine care. However, a lack of continuous support at home can make it difficult for patients and caregivers to follow through with care plans in daily life. To address this gap, we propose to develop a companion AI chatbot, BC Connect, that provides real-time, personalized assistance to patients and caregivers at home, helping them to navigate their care plans and answer questions as they arise. By leveraging a fine-tuned large language model alongside a knowledge base on dementia care, BC Connect will ensure to provide accurate and reliable information, mitigating the risk of misinformation common with AI systems. The study aims to: (1) identify common questions patients and caregivers face at home, (2) develop the BC Connect prototype, and (3) evaluate its usability and acceptability through real-world field testing. This innovation has the potential to improve the quality of care to persons with AD/ADRD while empowering families with the resources and ongoing support they need.

https://braincheck.com/

PennAITech YouTube Feature

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University of Pennsylvania

WATCH (WARNING ASSESSMENT AND ALERTING TOOL FOR COGNITIVE HEALTH)

Kyra O'Brien, MD, MSHP

Early detection of cognitive impairment, including dementia, is beneficial for patients and their families because it helps them access needed care supports. Screenings for many health conditions are done in primary care, but it is difficult to do screenings for cognitive impairment in this setting. This is because the time required to do a cognitive screen can be challenging to fit into a typical primary care appointment. The goal of this project is to make it easier for primary care providers to detect early signs of cognitive impairment in real-time. We aim to develop a prediction model that uses data from the electronic health record (EHR) and video and audio from the primary care visit to estimate a patient's risk of having undetected cognitive impairment. We will build off an existing cognitive impairment prediction model called the EHR Risk of Alzheimer's and Dementia Assessment Rule (eRADAR). We will use this model to recruit Penn Medicine primary care patients to participate in a recorded research visit, where we will conduct a cognitive and physical exam. Video and audio data from these visits will be combined with the EHR data to generate new predictive models. We aim to see if the addition of video and audio data to the prediction model improves detection of conditions such as Alzheimer's disease and related dementias. This will build the basis for future work aiming to integrate the new predictive model into primary care clinics and test its effectiveness in promoting early detection of cognitive impairment.

https://www.med.upenn.edu/kbjohnsonlab/ PennAITech YouTube Feature

pair
Palliative and Advanced Illness Research Center

DETERMINANTS OF ACCESS TO AND OUTCOMES FOLLOWING SPECIALIZED PALLIATIVE CARE FOR PATIENTS WITH ADRD

Emily Moin, MD, MBE

Through the PennAITech program, we will link electronic health record data from all patients at the University of Pennsylvania Health System (Penn Medicine) with inpatient encounters from 2017 – 2023 to claims data from the Centers for Medicare and Medicaid Services (CMS) from 2018 – 2024. The central goal of creating these linkages is to identify determinants of access to and outcomes following specialist palliative care (SPC) for patients with ADRD and other serious illnesses. Engaging SPC clinicians in the longitudinal management of patients with ADRD and other serious illnesses is a key priority, yet patients with ADRD less commonly receive SPC than do patients with cancer and other illnesses, and more commonly experience hospitalizations and inadequate symptom control. To surmount these inequities in care delivery requires filling key knowledge gaps related to the extents to which patients with ADRD experience novel and more holistic patient-centered outcomes than have commonly been measured, and whether patients at risk for poor outcomes can be reliably identified so as to target SPC resources toward them. We will achieve this central goal and address these knowledge gaps through completion of three specific aims. First, we will quantify differences in SPC consultation among Medicare and Medicaid beneficiaries with vs. without AD/ADRD admitted to Penn Medicine hospitals. We will first assess SPC access using the gold-standard approach we have pioneered of measuring signed SPC notes in the electronic health record (EHR), and second using the proportions with Z51.5 billing codes (“encounter for palliative care”) in CMS data. While this claims-based approach is commonly used due to its efficiency, there are many reasons to believe it may not possess favorable operating characteristics, thereby yielding biased conclusions when used as a measure of SPC receipt. Comparing its sensitivity, specificity, calibration, and other measures to our gold standard will elucidate this approach’s utility overall and specifically among patients with ADRD. Second, we measure changes in calculating a key patient-centered outcome – hospital-free days (HFDs), or days alive and living outside a hospital through 6 months of follow-up – using only EHR data vs. supplementing with CMS data among patients with ADRD and other serious illnesses. We hypothesize that adding CMS data to EHR data will produce more robust and accurate quantification of this critical outcome relative to either method alone. Third, we will build an Artificial Intelligence (AI) model to predict which patients with (1) ADRD and (2) all serious illnesses are at risk for low numbers of HFDs, thereby guiding the allocation of SPC services in practice enabling prognostic enrichment of patients with ADRD in future trials of palliative care interventions using this endpoint.

https://pair.upenn.edu/

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UNDERSTANDING AGING AND ADRD DISPARITIES USING A REPRESENTATIVE EPIGENETIC CLOCK

Rory Boyle, PhD

Disadvantaged groups may experience accelerated biological aging, due to the cumulative impact of repeated experiences with socioeconomic adversity and marginalization. This may cause early physical and cognitive health deterioration leading to disparities in aging and Alzheimer's disease and related dementias (ADRD) outcomes, as evident in associations of epigenetic clocks with worse aging and ADRD outcomes.

Epigenetic clocks apply machine learning to DNA methylation profiles from blood samples to estimate biological aging. Black American adults show accelerated epigenetic aging compared to White American adults and socioeconomic factors contribute to this racial disparity. However, epigenetic clocks have been developed using non-representative datasets consisting predominantly of White adults and therefore may not provide accurate estimates of epigenetic aging in other racial and ethnic groups.

We will use machine learning to develop and validate a representative epigenetic clock (REpiClock) to more accurately predict epigenetic age in Black adults. As the accuracy of epigenetic age estimates may be influenced by the genetic distance of a target individual from the average genotype of the training dataset, we will apply a data-driven method to correct epigenetic age predictions for the individual's genetic distance from the training set. In a deeply-phenotyped biobank, we will assess the relationship of the REpiClock with ADRD pathology, using plasma biomarkers, and ADRD risk and aging outcomes, using electronic health record data. This will allow us to establish whether a representative, genetic distance-corrected epigenetic clock, more precisely estimates disparities in epigenetic aging and whether these disparities underlie disparities in ADRD pathology and risk.

BOSTON UNIVERSITY

AI-BASED TOOL FOR MIXED DEMENTIAS

Vijaya Kolachalama, PhD

Diagnosing dementia can be challenging because many different types often occur together, making it difficult to identify what is truly causing a person's symptoms. For example, someone with both Alzheimer's disease and vascular dementia may not respond well to treatments designed just for Alzheimer's. Misdiagnosis can lead to ineffective or even harmful treatments, especially in older adults with complex medical histories. That's why it's so important to have tools that can accurately identify all the underlying causes of dementia. Our research team has developed an artificial intelligence (AI) model that can analyze a wide range of information, from brain scans and cognitive tests to medical history, to help determine what type or types of dementia a person may have. We tested this model on data from over 50,000 people and showed that it can reliably distinguish between different dementia types, even when multiple conditions are present. In some cases, neurologists using our AI tool improved their diagnostic accuracy significantly. Our next step is to build and test this AI tool in real-world healthcare settings. With support from the a2 Pilot Award, we will partner with two hospitals to test the tool on a diverse group of patients. The goal is to create a reliable, user-friendly platform that helps doctors make better decisions about diagnosing and treating dementia, ultimately improving patient care.

https://vkola-lab.github.io

PennAITech YouTube Feature

KurtLab

AN EXPLAINABLE DEEP LEARNING FRAMEWORK FOR BRAIN AGE PREDICTION IN AD

Mehmet Kurt, PhD

The biology of aging is a complex biological process that has yet to be fully understood. Recently, due to the growth in data availability and advances in deep learning techniques, brain age has been demonstrated as an effective biomarker for studying the brain aging process in the presence and absence of neurological disorders. This "brain age" provides a global estimate of how the subject's brain deviates from the average brain of a similar age. In the PennAITech project, we will extend brain age predictions to brain anatomy by providing age for different brain regions. We will also improve the transparency and accountability of this tool by explaining brain age in terms of clinically relevant image features, e.g., explaining brain age by highlighting brain regions that indicate accelerated aging. By identifying individual patterns of brain aging and specific areas of accelerated aging, clinicians using this tool can tailor individualized interventions and prognostic strategies. This subject-specific approach can improve outcomes by addressing specific risk factors and vulnerabilities.

MECHANICAL ENGINEERING
UNIVERSITY of WASHINGTON

https://www.me.washington.edu

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PILOT AWARDEES YR3
2024-2025

https://www.pennaitech.org

funded by the National Institute on Aging Grant Nr. P30AG073105

PYRAMES

IMPROVED ALGORITHMS FOR WEARABLE, PASSIVE, NONINVASIVE BLOOD PRESSURE MONITORING FOR OLDER ADULTS

Xina Quan, PhD

Older adults with high blood pressure (BP) are at increased risk of severe health concerns, e.g. heart disease, congestive heart failure, ischemic stroke, cerebral hemorrhage, vascular dementia and Alzheimer's disease. Frequent measurements improve BP control, leading to improved outcomes.

A significant barrier to BP control is obtaining sufficient measurements for effective management. Continuous monitoring with invasive arterial lines is limited to critical care facilities. Periodic cuff measurements through ambulatory BP monitoring provide an indication of BP variation, but devices are cumbersome and uncomfortable, leading to incorrect or insufficient usage.

A more convenient, cost-effective BP monitoring method providing passive measurements and actionable information potentially leads to reduced risk from cardiovascular disease.

PyrAmes has developed a comfortable, easy-to-use sensor band to monitor BP, enabling long-term, personalized BP management. It is soft, flexible, and lightweight, and has been validated for use with patients with fragile skin. Our innovative approach uses patented capacitive sensors to capture pulse waveform data, which is processed on a connected mobile device with neural networks to accurately determine BP values and provide detailed information about cardiovascular health.

Our first device, Boppli®, was FDA-cleared in 2023 for continuously monitoring the BP of critically-ill neonates. Our adult monitor uses identical sensors and validated software infrastructure and has shown initial feasibility. This project accelerates development for the older adult population, leading to FDA clearance and commercialization.

Our technology has the potential to become as ubiquitous for BP measurement as pulse oximeters are today, due to its accuracy, convenience, and ease of use.

https://pyrameshealth.com/

PennAITech YouTube Feature

PennState

TASK-ORIENTED MULTIMODAL CONVERSATIONAL AI FOR ASSISTING SENIORS WITH DAILY TASKS

Rui Zhang, PhD

With a global population of over 1 billion people aged 60 and above, there is a rapidly increasing need for innovative age tech solutions to improve the quality of life of older adults. Conversational assistants, powered by cutting-edge technologies in Artificial Intelligence (AI), Natural Language Processing (NLP), and Large Language Models (LLM), are permeating into home care, assisted living, and nursing facilities for smart elderly care. One type of conversational assistant is task-oriented, which can significantly enhance the life experience for senior people by helping them with real-world complex daily tasks. A task-oriented virtual assistant facilitates daily tasks spanning diverse scenarios such as calling for help in response to emergencies, helping with online grocery shopping, recommending cooking recipes, managing smart home devices, and providing financial education and decision-making. It greatly promotes the life quality of older adults by improving their well-being, efficiency, safety, and independence. In this proposal, we design, develop, and deploy a task-oriented multimodal conversational assistant to help older adults with daily tasks. The innovation of this proposal lies in the fact that we will employ a human-centered participatory approach by emphasizing collaboration between designers and end-users through interviewing, prototyping, and testing to address their unique needs and preferences to improve their daily lives.

https://ryanzhumich.github.io/ PennAITech YouTube Feature

BIDMC
NEUROLOGY

MOBILE TECHNOLOGY AS A COGNITIVE BIOMARKER OF ALZHEIMER'S DISEASE

Chun Lim, MD, PhD

Alzheimer disease's hallmark is insidious memory loss often accompanied by a lack of awareness of the deficit. Its diagnosis requires evidence of cognitive impairment and remains reliant on clinical assessments, primarily traditional pen and paper cognitive tasks, which, with its many limitations results in only one-half of patients ever diagnosed by physicians. Thus, a simple, inexpensive, and at-home method to capture more of these patients earlier in their disease process could facilitate earlier therapy and planning.

We propose to modernize the clinical diagnosis of Alzheimer's disease by taking advantage of smartphones to collect multiple streams of behavioral information including active data such as reaction/response time to cognitive tasks and games as well as data captured passively on the smartphone such as movement, location, and typing speed. Using advanced analytical tools, we propose to develop a new smartphone-based app for use in the home environment that detect signs and symptoms of early cognitive impairment and to continuously monitor for progression by capturing passive, real-world information, and active data.

https://bidmcneurology.org/ PennAITech YouTube Feature

DreamFace Technologies LLC

BUILDING DEEP DIGITAL TWINS FOR PREDICTION OF AD/ADR/MCI IN OLDER ADULTS

Mohammad H. Mahoor, PhD

The Alzheimer's Association predicts that the number of Americans aged 65 and older with Alzheimer's disease-related dementia (ADRD) will reach over 12 million people by 2050. ADRD often stars with mild cognitive impairment (MCI), which is characterized by challenges in memory, language, and thinking skills. Early MCI detection is vital for identifying those at risk of dementia, offering support, advice, and ongoing monitoring. Currently, older adults with MCI are diagnosed clinically; however, their daily challenges are often not noticeable to those whom they encounter irregularly. Artificial Intelligence (AI) holds promise for early cognitive impairment detection, with many AI studies focusing on expensive clinical assessments and medical scans like positron emission tomography (PET) and MRI. There is a pressing need for additional research to advance innovative, cost-effective, and accessible approaches for early detection and prediction of AD and MCI. Human digital twins are at the forefront of aging and longevity research, aiming to create personalized AI models that comprehensively simulate an individual's behavioral, biological, physical, mental, and socio-emotional attributes using health and medical records. These models hold the potential to revolutionize our understanding, prediction, and management of the aging process, offering personalized healthcare solutions. This pilot project aims to investigate AI techniques that leverage multi-modal audio-visual data, along with other available data modalities, to develop human digital twins for research in aging and, more specifically, for predicting MCI and the early onset of AD/ADRD. We design and implement a Deep Digital Twins (DDT) model using Conditional Variational Autoencoders (CVAEs) suitable for heterogeneous multi-modal data including speech, transcribed speech, and facial videos. We then evaluate the efficacy of the proposed model using publicly available datasets such as the I-CONECT and ADReSS datasets, which contain multi-modal data and other metadata suitable for our project. We hypothesize that DDTs trained using multi-modal comprehensive data can predict MCI/AD with high fidelity and accuracy compared to uni-modal data. We compare our proposed DDT with state-of-the-art models in the literature. We assess the models' performance, taking into account the impact of diverse data to ensure they remain unbiased. The expected outcome of this research are knowledge and prototyped Deep Digital Twins capable of assessing and predicting MCI/AD conditions in older adults. It is expected that the DDTs generate the longitudinal trajectories sampled from the data as well as predict the subject's future condition.

https://dreamfacetech.com/

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NYU

RORY MEYERS
COLLEGE OF NURSING

ALIVIADO

ALIVIADO DEMENTIA CARE MACHINE LEARNING ALGORITHM DEVELOPMENT FOR CAREGIVING

Ab Brody, PhD, RN, FAAN

Care partners (CP) of persons living with dementia (PLWD) provide crucial support and find significant meaning in the care they provide. They show compassion to those they are caring for, and resilience in the face of adversity. Yet, many CP lack high-quality, evidence-based guidance for addressing care needs of PLWD. One key area that is often challenging to CP, yet where they have little support, is in addressing neuropsychiatric symptoms (NPS) such as agitation or wandering. Most PLWD experience more than one NPS at a time and thus not only do CP lack support in managing these symptoms, they don't know which symptom to focus on first to reduce their burden and improve the quality of life of the PLWD. This is particularly true in underserved and marginalized communities who are less likely to have access to comprehensive dementia care or supportive services. Higher NPS, particularly in marginalized CP, greatly increases the risk of CP burden, physical and mental health challenges. To help CP make decisions about what NPS to prioritize, we will use artificial intelligence/machine learning (AI/ML) to develop a precision clinical decision support algorithm to assist CP in prioritizing which NPS to treat. The algorithm will be inserted into a user-friendly smartphone application which CP can download through the iOS or Android app store. The app will increase access to high-quality dementia support, empower CP to better manage NPS and improve the quality of life for both themselves and the PLWD.

https://aliviado.org/

PennAITech YouTube Feature

foresite HEALTHCARE

AI/ML ANALYSES OF MOBILITY CHANGES AMONG ELDERLY USING CONTINUOUS GAIT DATA

Nicholas Kalaitzandonakes, PhD

Novel pharmacological and non-pharmacological interventions for Alzheimer's Disease (AD) and Alzheimer's Disease and Related Dementias (ADRD) (e.g., physical therapy, occupational therapy, exercise, etc.) can slow the disease progression, but timely diagnosis is necessary for such interventions to be effective. Yet, early diagnosis of the disease remains difficult. Various biomarkers and specialized brain scans are accurate and effective in diagnosing the disease early, but they are expensive, invasive, and difficult to execute in practice.

In previous studies, gait (e.g., walking speed) and motion characteristics (e.g., cadence, stride time and variability, step length, step width, sacrum mediolateral range of motion) have been found to strongly associate with the onset of AD/ADRD and to, often, precede cognitive decline and the presence of other dementia symptoms. As such, it may be possible to use gait and mobility features as diagnostics for AD/ADRD.

In this project, we will identify and develop gait- and motion-related predictive biomarkers for AD/ADRD. For this purpose, we will analyze multiyear gait and motion data from more than 5,000 older adults in assisted living (AL) and memory care (MC) communities around the US. Residents in MC units are all professionally diagnosed with AD/ADRD.

The identified biomarkers will be used as digital diagnostics for early, easy, and inexpensive identification of AD/ADRD, including through passive monitoring of populations in communities with care management and those aging in place (e.g., via passive, physiological, sensors and wearables).

https://www.foresitehealthcare.com/ PennAITech YouTube Feature

Beth Israel Lahey Health
Beth Israel Deaconess Medical Center

DEVELOPING A HOME COGNITIVE VITAL SIGN TO DETECT COGNITIVE CHANGES AD

Daniel Press, MD

For the first time, patients with Early Alzheimer's disease (AD) are beginning disease modifying therapies such as lecanemab in large numbers. With the advent of these therapies, there is a critical need to monitor their cognitive function more closely as they are both at risk for acute cognitive decline, caused by amyloid related imaging abnormality (ARIA), and for chronic decline, to accurately measure disease progression. Unfortunately, there are no clinical tools currently in use to monitor cognition daily at home. Such a tool could not only detect acute changes, such as from ARIA or delirium, but might also be able to accurately measure disease progression over longer time scales, to personalize therapies. We have designed a simple spatial working memory test, the SWiM test, a 1-minute task in the form of a "serious game" that can be performed daily at home and potentially measure disease progression. In addition, this test can act as a "cognitive vital sign", allowing patients and their caregivers to monitor attentional ability daily to detect the cognitive changes that presage either symptomatic ARIA or delirium. We intend to assess the feasibility and the utility of the task in its first "at home" use in 25 patients with early AD, most in our Disease-modifying Immunotherapies for Alzheimer's Disease (DiAD) program. Participants and their caregivers will perform the task daily for six months. We are using a combination of standard (Item Response Theory) analytics and advanced machine learning algorithms to assess patient performance.

https://www.bidmc.org/daniel-press-laboratory PennAITech YouTube Feature

University of Missouri

MOTOR FUNCTION ASSESSMENT FOR MILD COGNITIVE IMPAIRMENT, FRAILTY, AND FALL RISK

Trent M. Guess, PhD

Fall risk, mild cognitive impairment (MCI), and frailty are three interrelated health conditions that diminish quality of life for older adults and put them at higher risk for adverse outcomes, including hospitalization, disability, and death. A common characteristic shared by these conditions is a decline in motor function, most often manifested by degradation in balance and gait performance. Comprehensive early detection of motor declines may offer our best chance of addressing these geriatric conditions. While there is growing interest in using sensors to measure movement and balance, currently available technologies are prohibitively expensive or do not capture multiple aspects of movement. As a solution, we have developed the Mizzou Point-of-Care Assessment System (MPASS), which integrates measurements from multiple sensors to provide an objective, comprehensive dataset of human movement and cognitive performance. The total cost of the testing platform is under $1,500 and MPASS motor function assessments typically take less than 15 minutes. Our goal is to integrate the MPASS with artificial intelligence (AI) approaches to translate the system into a clinically effective tool that quickly, affordably, and accurately assesses risk for falling, MCI, and frailty, in real-world clinical and community settings. Specifically, we will collect data on MPASS motor function, cognitive testing, fall history, and frailty for 30 persons with MCI and 50 community dwelling adults. We will then employ AI to develop prediction algorithms that distinguish persons with MCI, fall risk, and frailty. Finally, we will develop clinically usable outputs based on the prediction algorithms.

https://healthsciences.missouri.edu/ PennAITech YouTube Feature

DREXEL UNIVERSITY
School of
Biomedical Engineering, Science and Health Systems

DETECTING COGNITIVE IMPAIRMENT USING LARGE LANGUAGE MODELS FROM SPEECH

Hasan Ayaz, PhD

Early detection of cognitive decline due to Alzheimer's Disease and Related Dementias (ADRD) in older adults living alone is essential for developing, planning, and initiating interventions and support systems to improve patients' everyday function and quality of life. Conventional, clinic-based methods for early diagnosis are expensive, time-consuming, and impractical for large-scale screening. This project aims to develop and translate an artificial intelligence (AI)-enabled speech-powered dementia screening tool that is cost-effective and user-friendly for early detection of cognitive impairment to inform clinical practice (healthcare, clinical trials). We plan to harness the full potential of the state-of-art large language models (LLMs) for dementia prediction based on speech that will be a low-cost, easy-to-use, scalable approach to detection of AD, thereby holding immense potential for revolutionizing AD prognosis, diagnosis, and clinical research by enabling the earlyEarly detection of cognitive decline due to Alzheimer's Disease and Related Dementias (ADRD) in older adults living alone is essential for developing, planning, and initiating interventions and support systems to improve patients' everyday function and quality of life. Conventional, clinic-based methods for early diagnosis are expensive, time-consuming, and impractical for large-scale screening. This project aims to develop and translate an artificial intelligence (AI)-enabled speech-powered dementia screening tool that is cost-effective and user-friendly for early detection of cognitive impairment to inform clinical practice (healthcare, clinical trials). We plan to harness the full potential of the state-of-art large language models (LLMs) for dementia prediction based on speech that will be a low-cost, easy-to-use, scalable approach to detection of AD, thereby holding immense potential for revolutionizing AD prognosis, diagnosis, and clinical research by enabling the early forecasting of AD risk in longitudinal, unobtrusive monitoring of cognitive health.

https://liang-lab.org/

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THE UNIVERSITY OF TENNESSEE KNOXVILLE

MUSICARE-VR: MUSIC INTERVENTION WITH VIRTUAL REALITY FOR ALZHEIMER'S CARE

Jindong Tan, PhD

MUSICARE-VR is an innovative system that combines the benefits of music intervention with the connective power of virtual reality to improve the well-being of people with Alzheimer's disease and related dementia (PwADRD). By providing engaging music sessions in a virtual environment, MUSICARE-VR aims to enhance cognitive function, physical activity, emotional positivity, and social connectedness among PwADRD, especially those living in isolation. The system will be developed using cutting-edge virtual reality technologies. PwADRD will participate in personalized, interactive music activities led by skilled music therapists, fostering a sense of achievement and encouraging repeated engagement. A key feature of MUSICARE-VR is the integration of artificial intelligence (AI), which will adapt music interventions in real-time based on users' emotional and physiological responses, ensuring an engaging and effective experience. AI-powered virtual agents will also join the sessions, enhancing social interactions and overall engagement. To ensure the system's success, MUSICARE-VR will be developed through a user-centered, iterative design process. The feasibility and acceptance of the system will be evaluated among PwADRD and their caregivers, with a focus on usability, engagement metrics, and participant feedback. By combining music intervention, virtual reality, and AI, MUSICARE-VR promises to be a groundbreaking tool for improving the quality of life of PwADRD and their caregivers.

https://mabe.utk.edu/

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Penn
University of Pennsylvania
Artificial Intelligence and Technology Collaboratory for Healthy Aging

PILOT AWARDEES YR2
2023-2024

https://www.pennaitech.org

funded by the National Institute on Aging Grant Nr. P30AG073105

Perelman SCHOOL OF MEDICINE
UNIVERSITY of PENNSYLVANIA

ADVANCING DIAGNOSTIC EXCELLENCE FOR OLDER ADULTS THROUGH COLLECTIVE INTELLIGENCE AND IMITATION LEARNING

Gary Weissman, MD, MSHP

Diagnostic errors are common in the primary care setting and lead to direct patient harms, increased healthcare costs, and decrease patient satisfaction. Older adults are especially at risk for such diagnostic errors because of their higher comorbidity burden, medical complexity, increased rates of frailty and cognitive impairment, and decreased representation in clinical datasets and research studies. Artificial intelligence (AI) and machine learning (ML) methods have good face validity for offering clinical decision support (CDS) in this setting to promote diagnostic excellence. However, there is little data to suggest that any particular diagnostic CDS is transparent, reproducible, equitable, and effective at improving the diagnostic process. Therefore, our objective is to create a diagnostic CDS system for use in primary care clinics to facilitate the diagnostic process, present suggestions about important features of the history and exam to consider that are tailored to patient characteristics, and promote diagnostic excellence for older adults. This proposal overcomes existing limitations to training diagnostic CDS systems in primary care where there is a broad diagnostic scope and tremendous clinical uncertainty around training labels. To accomplish this, we will rely on imitation learning and collective intelligence to build AI/ML models that provide predicted suggestions into diagnosis and tests based on expected behaviors from peer clinicians caring for similar patients. These models will be trained using existing data from the electronic health record and deployed in a pilot study across diverse primary care clinics to assess their diagnostic accuracy and acceptability to clinicians, patients, and their caregivers.

https://pair.upenn.edu/

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KENNESAW STATE UNIVERSITY

GLUCOCHECK: A NON-INVASIVE & AI-ASSISTED BLOOD GLUCOSE MONITORING DEVICE FOR OLDER ADULTS

Maria Valero, PhD, MsC

The GlucoCheck project presents a significant advancement in the realm of diabetes management, with a specific focus on enhancing the quality of life for older adults. In light of the escalating global prevalence of diabetes and its associated complications, the imperative for non-invasive, accurate, and user-friendly blood glucose monitoring has never been more pronounced. Diabetes poses severe health risks, particularly for older adults, making effective and comfortable glucose monitoring paramount. Existing methods, characterized by frequent finger-pricking and subcutaneous needle implants, entail discomfort, infection risks, and potential tissue damage, particularly in individuals with diminished skin elasticity and compromised immune responses. GlucoCheck emerges as a pioneering solution, harnessing near-infrared spectroscopy (NIR) technology augmented by AI. This device offers a non-invasive means of consistently monitoring blood glucose levels by simply wearing it on one's finger. Importantly, GlucoCheck integrates AI algorithms that adapt to individual skin attributes, including color and texture, enhancing precision across diverse demographics.

This project's core objectives encompass rigorous validation of GlucoCheck's efficacy, with a primary emphasis on older adult demographic. Comparative analyses will be conducted, aligning GlucoCheck's measurements with conventional blood glucose monitors to ascertain accuracy and reliability. Our mission is underscored by the desire to deliver an efficacious, user-centric device tailored to the unique requirements of older adults. The project's outcomes will furnish valuable insights that drive refinements in GlucoCheck, propelling us closer to positively impacting the livesof millions of individuals grappling with diabetes.

http://iotas.kennesaw.edu/

PennAITech YouTube Feature

Tony C. Carnes, PhD

REAL-TIME REMOTE MONITORING OF CONFIRMED MEDICATION ADHERENCE

Medication non-adherence is responsible for up to $300 billion of avoidable healthcare costs in the United States with patients over 60 years of age consuming 50% of dispensed prescription drugs. This project enables real-time, remote monitoring of medication ingestions and enhances patient and caregiver feedback to help patients stay adherent and thus extend the time they are able to age grace fully at home.

The existing FDA-cleared IDCap system detects ingested medication signals using a watch or lanyard-style reader worn by the patient and forwards information to a server through an app on a patient's smart phone. In this proposal we are looking to remove the individuals' worn reader from the system and replace it with a series of readers placed in multiple locations in a person's home to ensure ingestion detection without the user changing their usual behavior. Additionally, the new readers will interface with Alexa to facilitate audible and visual reminders and confirmations of medication ingestion. If the end user allows, remote care providers will be able to participate in the adherence journey and intervene when needed.

https://etectrx.com/

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Maryam Zolnoori, PhD

A SPEECH-PROCESSING ALGORITHM FOR AUTOMATIC SCREENING OF AFRICAN AMERICAN PATIENTS WITH MILD COGNITIVE IMPAIRMENT AND EARLY DEMENTIA IN HOME HEALTH SETTINGS

Mild cognitive impairment (MCI) and early-stage dementia (ED) are prevalent concerns, impacting one-in-five adults over age 60. Alarmingly, a significant percentage of these cases remain undiagnosed, leading to missed timely interventions. Our data emphasizes that African American seniors are particularly vulnerable, with existing disparities in healthcare access, biases, and varying health literacy levels exacerbating the situation. A novel observation we intend to leverage is the correlation between linguistic shifts and the onset of cognitive issues. Language, a foundational element of cognition, exhibits early perturbations during cognitive decline. The nuances of these changes can vary across racial boundaries, influenced by dialectic variations such as African American Vernacular English. In this pivotal study, our objective is to architect a diagnostic tool to detect nascent signs of MCI-ED by analyzing African American patients' verbal communications during regular health consultations. By meticulously recording, processing, and extracting linguistic and phonetic features from these conversations, complemented by additional clinical data, we aim to devise a potent screening algorithm. This initiative aligns seamlessly with the National Institute on Aging's focus on early identification of cognitive impairment in the elderly. The prospective outcome, an innovative algorithm, holds promise to enhance timely MCI-ED diagnosis efficacy, especially among African American individuals, thereby optimizing care quality and addressing longstanding disparities.

https://www.nursing.columbia.edu

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EMORY | NELL HODGSON WOODRUFF SCHOOL OF NURSING

A DEVICE FREE WIFI SENSING SYSTEM TO ASSESS DAILY ACTIVITIES AND MOBILITY IN LOW-INCOME OLDER ADULTS WITH AND WITHOUT COGNITIVE IMPAIRMENT

Jane Chung, PhD, RN

Low-income older adults face an increased risk of cognitive impairment and dementia. Cognitive impairment affects the ability to perform and manage daily activities and mobility behaviors. Detecting the changes in these abilities early is crucial but often difficult among low-income older adults due to limited resources. Our goal is to meet the unmet needs of low-income older adults by creating a cutting-edge system that uses Wi-Fi signals to localize and recognize different patterns of in-home activities and mobility. We employed machine learning algorithms to process the Channel State Information of the collected Wi-Fi signals and extract different activity and mobility features. Our system has demonstrated its ability to automatically categorize and quantify various in-home activities with accuracy rates ranging from 80% to 90%, depending on the activity type. Our project also collected self-reported physical function and psychosocial health data, and older adults' feedback on Wi-Fi sensing technology acceptance and implementation. This innovative project leverages Wi-Fi sensing technology and machine learning to detect changes in the levels and patterns of daily activities, empowering older adults experiencing cognitive decline. By providing an accessible and cost-effective solution, we can enhance monitoring capabilities, enabling better support for vulnerable older adults and promoting their quality of life and brain health.

https://www.nursing.emory.edu/

PennAITech YouTube Feature

Xinyu Zhang, PhD

NON-INTRUSIVE, FINE-GRAINED IN-HOME DAILY ACTIVITY TRANSCRIPTION FOR ALZHEIMER'S MONITORING

Recent research identified a strong correlation between onset of Alzheimer's disease (AD) and changes in fine physical activities, e.g., movement and dwelling time across locations, daily routines like medicine/water intake. Early detection of such indicators is crucial in compiling better treatment and slowing the progression. Conventional methods for monitoring the activities of daily living (ADL) rely on observation or self-report, which are time consuming, error-prone, and require strict patient compliance. This project aims to transcend such limitations and bridge the key technology gaps in bringing ADL sensing close to clinical practice. The project focuses on the development of EgoADL, a system that uses non-intrusive smartphone/smartwatch sensors to sense ADL. EgoADL builds on a novel self-supervised sensor fusion model that trains itself without user intervention. Instead of classifying among a small known set of ADLs, it directly transcribes raw multi-modal sensor signals into text logs of ADLs which can be interpreted by clinical practitioners or AI models. EgoADL will be the first to use non-visual sensors to transcribe fine ADLs (e.g., human-object interaction) with near-vision precision, in real-time and in a privacy-aware manner. The sensing data can facilitate follow-on clinical and AI analytics, potentially enabling early detection of chronic diseases and safe aging in place. Ubiquitous health monitoring is particularly important for rural and underserved communities, who either do not have access to or cannot afford prolonged hospitalization. EgoADL will be verified through a pilot study in UCSD's and Upenn's healthy aging facilities.

http://xyzhang.ucsd.edu/index.html

PennAITech YouTube Feature

Aidong Zhang, PhD

UNIVERSITY of VIRGINIA

FAIRNESS AND ROBUST INTERPRETABILITY OF PREDICTION APPROACHES FOR AGING AND ALZHEIMER'S DISEASE

Machine learning (ML) approaches have been increasingly used for facilitating clinical decision-making in Alzheimer's Disease (AD) and AD related dementia (ADRD). However, recent research has shown that existing ML techniques are prone to unintentional biases towards protected attributes such as age, race, sex, gender, and/or ethnicity. Moreover, although deep learning (DL) models have been a great success in many applications including AD/ADRD prediction, DL models are usually expressed in a way that is not interpretable. Thus, ML approaches using health data may incur ethical and trustworthiness concerns that may result in the unfair treatment of patients. As decision-making systems for aging and AD/ADRD become popular, a major challenge is how to ethically integrate AI/ML methods into the lives of people, given that ethical principles may often be violated in existing methods. This has become an important issue for both the ML community and the AD/ADRD community. Moreover, ML approaches that are not transparent can be prone to repeating discriminatory patterns from prior data or generating new ones based on biased learned patterns. This project develops electronic health records (EHRs) based ML methods for Penn Medicine EHR AD/ADRD datasets that are fair, generalizable, and interpretable solutions that would help inform the clinician for AD/ADRD diagnosis and care management. We focus on studying fairness and interpretability, two important factors for making AI methods trustworthy, particularly during deployment or use of the methods. We study how bias affects our prediction models. Also, we will develop explainable methods to increase clinical interpretability.

https://engineering.virginia.edu/

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UNIVERSITY of WASHINGTON

TALKING TECH WITH DEMENTIA CARE DYADS: IMPROVING A SELF-ADMINISTERED TOOL TO SUPPORT INFORMED DECISION

Clara Berridge, PhD, MSW

The proposed project is to enhance the Let's Talk Tech (LTT) intervention that is delivered as a web application. LTT is the first of its kind self-administered tool to help families meaningfully engage people living with mild dementia in digital technology use planning to enable optimal use to support dementia caregiving at home. Let's Talk Tech is an education and communication intervention that supports decision making and planning for technology use. It includes the following components: education accessible to people living with mild AD/ADRD and care partners about multiple technologies, facilitation of dyadic communication, and documentation of the person living with dementia's preferences. LTT has demonstrated in a pilot promising preliminary feasibility and efficacy on targeted measures for informed shared decision making about technologies. This project will implement what was learned from the pilot study about ways to further expand its reach, relevance, and sharing with the entire care network. Aim 1 is to enhance Let's Talk Tech to achieve wider relevance and equitable access with 4 new features. Aim 2 is to implement EHR integration and patient-controlled sharing of LTT's preference summaries, and Aim 3 is to assess clinician acceptability of viewing dyad's LTT preferences in a test instance the EHR. This will expand the intervention's reach and functionality, employ standards to promote interoperable sharing of documented preferences, and further test and iteratively improve LTT.

https://socialwork.uw.edu/news/project/lets-talk-tech/

PennAITech YouTube Feature

Vaaji

PREVENTION OF PATCH POISONING IN ELDERLY ALZHEIMER'S PATIENTS

Sandeep Patil, MD, PhD

Patients with Alzheimer's are prone to medication errors with serious consequences. Some errors, however, may be preventable if detected early. This project will develop smart patch technology to track errors in real time to prevent adverse outcomes.

Fatalities or emergency hospitalizations can occur due to transdermal patch overdose/poisoning by placing more than the prescribed number on the body.

Transdermal therapies typically have excess drug over what is intended to be delivered during the period when the patch is specified to be on body. Thus, an overdose can also happen if a new patch is placed without removing the older patch. A wide range of overdose symptoms occur with most commonly used drugs [cholinergic drug patch(s)] for Alzheimer's. In severe cases, these include rapid dehydration, and renal failure, and/or low heart rate potentially leading to sudden cardiac arrest and death.

Early detection of one or more excess patches AND prompt removal within a defined period protects against effects of overdose. A prototype patch(s) will be built with a signaling tag that can be easily detected by a fixed reader. We will then assess the performance of this prototype patch system as Healthy Volunteers move freely in different sections of the Home Care Suite. Successful implementation of this technology will contribute to healthy aging at home and improve the well-being of the patients and their caregivers.

https://vaaji.io/

PennAITech YouTube Feature

Julie Faieta, PhD

HEALTH APP REVIEW TOOL: CONNECTING THOSE AFFECTED BY ALZHEIMER'S TO NEEDED TECHNOLOGY SUPPORT

The goal of this project is to connect those affected by Alzheimer's disease and related dementias (ADRD) with effective apps using an intelligent decision-making aid, the Health App Review Tool (HART). The HART is comprised of a User Assessment and App Assessment, that together characterize the features of health apps relative to the needs, abilities, and preferences of individuals with ADRD and their informal caregivers. The HART assesses the goodness of match between user and app variables in order to guide app selection.

The first phase of this pilot project will be used to develop a web-base and app interface to house the HART. The dedicated interface is necessary in preparation for real-world and wide-spread use of the HART. There will be a user interface displaying the HART assessment questions, a back end that completes the scoring process, and a results display. In addition, we will establish a cloud-based library of app scores that can be downloaded and compared to new HART users in the future. The second phase of the project will be a usability study to gather feedback and insight on the HART interfaces for those impacted by ADRD.

The Health App Review Tool (HART) is expected facilitate clinicians, caregivers, and community organizations to select the best apps to meet the unique needs of individuals with ADRD and their caregivers. Improving access to person centered, easy to use technology guidance is intended to increase the impact and equity of app-mediated care.

https://www.shrs.pitt.edu/rst

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Artificial Intelligence and Technology Collaboratory for Healthy Aging

PILOT AWARDEES YR1
2022-2023

https://www.pennaitech.org

funded by the National Institute on Aging Grant Nr. P30AG073105

Kendra Ray, PhD

AUTOTUNE ME

TITLE: A MUSIC-BASED MOBILE APP TO COMBAT NEUROPSYCHIATRIC SYMPTOMS IN PEOPLE LIVING WITH ADRD

The purpose of this pilot project is to develop a mobile application “TuneMind” that detects pulse and sedentary movements of homebound individuals with Alzheimer’s disease and related dementias (ADRD) and triggers auto-play of personalized songs in a wearable device. By collecting quantitative and qualitative data from the app and users, we will test the acceptability and feasibility of the app. This app will be an important tool to include in daily caregiving in a home setting by extending established benefits of music therapy for people with ADRD. The aims are as follows:

Aim 1. Develop TuneMind. TuneMind will be developed to respond to changes in the pattern of heart rate and sedentary behaviors of people with ADRD. An algorithm will be created to (1) find changes of the heart rate to trigger the application to play music; (2) adaptively improve learning when music is needed, e.g., time of day; (3) predict the music dose required to better control heart rate and movement.

Aim 2. Test the usability of the app. A total of 10 stakeholders will be asked to test TuneMind for two weeks. Based on a survey and focus groups, improvements will be made to app.

Aim 3. Determine the performance and usability of the app for use by people with ADRD and their family caregivers at home. Twenty dyads will be recruited to test TuneMind for two weeks. We will collect physiological measures based on the app’s demonstration to auto-play music according to pulse and/or sedentary states.

https://autotuneme.org/

PennAITech YouTube Feature

bestiebot

TITLE: RGBD+ THERMAL COMPUTER VISION PLATFORM FOR HOME MONITORING AND TELEHEALTH

Richard Everts

We're building a new class of a home-based, AI-enabled, camera system that combines stereo vision with thermal sensors to detect falls, send alerts, and perform basic health diagnostics. Using unique sensor fusion with RGBd and thermal sensors, along with a pre-existing and strong software platform, we can in a short time: 1) Increase safety through robust pose detection for falls and send alerts when appropriate, 2) Expand home health tools like exercise and flexibility detection such as Yoga Pose detection or flexibility measurements, 3) Assist with preventative care with thermal sensors for health diagnostic capabilities Our goal is to customize a pre-existing board from Luxonis and utilize its well-developed SDK Python package to create our software platform. The software itself will enable the person tracking, pose detection, temperature checks, and body part tracking necessary to accomplish these goals. At the end of the project, the hardware boards will be available for purchase by anyone wanting to continue development of their own systems in cameras or robotic systems, and we will be able to open-source much of the procedurally generated datasets. Our completed device with both hardware and software will be in a state that it can be placed in further testing with users for longer-term studies and made available to end-users for immediate use.

https://bestiebot.com/

PennAITech YouTube Feature

TITLE: PHYSIOLOGICAL DETECTION AND MONITORING OF ALZHEIMER'S DISEASE

David Yonce, MS, MBA

Cogwear has developed a wireless dry-sensor EEG wearable that can easily collect clinical-grade brainwave data anywhere, anytime with comfort and no limits on mobility. Initially applied to behavioral health, here we propose to extend our platform to early detection and trending of dementia and Alzheimer's Disease (AD) based upon brain physiology. With the ability to sense EEG from the frontal and temporal lobes, the parts of the brain that regulate short and long-term memory, planning, and executive functions, our system can detect EEG changes implicated in dementia and AD: slowing, reduced complexity, decrease in synchronization, and neuromodulatory deficits.

Our project will focus on two components: migrating our wearable to a soft goods form factor with downsized electronics more appropriate for in-clinic and home use and begin to develop the EEG signal processing and applications to quantitatively detect and trend brain processes associated with dementia and AD. Deliverables will include an advanced prototype and pilot testing of algorithms with humans in a small sample of healthy and AD/ADRD patients.

Our expectation is that these algorithms will ultimately show efficacy to detect pre-symptomatic brain changes, allowing intervention by caregivers to prepare patients and families. Further, because subtle EEG shifts can be indicative of changing disease states, we can provide quantitative trending of AD based upon brain physiology, providing new methods to titrate pharmaceuticals and evaluate disease treatments. Through earlier detection and enhanced monitoring, our goal is to better support patients and their families by enabling more years of high-functioning and independent living.

https://www.cogweartech.com/ PennAITech YouTube Feature

GW Public Health

CROSSWATER DIGITAL MEDIA

TITLE: AI-ENABLED CONVERSATIONS TO MEASURE MENTAL STATUS AND MANAGE PSYCHOTROPIC MEDICATION USE

Lorens Helmchen

Continuous monitoring of cognitive function among the elderly is vital for early detection and proper management of Alzheimer's Disease and related dementias. Similarly, continuous monitoring of changes in mood is indispensable for the appropriate dosing of psychotropic medication.

Yet, current means of monitoring cognitive function and mood among the elderly are often infrequent, inconsistent, and imprecise because they rely on the completion of standardized questionnaires that may fail to flag clinically relevant leading indicators.

This project aims to deploy and validate the use of digital "conversation companions", a remote patient-monitoring technology that can be installed on tablet computers and smartphones by untrained caregivers or the elderly themselves.

The recordings and transcripts of the conversations between elderly residents and these digital companions will be used to train machine-learning algorithms that can measure the presence and severity of dementia and depression and predict fall risk.

Expert clinicians, family members, and community stakeholders will ensure that the predictions are clinically informative, actionable, transparent, and culturally appropriate.

As the technology can be used by patients on their own and as the voice and the visuals of the digital conversation companions can be adapted to a patient's linguistic and cultural background, this technology can reach traditionally under-served patient populations such as racial minorities and those living in remote areas.

This technology will allow caregivers to detect small and subtle changes in an individual's cognitive function and mood in a way that is less intrusive, more frequent, more consistent, and more precise than current practice.

https://www.gwu.edu/ https://crosswater.net/ PennAITech YouTube Feature

David Stout

TITLE: AI-ASSISTED FALL DETECTION AND REMOTE MONITORING FOR SENIORS WITH ADRD

Falls are a significant contributor to health decline in older adults. Iris Technology Inc is using a proprietary AI Vision architecture to build a better fall detection and prevention solution for use in health care facilities and eventually home care environments. Our proprietary AI architecture, Deep Detection™, will revolutionize how we detect and even prevent falls by allowing us to create highly accurate models with minimal training data, and by generalizing and incorporating context to provide deeper insights. Our solutions operate entirely on the edge, ensuring patient privacy in the health care setting and giving users total control over their data. In partnership with UPenn and the National Institute of Aging, our project is focused on harnessing the unique capabilities of our AI to create a model that can more accurately detect fall events and learn when the risk of a fall is high to support preventative intervention. Our ultimate vision is to build a full suite of tools and a library of models that can facilitate better, more personalized care for seniors that both enables greater independence and fully protects their privacy without the need for expensive or unscalable monitoring. There is an ever-growing need to develop good technology that can ease the increasing burden on caregivers and help ensure that seniors are receiving the highest levels of care. Iris Technology's mission is to empower people to solve humanity’s unsolvable problems, and we are confident that we can help to develop cutting-edge AI that will help solve real-world problems facing seniors and caregivers today.

https://www.poweredbyiris.io/

PennAITech YouTube Feature

KODAHEALTH

TITLE: PATIENT-SURROGATE ALIGNMENT IN DIGITAL ADVANCE CARE PLANNING

Desh Mohan, MD

Advance Care Planning (ACP) encompasses educating patients on potential future healthcare decisions, clarifying patients' values and healthcare preferences, and sharing decisions with family and care providers. Most individuals lacking decision-making capacity near end-of-life will need a surrogate decision maker (SDM) to make or voice decisions for them. However, less than 25% of SDMs are engaged in the ACP process or aware of patient preferences, and often feel unprepared for decision-making. Koda is a machine-learning based ACP platform which offers dynamic educational content, decision guidance, and advanced directive documentation for patients and SDMs. Aims of this study are to: 1) determine motivators of patient-SDM alignment among Koda users and 2) develop a machine learning algorithm to perform SDM persona identification.

Participants will be 50 patient-SDM dyads. Eligible patients will be 50+ years of age, without dementia or blindness. SDMs will be 18+ years old. All participants should have an email address and ability to read and speak English. Following informed consent, patients will complete the Koda ACP platform and a survey about SDMs' values and experiences. SDMs will complete a self-survey and perceived alignment surveys before and after reviewing the patient's completed ACP. Survey data will be used to train the SDM persona detection algorithm. Dyads will also be invited to complete qualitative interviews, for further exploration of patient-SDM experiences.This pilot project aims to better understand patient-SDM alignments and to develop an algorithm for identification of SDM personas, with the ultimate goal of facilitating increasingly high-quality ACP and goal-concordant care.

https://www.kodahealthcare.com/

PennAITech YouTube Feature

University of Colorado Anschutz Medical Campus

KAISER PERMANENTE® Institute for Health Research

TITLE: LEVERAGING PATIENT PORTALS TO SUPPORT CAREGIVERS

Jennifer Portz, PhD

Caregivers for people living with dementia (PLWD) make up a diverse group of individuals and can include family, friends, and paid direct care workers. Nearly 30% of caregivers in the United States report caring for a PLWD. While providing care to a loved one can be rewarding, some caregivers may feel caregiver burden and become self-neglectful (e.g., eating poorly, poor exercise habits), which have the potential to lead to poor health outcomes among caregivers. Caregiver-specific interventions are beneficial for improving mental health, confidence in caregiving, and self-care. However, caregivers often experience barriers to such interventions such as time and access. The objective of this pilot is to develop a data-framework for finding caregivers from the electronic medical record (EMR) who can benefit from caregiver and dyadic interventions. PLWD and their caregivers often receive health care services within the same healthcare system and their data hosted within the same EMR. Our previous work found that health outcomes, such as hospitalization, for caregiver-PLWD dyads living in the same household are linked. However, our current model is limited to caregivers living in the same household, often spouses, who share health insurance. Natural language processing can fill this gap by analyzing unstructured EMR data to find patterns among caregivers that will allow us to further idenify non-traditional caregivers (e.g., friends, neighbors) and caregivers outside the home (e.g., adult children, extended family members). By automating the process of caregiver identification through the EMR, interventions can be more easily delivered to engage and support the caregiver.

http://kpco-ihr.org/

PennAITech YouTube Feature

SCHOOL OF INFORMATION
UNIVERSITY OF MICHIGAN

TITLE: CONVERSATIONAL CARE TECHNOLOGIES

Robin Brewer, PhD

This project focuses on designing and developing conversational care technologies for older adults and their caregivers. In prior work, we surveyed informal caregivers and older adult care receivers to understand their care routines. Survey findings showed how nearly 20% of care partners used voice assistants in their homes, signaling an opportunity to extend research on older adults' conversational technology use to include care partners. Next, we conducted a diary study and interviews with caregivers and care receivers to investigate gaps in care interactions and conversations. We found that care receivers experienced more communication frustrations than caregivers and that older adult caregivers wanted more opportunities to influence their care routines.

In this project, we will use these findings to develop in-home conversational technologies that use prompts to structure care conversations between older adults and their caregivers.

We contribute a nuanced dyadic perspective to care relationships as most care research focuses solely on caregiver perspectives. We also extend conversational technology research beyond information seeking to include more social uses by developing conversational technology applications with mainstream voice technologies (e.g., Amazon Alexa) to support improved care relationships, social and emotional well-being, and quality of life.

https://robinbrewer.com/

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UNIVERSITY OF MINNESOTA
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TITLE: DESIGNING USABLE TECHNOLOGIES FOR OLDER ADULTS VIA DATA-DRIVEN WHOLE-PERSON USER PERSONAS

Robin Austin, PhD, DNP

The long-term goal of this research led by Dr. Robin Austin at the University of Minnesota and her team is to improve health outcomes by combining whole-person patient-generated health data with EHR data, to inform clinical conversations, predict patient trajectories, and identify appropriate interventions. This research, Designing Usable Technologies for Older Adults via Data-Driven Whole-Person User Personas, will create a set of data-driven user personas based on data from 6 studies where 783 adults 65+ years old independently completed a comprehensive health assessment using the MyStrengths+MyHealth (MSMH) mobile app developed by Dr. Robin's team. MSMH assesses 42 strength/problem areas (e.g., Income, Spirituality, Nutrition) divided into four categories (e.g., My Living, My Mind and Networks, My Body, My Self- Care). Individuals can specify any of 335 challenges (e.g., Hard to concentrate) and any of 4 needs related to each strength/problem area (e.g., Check-ins, Hands-on Care, Info/Guidance, Care Coordination). We will use machine learning approaches, clustering analysis and association rule learning, which are frequently used to develop user personas. These whole-person user personas will account for a 360 degree view of the person, meaning the environments in which individuals live, their psychosocial and physical health needs, and their strengths. This research will inform person-centered technology design and develop a better understanding of the types of older adults who may use AI-based technologies.

https://nursing.umn.edu

PennAITech YouTube Feature

Perelman School of Medicine, University of Pennsylvania

Penn Frontotemporal Degeneration Center

TITLE: FEASIBILITY OF DIGITAL MONITORING TO DETECT AUTONOMIC MARKERS OF EMPATHY LOSS IN BV FTD

Emma Rhodes, PhD

Loss of empathy is a core symptom of behavioral variant frontotemporal dementia (bvFTD) that negatively impacts daily functioning and is highly distressing to families and caregivers. Scientific research has struggled to understand the specific causes of empathy loss in bvFTD. A relatively unexplored but promising avenue of scientific inquiry is the role of autonomic nervous system (ANS) arousal in empathy loss in bvFTD. The ANS is comprised of two complementary subsystems, the sympathetic and parasympathetic nervous systems, which operate together to regulate an individual's level of physiologic arousal in response to emotional cues from the environment. Patients with bvFTD show abnormalities in autonomic arousal that are linked to symptoms of social dysfunction, including loss of empathy, but this line of research has been hindered by reliance on traditional methods of measuring autonomic arousal, namely hard-wired EKG and skin conductance sensors, which restrict the movement of the patient and are sensitive to motion effects. Recent advances in wearable smartwatch technology allow for precise, unobtrusive measurement of autonomic arousal with built-in motion sensors that more accurately capture key arousal variables, such as respiratory sinus arrythmia and skin conductance. Use of smartwatch technology will advance our understanding of physiologic mechanisms of empathy loss in bvFTD and other neuropsychiatric symptoms in ADRD and identify potential treatment targets. The overarching goal of this project is to test the feasibility of using a smartwatch to capture abnormalities in autonomic arousal in bvFTD and validate digital markers of autonomic abnormalities against behavioral measures of empathy loss.

In this project, we will use these findings to develop in-home conversational technologies that use prompts to structure care conversations between older adults and their caregivers.

We contribute a nuanced dyadic perspective to care relationships as most care research focuses solely on caregiver perspectives. We also extend conversational technology research beyond information seeking to include more social uses by developing conversational technology applications with mainstream voice technologies (e.g., Amazon Alexa) to support improved care relationships, social and emotional well-being, and quality of life.

https://www.med.upenn.edu/ftd/

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USC Viterbi
School of Engineering

TITLE: AN ACCESSIBLE MACHINE LEARNING-BASED ADRD SCREENING TOOL FOR FAMILIES AND CAREGIVERS

Maja Matarić, PhD

The goal of this project is to develop an app-based screening system capable of detecting early signs of Alzheimer's Disease (AD) using data captured during sessions of standard clinical AD diagnostics. Approximately 50 million people worldwide are diagnosed with dementia. As of 2021, an estimated 6.2 million Americans, one in nine people 65 and older, are living with AD.The majority of affected people do not obtain early screening toward a timely dementia diagnosis. Consequently, there is a large and rapidly growing need for low-cost, non-invasive, and accessible tools for dementia screening toward alerting families and caregivers and encouraging them to pursue medical evaluation. The proposed app is intended for family members and caregivers and will be designed to be easy to use and encourage regular screening. The goal is for the proposed app to enable convenient early flagging of AD for the general public.

https://maja-mataric.web.app/

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TITLE: DETECTING RESPIRATORY DISTRESS IN PATIENTS WITH ADVANCED ADRD USING RADIO SENSORS

Veerawat Phongtankuel, MD, MS

This project focuses on designing and developing conversational care technologies for older adults and their caregivers. In prior work, we surveyed informal caregivers and older adult care receivers to understand their care routines. Survey findings showed how nearly 20% of care partners used voice assistants in their homes, signaling an opportunity to extend research on older adults' conversational technology use to include care partners. Next, we conducted a diary study and interviews with caregivers and care receivers to investigate gaps in care interactions and conversations. We found that care receivers experienced more communication frustrations than caregivers and that older adult caregivers wanted more opportunities to influence their care routines.

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https://weill.cornell.edu/

PennAITech YouTube Feature

We are excited to share our PennAITech Video Library consisting of educational videos covering a broad range of topics from an introduction to Alzheimer's Disease and Related Dementias to Basics of Artificial Intelligence, Machine Learning and Natural Language Processing. The library addresses clinical, technical and ethical implications of designing and deploying AI and other technologies for aging and persons with dementia and their families. The topics include:

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