## Scalable Next-Generation Smartphone Gait Assessment for Early Detection of AD/ADRD



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## **Project Overview**



Computer Vision Artificial Intelligence



- Al Supervision
- Motion Tracking
- SPPB Scoring

## **Project Overview**

Target Data (N=120): 60 MCI vs. 60 HC



HC := Healthy Control MCI := Mild Cognitive Impairment CV := Computer Vision

**Evaluation of Preliminary Clinical Validity of Select Markers** 

## Our Team



## Impact - Unmet Need

- Availability of **disease-modifying drugs** makes AD/ADRD large-scale **early detection** highly relevant
- Need for cost-effective, scalable, and easily administrable screening tools
- Gait and postural control characteristics among key early indicators of neurodegeneration





5



## **Impact - Innovation**



Large Vision-Language Model Supervision

## Impact – Accessibility, Inclusion, Diversity

- Reliance on smartphone-only reduces barriers
- Use of extensive assistive AI technology to combat the digital divide



## Smartphone adoption in seniors is skyrocketing!

## Feasibility

### **Preliminary Data**

### **Smartphone based Gait and Posture**

- 63 HC vs 41 MCl<sub>AD</sub> differences in, e.g., doublesupport time and torso inclination angle (preliminary data from Stanford)
- Estimation of gait impairment in PD<sup>[1,2,3]</sup>

#### **SPPB Scores**

 Associations with cognitive assessment scores<sup>[6,7]</sup>



### **Technical Feasibility**

#### **Smartphone-based Gait and Posture**

- Track record in the field<sup>[1,2,3,7]</sup>
- US Patent #11,918,370 with Stanford OTL<sup>[4]</sup>

### **AI Assessment Supervision**

 Our team brings leading expertise in large vision-language models<sup>[5]</sup>

**IRB Status** 

- Stanford IRB #33727 for SPPB video recording
- Mobile app development IRB under review
- Will develop a new IRB for Multi-ADRC project

[1] Lu, ..., Adeli "Quantifying Parkinson's disease motor severity under uncertainty using MDS-UPDRS videos." Medical Image Analysis 2021.

[2] Endo, ..., Adeli "GaitForemer: Self-supervised pre-training of transformers via human motion forecasting for few-shot gait impairment severity estimation." MICCAI 2022.
[3] Endo, ..., Adeli, "Data-Driven Discovery of Movement-Linked Heterogeneity in Neurodegenerative Diseases.", Nature Machine Intelligence (under review, revised), 2024.
[4] Adeli et al. "Systems and methods for estimation of Parkinson's Disease gait impairment severity from videos using MDS-UPDRS." U.S. Patent No. 11,918,370. 5 Mar. 2024.
[5] Luo, ..., Adeli, Li "MOMA-LRG: language-refined graphs for multi-object multi-actor activity parsing." NeurIPS 2022.

PD := Parkinson's Disease OTL := Office of Technology Licensing

[6] Handing et al. "Association Between Physical Performance and Cognitive Function in Older Adults Across Multiple Studies: A Pooled Analysis Study." Innov Aging. 2020. [7] Adeli, "Automated Physical Performance Battery as a Digital Marker for Alzheimer's Disease and Mild Cognitive Impairment" AAIC 2024

## Scalability

- Will fit and scale well to the current ADRC programs with minimum additional effort for personnel
- Extracted measurements can be tracked repeatedly over time to ensure timely diagnosis
- We plan on collecting validation data during this project and start early communication with the FDA to certify SPPB++ as SaMD







#### **Deployment strategies**

Licensing the underlying technology (white-label)
Direct commercialization of the app to healthcare providers, pharmaceuticals, and possibly insurers



#### Other applications

- •Fall-risk
- Rehabilitation
- •Integrating with other digital measures of interest by ADRCs

SaMD := Software as a Medical Device

# Thank you!

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