

INTRODUCTION

Parkinson's disease is the fastest growing neurological disorder

Brain cells that control movement die off over time, producing tremor, slowed movement, and gait impairments. There is no cure, but therapies can reduce symptom severity and help preserve independence.

- **1 million+** Americans are living with Parkinson's disease
- **~90,000** are newly diagnosed every year
- **110,000+** veterans are affected by Parkinson's disease, and service-related exposures raise the risk

Problem: Therapy needs adjustments over time, but access to care does not keep pace

- Only 9% of US patients see clinicians with training in movement disorders
- Months of waiting between appointments is typical
- Long drives are often required as most clinicians are located in large cities

WHAT WE PROPOSE

Therapy decisions depend on what the clinician sees

During clinical visits, clinicians assess motor symptoms by observing the patient perform simple movement tasks such as tapping fingers, holding hands out, and walking across the room.

- Clinicians rate speed, amplitude, steadiness, and hesitation by eye
- Those ratings drive disease management and treatment selection
- The accuracy of evaluations depends on the clinician's expertise

Our approach: capture the same movements on video

- Patients record the same movement tasks with a smartphone at home
- AI-based methods track the hands and body movements frame by frame
- Analysis returns objective measures of speed, amplitude, gait, and tremor
- Assessments can be repeated as often as needed between visits

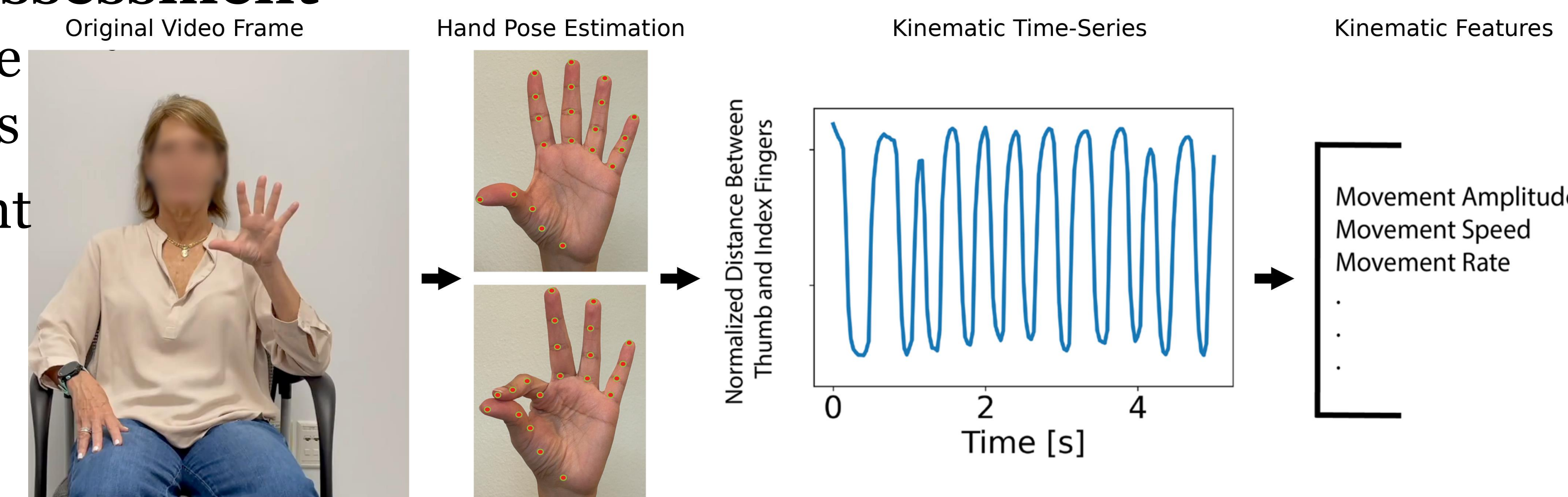
Home video assessments could extend specialist-level monitoring to 110,000 veterans

METHODS

From videos to motor assessment

Fig 1. Standard videos become objective movement measures

- Patient performs movement tasks in front of a camera
- Machine learning models localize and track multiple body segments
- Kinematic signals and features representing the movement of interest are extracted
- These features form the Digital Bradykinesia Composite Score (DBCS), a score that summarizes movement vigor, variability, rhythm, decrement in movement and pauses.



Home-based assessments

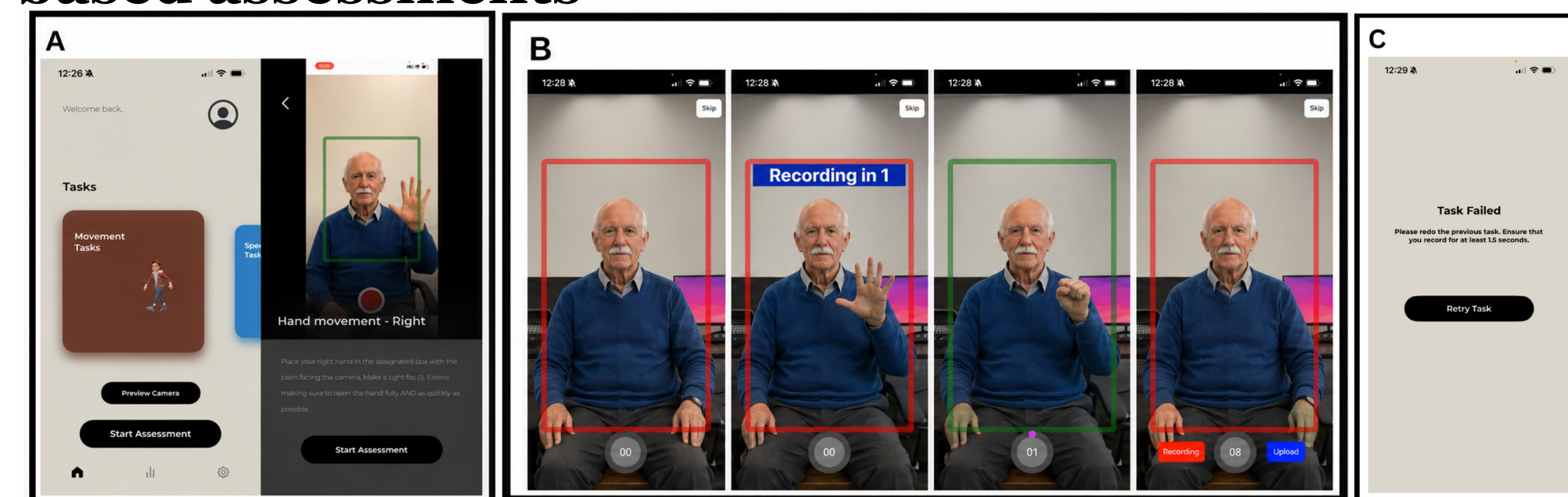


Fig 2. Our custom app (VisionMD) guides patients through recording on their own

- A) Patient selects the assessment and sees written/video instructions before each task
- B) On-screen box turns green when positioning is correct, recording starts automatically
- C) Quality checks run on device before videos are uploaded to a secure server

RESULTS

15 patients recorded home video every other week for six months

Fig 3. Video-derived clinical scores and DBCS over six months

- Both measures increased over time
- Clinical scores rose 0.3 points, below the 1-point scale resolution
- DBCS rose continuously, $p = 0.002$

Video-derived measures resolve change the clinical scale cannot

