Technologies to address Alzheimer's disease and related dementia care

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Purpose: The growing of Alzheimer's Disease and Related Dementia (AD/ADRD) present a formidable challenge to global healthcare systems. By 2030, the U.S. Census Bureau projects 21% of the U.S. population will be over 65. According to the United Nations, by 2050, half of the world's population will reside in countries where 20% are over 65. This demographic shift heralds a significant increase in the prevalence of ADRD, with current figures standing at approximately 55 million people worldwide, expected to rise to about 153 million by 2050. In the U.S. over 6.2 million adults 65 and older live with ADRD, surging 47% to around 13.8 million by 2060. Escalating cases of ADRD intensify the demand for caregivers, leading to shortages that have become a national crisis. In early-stage dementia, people have difficulty managing finances, preparing meals, shopping, and arranging healthcare. With advanced dementia, the ability to manage basic ADLs such as bathing, dressing, feeding, and bowel and bladder continence are often lost. Most caregivers for people with ADRD are informal (unpaid) caregivers, most often spouses and adult children. The shortage will reach 355,000 by 2040, with Florida home to nearly 600,000 older adults living with ADRD. The ramifications are profound, caring for individuals with ADRD is particularly complex due to cognitive and behavioral symptoms, including memory loss, communication difficulties, aggression, and wandering. These symptoms elevate risk of accidents and infections leading to social isolation and diminished quality of life. At USF, as part of the effort to establish the Center for Innovation, Technology, and Aging (CITA) with a mission to transform care for individuals with ADRD and other vulnerable older adults, we are developing AI and robotics technology as direct applications of gerontechnologies. **Method**: A team of 36 faculty from the Colleges of Engineering, Behavioral and Community Sciences, Education, Arts and Sciences, Medicine, and Nursing is developing a Data, Models, Modules, and Solutions (DMS2) Hub to generate personalized solutions for individual caregivers based on patients' health/medical record, and home living conditions (Figure 1). The solution is built with modules of three Pillars: *monitoring*, *intervention*, and *assistive technologies*. The ***monitoring pillar*** focuses on modules using AI models and unobtrusive sensing technologies to monitor physical and mental conditions, dietary habits, behaviors, etc. to facilitate early detection and intervention, while upholding the highest standards of privacy and data security. The ***intervention pillar*** focuses modules that employ reinforcement learning agents and generative models through multi-media, extended reality (XR), robots, and smart devices to provide interventions such as mitigating patients' agitation and aggression, preventing wandering and handling emergencies. The ***assistance pillar*** focuses on modules that use optimization, AI, and robotics technologies to enhance caregivers' physical and cognitive capabilities, assist them in highly demanding activities, and alleviate burden and stress. **Results and Discussion**: Previous research has often concentrated on a single module within one pillar. CITA employs a holistic and systems-based strategy to develop innovative monitoring, intervention, and assistive technologies. By bringing together expertise from multiple disciplines, CITA addresses the complex needs of people with ADRD and their caregivers, integrating diverse perspectives and methodologies to enhance research outcomes. CITA advances understanding of ADRD care and pushes the boundaries of AI and robotics technologies to significantly improve the lives of those with ADRD, thereby benefiting caregivers, families, and society at large.

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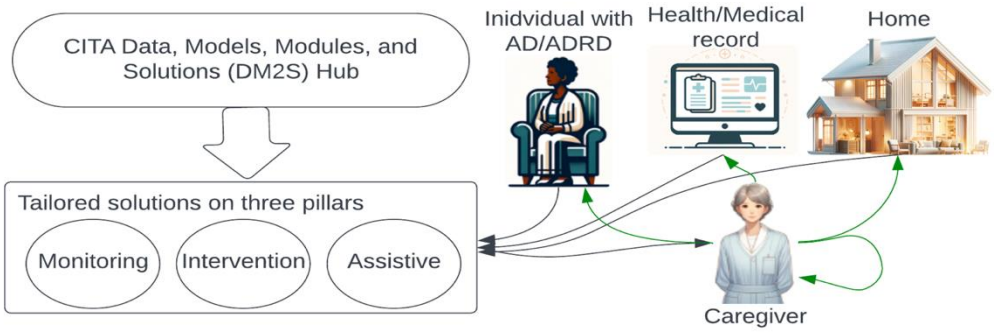

Figure 1. Data, Models, Modules, & Solutions (DMS2) Hub of CITA