

Role of AI-Driven Engineering Innovations in Enhancing Functional Mobility, Balance, Fall Prevention, and Rehabilitation in Older Adults: A Systematic Review - 2026

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Abstract

Background: As the world's population grows older, one of the most pressing challenges we face is the rising number of falls among people aged 60 and above. The good news is that many of these falls can actually be prevented. Today, AI-powered technologies are opening exciting new doors to help older adults move more safely and confidently. This review brings together the best available evidence on how AI can support older people in staying balanced, independent, and living life to the fullest.

Methods: A comprehensive search of PubMed/MEDLINE and Google Scholar was performed from May 2021 to May 2026 following PRISMA 2020 guidelines. A multistage screening process resulted in the inclusion of 22 studies: 20 primary studies on functional mobility, fall detection/prevention and balance outcomes in healthy older adults using AI, and 2 additional studies with a rehabilitation focus. Purely technical engineering validations and disease specific validations were excluded.

Results: The 22 included studies used a wide range of AI technologies, including machine learning classifiers (Random Forest, XG Boost, SVM), deep learning (CNN, LSTM, BiL STM), wearable IMU sensors, robotic systems, virtual reality exergames, and AI-driven postural screening platforms. Sample sizes varied from 5 to 660417 participants. AI models showed a high accuracy in classifying fall risk (67% to over 99%) and wearable-based gait analysis systems showed considerable improvements in mobility and balance outcomes from intervention studies.

Conclusions: The advancements in AI engineering have shown high potential for fall prevention, balance monitoring, gait rehabilitation, and functional mobility in older adults. The use of AI in routine geriatric care, community-based screening and home-based exercise programs, has huge potential to promote healthy aging. Future work should include randomized controlled trials, diverse populations, and long-term follow-up.

Keywords

Artificial intelligence, fall prevention, balance, functional mobility, older adults, machine learning, wearable sensors, rehabilitation, gait analysis, deep learning.