The Use of Artificial Intelligence in Fall Prevention for the Elderly

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Abstract

Falls are among the most common cause of decreased mobility and independence in older adults and rank as one of the most severe public health problems with frequent fatal consequences. In the present study, gait characteristics from 171 community-dwelling older adults were evaluated to determine their predictive ability for future falls using a wearable system. Participants wore a wearable sensor (inertial measurement unit, IMU) affixed to the sternum and performed a 10-m walking test. Measures of gait variability, complexity, and smoothness were extracted from each participant, and prospective fall incidence was evaluated over the following 6-months. Gait parameters were refined to better represent features for a random forest classifier for the fall-risk classification utilizing three experiments. The results show that the best-trained model for faller classification used both linear and nonlinear gait parameters and achieved an overall $81.6 \pm 0.7\%$ accuracy, $86.7 \pm 0.5\%$ sensitivity, $80.3 \pm 0.2\%$ specificity in the blind test. These findings augment the wearable sensor's potential as an ambulatory fall risk identification tool in community-dwelling settings. Furthermore, they highlight the importance of gait features that rely less on event detection methods, and more on time series analysis techniques. Fall prevention is a critical component in older individuals' healthcare, and simple models based on gait-related tasks and a wearable IMU sensor can determine the risk of future falls.

References

[1] Lockhart, T., Soangra, R., Yoon, H., Wu, T., Frames, C., Weaver, R., and Roberto, K., (2021). Prediction of Fall Risk Among Community-Dwelling Older Adults Using a Wearable System. Scientific Reports 11, 20976.https://doi.org/10.1038/s41598-021-00458-5