331

Enhancing Fall Risk prediction In Chinese Older Adults Using Explainable Machine Learning

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PURPOSE: This study aims to integrate explainable ensemble learning techniques for improving fall risk prediction among the elderly population in the Tsinghua University community. The focus is on developing a predictive model that is not only accurate but also interpretable, aiding in better understanding and prevention of falls in older groups.
METHOD: A mixed-methods approach was employed, gathering data from 1500 participants from 2019 to 2022, aged 65 years and above, living in the Tsinghua University community. The data collection included comprehensive health assessments, lifestyle questionnaires, and environmental risk evaluations. We applied the least absolute shrinkage and selection operator (LASSO) method was applied to determine the optimal predictors and then five commonly used ensemble learning algorithms: Random Forest (RF), Light Gradient Boosting Machine (LightGBM), categorical boosting (Catboost), Gradient Boosting Decision Tree (GBDT), and Extreme Gradient Boosting (XGBoost) were used to build a predictive model.
RESULTS: The study identified that the XGBoost model provided the highest accuracy. It showed the largest AUC value in the 10-fold cross-validation (0.8592; 95% CI: 0.8337-0.8726), testing (0.8542; 95% CI: 0.8347-0.8660) as well as the smallest Brier score in the training (0.1534; 95% CI: 0.1482-0.1609) and testing set (0.1601; 95% CI: 0.1565-0.1707). Notably, SHAP value analysis revealed that indoor environmental hazards, mobility patterns, experience of falling, medication history, cognitive function as well as changes in weight were significant predictors.
CONCLUSION: The integration of explainable ensemble learning models in fall risk assessment offers a powerful tool for identifying and understanding risk factors among the elderly. Particularly in the Tsinghua University community, this approach enables the creation of targeted and effective fall prevention strategies. The study underscores the value of explainable machine learning in geriatric care, ensuring that predictive models are both accurate and understandable to clinicians and community caregiver.
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332

A Comparative Analysis Of Seasonal Variations In Physical Activity Patterns Among Older Adults

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PURPOSE: Physical activity patterns in human can vary significantly based on seasonal changes. However, their influence on the daily life cycle of physical activity has not been examined yet. The purpose of this study was to compare the physical activity patterns of older individuals between summer and winter while considering the daily life cycle.
METHODS: Twenty-seven community-dwelling older adults participated in this research. In the summer and winter from July 2021 to August 2023, each participant wore both a Polar M430 sports watch and an ActiGraph wGT3X-BT accelerometer from the moment they woke up until they went to bed for seven consecutive days. The Polar M430 was used to measure waking and sleeping times, whereas the ActiGraph wGT3X-BT was utilized to evaluate the vector magnitude and step counts. Furthermore, moderate-to-vigorous physical activity (MVPA) time were evaluated using the criteria developed by of Sasaki et al. (2011). Days when the device was not worn for at least 10 hours or unverified waking and sleeping times were excluded from the analysis. To analyze each day data comprehensively, 24-hour time was divided into 4-hour intervals: early morning: (4:00 am-8:00 am), morning: (8:00 am-12:00 pm), afternoon: (12:00 pm-4:00 pm), evening: (4:00 pm-8:00 pm), night:(8:00 pm-12:00 am).
RESULTS: Accepted days for analysis were 180 in summer and 185 in winter. The MVPA time and daily step counts were significantly higher in the summer than in the winter: MVPA time lasted 55.8±41.6 min/d, and the step counts was 8349.0±4214.4 steps. In contrast, during the winter, MVPA time averaged 47.6±40.6 min/d, and daily steps were 7317.4±3934.3 steps. The step counts in the morning and the evening were significantly higher in the summer than in the winter. On the other hand, the step counts and MVPA time in the afternoon were higher in the winter than in the summer. In summer, higher step count was observed in the morning and evening, with decreased activity in the afternoon, due to the increased awareness among older people from heat stroke. Conversely, in winter, physical activity was found to increase in the afternoon rather than in the evening, influenced by the earlier sunset.
CONCLUSIONS: These findings highlighted distinctive activity patterns between summer and winter among the older adults.

333

Biological Age Estimation Based On Multi-domain Biomarkers In Older Adults

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Biological age (BA) provides valuable information about age-related risk of adverse health outcomes and the extent to which aging deviates from chronological age (CA). Aging spans multiple domains; yet, the accuracy of BA estimates using multi-domain biomarkers remains uncertain.
PURPOSE: This study derives the sex-specific measures of BA in a population of Korean older adults based on six-domain biomarkers that are commonly available in clinical practice: physical, body composition, cognitive function, psychological and sensory abilities, and blood biomarkers.
METHODS: We used data of 2,400 older adults aged 70-84 years (mean age: 76.5 ± 3.9 years; women: 52.8%) from the Korean Frailty and Aging Cohort Study at baseline survey. Seventy-two biomarkers from six domains were drawn from blood samples, sensory assessments, physiological tests, physical and cognitive function evaluations, and body composition assessed using dual-energy X-ray absorptiometry. We calculated the sex-specific BA estimate using the Klemera and Doubal (KD) method. Additionally, we assessed its efficacy in predicting incident physical frailty and all-cause mortality over a 4-year period, validating the utility of BA in these