Abstract

With the aggravation of population aging, falling has become a serious social problem. In a series of falls, especially from the seat state, due to the concealment and potential danger of its movement characteristics, it has become a major challenge in health monitoring.

This study proposes an innovative fall detection framework that combines 9-axis sensors (accelerometer, gyroscope, magnetometer) and dynamic multimodal attention. The core of the system uses a model combining time convolution network (TCN) and dynamic multimodal multi-head attention mechanism, which can efficiently extract the characteristics of time series and adaptively adjust the weight according to the importance of each mode.

The experimental results show that the system is significantly better than the traditional methods in the accuracy, precision and recall of seat fall detection. In addition, through the interpretability analysis of the dynamic multimodal attention mechanism, the contribution of each mode in different fall scenarios was determined. This study provides a scalable and interpretable solution for multi scene real-time fall detection, which is of great significance to the development of intelligent elderly care and assistive technology.