Falls are a leading cause of injury among the elderly, making accurate fall detection crucial for timely medical intervention. Wearable sensors play a significant role in automated fall detection systems, but the optimal placement of these sensors remains an open research question. In this study, we leverage the publicly available UP-Fall Detection dataset to evaluate the effectiveness of different wearable sensor placements on the human body. We compare multiple machine learning (ML) and deep learning (DL) models to determine the best sensor location for accurate fall detection. Our experiments reveal that sensor placement significantly impacts classification performance, with waist and pocket positions yielding the highest accuracy. We also demonstrate that multimodal sensor fusion improves detection performance. The findings of this study provide valuable insights for designing wearable fall detection systems with optimal sensor placement.

Falls are a major public health concern, particularly for elderly populations. According to the World Health Organization (WHO), falls are the second leading cause of accidental injury-related deaths globally. Early detection of falls can mitigate severe consequences and improve patient outcomes. Wearable sensors embedded in smart devices such as accelerometers and gyroscopes have gained popularity in fall detection systems due to their affordability and ease of use. However, optimal sensor placement is critical for achieving high detection accuracy.

This paper investigates the impact of different sensor placements on fall detection accuracy using the UP-Fall dataset. We compare various ML and DL models to determine the best sensor position and discuss the implications of our findings for real-world applications.

Several fall detection datasets have been developed, including SisFall, MobiFall, and UMAFall. However, the UP-Fall dataset provides a multimodal approach by integrating wearable, ambient, and vision-based sensors. Previous studies have explored various ML techniques for fall detection, including Support Vector Machines (SVM), Random Forests (RF), and Convolutional Neural Networks (CNNs). Few studies, however, have systematically compared sensor placements using different ML models, which is the primary contribution of this work.