Title: Enhancing Walking Safety for Overweight Individuals in Urban Neighborhoods Using Wearable Sensors and Deep Learning Algorithms

Author names: Tasriva Sikandar, I. Mohd Izzeldin, Kamarul Hawari Ghazali, S. A. M. Matiur Rahman & Mohammad Fazle Rabbi

Abstract: Overweight individuals are often overstressed due to fear of fall when encountering variation in walking surfaces. Encouraging overweight individuals to adopt an active lifestyle through exercise and recreational walk have been recommended that may lead to healthy living. To enhance the walk safety, wearable devices equipped with inertial measurement units (IMUs) and artificial intelligence approaches such as deep learning (DL) method have emerged to detect walking surfaces and provide an alert to the individuals while walking. In this study, IMU data from two legs were collected from overweight participants while they were walking on nine different surfaces in urban neighborhood. The significant changes in IMU data were analyzed using statistical tool, and then three DL methods, such as Convolution neural network (CNN) model, Long short-term memory (LSTM) and a CNN-LSTM hybrid model, were employed to classify walking surfaces. The results demonstrate that IMU data from both legs exhibit more variations across all walking surfaces when compared to the data from single leg. Consequently, the developed CNN-LSTM Hybrid model effectively detected all walking surfaces when utilizing data from both legs, achieving an improved mean classification accuracy of $97.07 \pm 1.41\%$ across all walking surfaces and mean correct classification rates of greater than 95% for all nine walking surfaces, respectively, outperforming previous studies. The findings of this study will help developing AI-based application to offer walk safety in overweight population.

https://link.springer.com/article/10.1007/s42979-026-04969-8