Detection of Falls and Near-Falls While Using Conventional Assistive Devices

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Falls & Assistive Devices

Falls
Over 1/3 of older adults fall at least once.
- More than 37 million falls require medical attention;
- Treatment costs round $50 billion (USA);
- Social & Economic burden tends to get worse due to the aging of society.

Problem: The non-use of assistive devices

Causes: Forgetfulness, inaccessibility, feeling of oldness, the thought of no need, inappropriate device prescription, lack of user education, or use of unprescribed devices.

Evidences: Absence of the device during home falls

Solution: Develop and test strategies capable of improving social usability and acceptability using cutting edge technology.

Present published work about the use of cutting edge technology for fall and near-fall detection while using assistive devices

GOAL

Assistive Smart Cane

Cane: Conventional cane instrumented with an Inertial Measurement Unit (IMU) for fall detection (Fig. 1).

Work Developed: Test and Modify the State-of-the-art Fall Detection Algorithms by using only inertial data.


Experimental Protocol:

Trials: Walk and fall with the cane, cane’s free fall and throw out the device

Results: Best performance – sensitivity 96.90%, specificity 98.98%.

Fig. 1. Instrumented cane (left) and accelerometry signals (right).

Conventional Rollator

System: Waistband instrumented with an IMU for fall detection (Fig. 2).


Classifiers: KNN, Ensemble Learning, Discriminant Analysis, Decision Tree and Support Vector Machine.

Experimental Protocol:

Trials: walk forward (10 m) and simulate near-falls to the right, left and forward.

Results: The Ensemble Learning with the first 51 ranked features by the mRMR presented the best performance results (Accuracy = 95.18%; Detection time before recovery = 1.48 ± 0.68s).

Fig. 2. System description: a) Waistband IMU and rollator; b) Wearable sensors location (IMU - back lower trunk; FSR - heel and toe).

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