

Fall Detection Method using a Microwave Doppler Sensor in Bathroom Considering Effects of Wetness Condition

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ABSTRACT

Increased number of falling in the bathroom are reported in ageing people due to the shock caused by temperature change, thus fall detection is an important area of study. We have proposed a fall detection method that can automatically detect the fall by calculating the frequency distribution trajectory from a signal measured by a microwave Doppler sensor in the living room. However, while applying the conventional method to the bathroom, wetness and shower-water noise can influence the fall detection. Hence, in this study, we propose a novel fall detection technique that can be robust against the presence of wetness and shower-water noise. In the proposed method, the frequency band of the noise due to wetness or shower-water is identified by an experiment; and the cut-off frequency of the high-pass filter is designed to remove the noise. Furthermore, we combine the dynamic time warping technique and the support vector machine to differentiate fall detection. To validate the usefulness of the proposed method, we conducted an experiment with a male subject. The environmental conditions are set as, dryness, filling the bathtub with hot water, filling the bathtub and start the shower. The subject was asked to perform the non-fall motions (picking-up, sitting-down, straddling the bathtub and washing the body, namely), and fall motions (falling due to straddling the bathtub, falling with slipping, falling due to fainting and falling by collapsing, namely). As a result, the accuracy to differentiate fall motions and non-fall motions is 0.95, whereas in conventional method, it was 0.81.

Keywords: bathroom, dynamic time warping (DTW), fall, microwave Doppler sensor, support vector machine (SVM)