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AFTER FALL MOTION DISCRIMINATION SYSTEM USING AUTOENCODER

Abstract:

With the increase in world's older population, the cases of fall accidents among the elderly has increased, with 32% - 42% of the annual fall accidents from people aged 70 years and older. Because the impact of falls can cause some serious aftereffects on the elderly, early detection of the fall accident and appropriate treatment based on the condition after the fall are required. To perform appropriate treatment upon arrival at the incident scene, it is essential to assess the behavior and condition of the elderly after the fall (whether they are standing, conscious, or unconscious) in advance. Under these circumstances, many previous researches have proposed automatic fall detection systems for early detection. Our previous studies have proposed an unconstrained fall detection system utilizing a microwave Doppler sensor; however, these studies did not focus on behavior assessment after fall accident. Hence, this study proposes a system that could assess behavior after fall accident.

This study used two types of sensor: a microwave Doppler sensor, which was attached to the ceiling, and a piezoelectric ceramic, which was installed on the floor. The output signal from the microwave Doppler sensor was extracted for 3 seconds after the time the impact on the floor was detected by the piezoelectric ceramic. The extracted data was downsampled to reduce the data size and was applied to the autoencoder to compress dimension. The compressed data was used as input to a neural network for multiclass discrimination. The output from the neural network was converted into probability by the softmax function. Finally, the class with the largest probability was determined as the motion after the fall.

In the verification experiment, four subjects in their 20s were set up. Each subject was asked to stand up and not to stand up (unconscious and conscious) after each fall, with 30 times data for each set, which corresponded to 3 classes to be discriminated. The sampling frequency, sampling points, and measurement time were set to 4000 Hz, 60000 points, and 15 seconds, respectively. From the data collected, 2400 points were obtained with downsampling point of five. Then, the dimension of the hidden layer was set to 50. For the evaluation of the proposed system, leave-one-subject-out

cross-validation was performed. The result shows a correct answer rate of one for all subjects.

Keywords:

After fall motion discrimination, Autoencoder