

Public Abstract

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Title:Deriving Information from Spatial Sampling Floor-Based Personnel Detection System

Research has shown and identified a clear link between human gait characteristics and different medical conditions. Therefore, a change in certain gait parameters may be predictive of future falls and adverse events in older adults such as physical functional decline and fall risks. We describe a system that is unobtrusive and continuously monitors the gait during daily activities of elderly people. The early assessment of gait decline will benefit the senior by providing an indication of the risk of falls. We developed a low cost floor-based personnel detection system; we call a smart carpet, which consists of a sensor pad placed under a carpet; the electronics reads walking activity. The smart carpet systems is used as a component of an automated health monitoring system, which helps enable independent living for elderly people and provide a practical environment that improves quality of life, reduces healthcare costs and promotes independence. In this dissertation, we extended the functionalities of the smart carpet to improve its ability to detect falls, estimate gait parameters and compared it to GAITRite system. We counted number of people walking on the carpet in order to distinguish the plurality of people from fall event. Additionally, we studied the characteristics and the behavior of the sensor's scavenged signal. Results showed that our system detects falls, using computational intelligence techniques, with 96.2% accuracy and 81% sensitivity and 97.8% specificity. The system reliably estimates the gait parameters; walking speed, stride length and stride time with percentage errors of 1.43%, -4.32%, and -5.73% respectively. Our system can count the number of people on the carpet with high accuracy, and we ran tests with up to four people. We were able to use computational features of the generated waveform, by extracting the Mel Frequency Cepstral Coefficients (MFCC), and using formal computation intelligence to distinguish different people with an average accuracy of 82%, given that the experiments were performed within the same day.