



Vision-based human fall detection systems using deep learning: A review

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Abstract

Human fall is one of the very critical health issues, especially for elders and disabled people living alone. The number of elder populations is increasing steadily worldwide. Therefore, human fall detection is becoming an effective technique for assistive living for those people. For assistive living, deep learning and computer vision have been used largely. In this review article, we discuss deep learning (DL)-based state-of-the-arts non-intrusive (vision-based) fall detection techniques. We also present a survey on fall detection benchmark datasets. For a clear understanding, we briefly discuss different metrics which are used to evaluate the performance of the fall detection systems. This article also gives a future direction on vision-based human fall detection techniques.

Introduction

According to a report of the United Nations (UN) [1], the elderly population of age 65 years or above was 727 million globally in 2020, which is expected to reach 1.5 billion (more than two times) by 2050. The percentage of the elderly population of this age group was 9.3% in 2020 which will be 16.0% in 2050. Due to a better standard of life and improvement in healthcare, the average life expectancy is increasing. If this trend continues, Very soon there will be more elderly populations than adults. So, the caring of the elders may become a big problem due to the scarcity of caretakers. These days we are very much dependent on technologies, and for the elderly population, this is not an exception. One of the main health problems in the elderly population is fall due to weakness and other reasons. Falls are one of the most common reasons for hospitalization for elderly people [2]. Not only prevention but detection of falls as early as possible is very crucial for the health of the concerned person. A slight delay in