FALL DETECTION USING CAMERAS VALIDATED WITH REAL LIFE VIDEO

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1 Introduction

Many older persons fall and are not able to get up again unaided. Thirty to forty-five percent of the persons aged 65 or older living at home fall at least once a year resulting in minor or major injuries. The lack of timely aid can even lead to severe complications. Falls can also have psychological consequences, e.g. fear to fall and losing independence.

A major drawback of most related studies, is that they use simulated data. In this work real life data is used to evaluate an in-house camera-based fall detection system. For this, cameras were installed to monitor the falls of four older persons (aged between 85 and 95) at their home for 6 months, yielding a dataset of over 14000 hours video containing 26 real falls of 3 different persons.

2 Fall detector architecture

As presented in Figure 1, the proposed fall detection system consists of four main parts: video acquisition, person tracking, fall detection and alarm generation. Per time-slot a person tracker module identifies a region in the images as being linked to a person. Using this information 4 features are extracted: aspect ratio (AR) of the bounding box, fall angle (FA), speed of center of gravity (CS) and head speed (HS). Based on these features a Support Vector Machine (SVM) model is estimated to allow for automatic fall detection. A more in depth description of the system can be found in [1].

3 Preliminary experiments and results

From the acquired video data, 24 video segments of 20 minutes, each containing a fall at the end, were selected. Each segment was further split-up in chunks of 2 minutes. From these chunks the aforementioned features were extracted.

The described fall detector obtains a recall of 0.90 and a precision of 0.25.

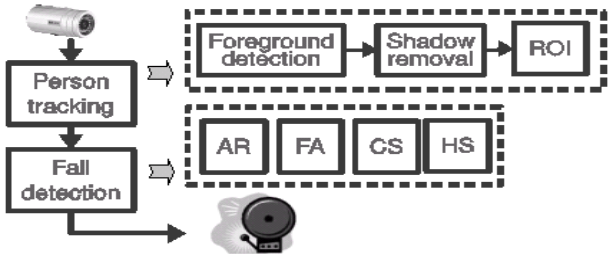

Figure 1: Overview of the fall detector

4 Discussion

Using a greedy feature selection strategy the combination of AR and HS seems to give best performance. This meets our expectations. The change in AR is visible in most falls, while the head suffers less from occlusions. Further inspection reveals that 90% of the false alarms are caused by: a) the presence of 2 persons in the room (25%), b) another foreground object has almost the same size as the person (20%), c) the person's image is split in 2 blobs which are almost the same size (25%), d) there is interference of a ghost figure or moved furniture (20%). All these cause large changes in AR and high HS due to the switching between multiple regions identified as being related to the person. It is expected that tracking algorithms, e.g. kalman or particle filter, to some extend will solve such problems.

5 Conclusion and future work

A fall detector based on state-of-the-art algorithms was validated on real-life video data. Analysis of the results reveals the need of extra refinement such as tracking algorithms to further increase precision while maintaining the recall.

References

[1] Debard, G. et al. Camera Based Fall Detection Using Multiple Features Validated With Real Life Video. *Workshop Proceedings of the 7th International Conference on Intelligent Environments*, 441-450, 2011.