Location Prediction in Real Homes of Older Adults based on K-Means in Low-Resolution Depth Videos

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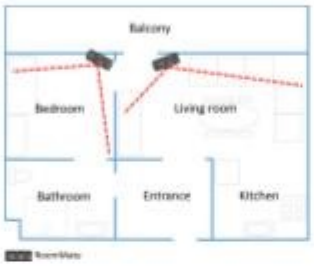
Assisted Living Project (ALP)

- Interdisciplinary project involving expertise in technology, health care, and ethics.
- Aim: develop Assisted Living Technology (ALT) to enable older adults with mild cognitive impairment or dementia live a safe and independent life at home.
- Activity and location prediction are prerequisites towards advanced support functions in a smart home.

Field trial involving four real homes.

- One-bedroom apartments.
- A mix of binary sensors and low resolution depth video sensors were installed within each apartment.



RoomMate camera was used to record depth video images.

- Recordings over a period of seven weeks in total
- Different periods through the year.

Methods

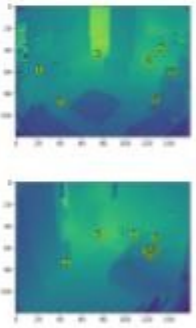
Key positions within the apartment are identified through clustering with K-means.
Location prediction is then performed using sequence algorithms (RNNs)

Object detection algorithms are used to track the person throughout the apartment.

- You Only Look Once (YOLOv3).

Key locations are identified by clustering recorded locations

- Locations that are often frequented are identified.
- Issue here is that the required manual process in choosing the appropriate number of clusters.

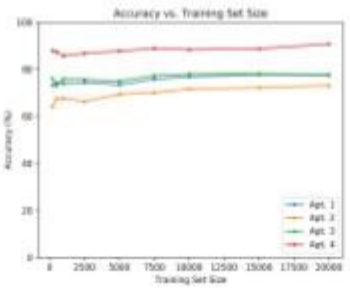


Results

Six to twelve clusters per room, found to be optimal. Accuracies between 73%-91%

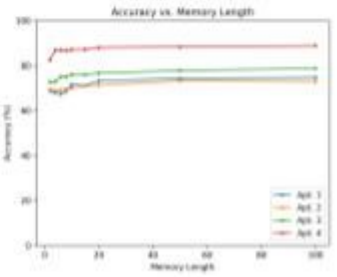
Amount of data needed.

- Good results already at small dataset sizes □ Shows the effectiveness of the method at identifying locations that enable prediction.



- Improvement trend with increasing data size – hence, results better accuracy possible with more data.
- Using other features like time of day might be useful for further improvement.

Memory length is defined as the number of previous clusters used to predict the next cluster



- Peak accuracy attained already at memory length of about 20 previous clusters.
- Possible explanation: the modest size of the apartments allows for few unique paths within the homes, hence, long memory does not enhance result.