

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

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Outline

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Introduction And Project Description

Introduction

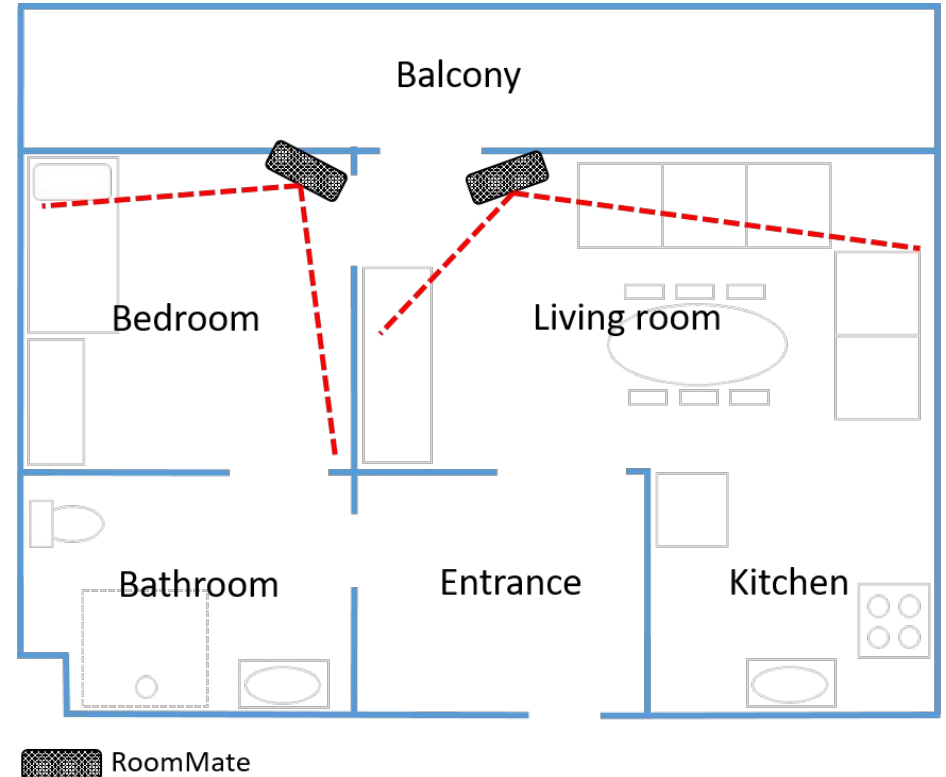
Assisted Living Project (ALP)

- 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.

Project Description

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.



Project Description

RoomMate camera was used to record depth video images.

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



www.roommate.no

Methodology

Methodology

Depth video images are used to identify key locations within the apartments. Subsequently, sequence algorithms are used to predict the next location.

Methodology

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

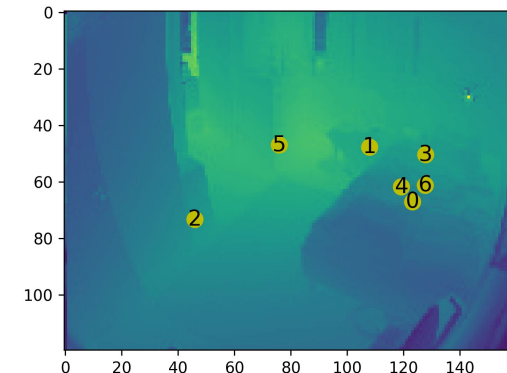
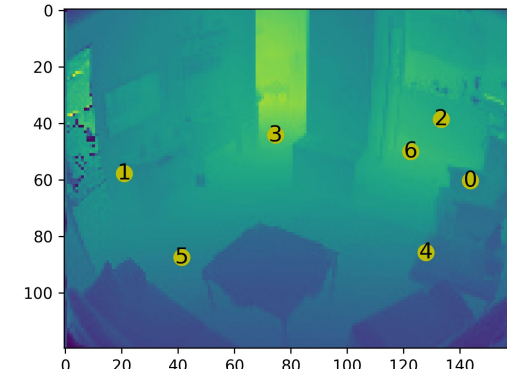
- You Only Look Once (YOLOv3).



Methodology

Key locations are identified by clustering recorded locations

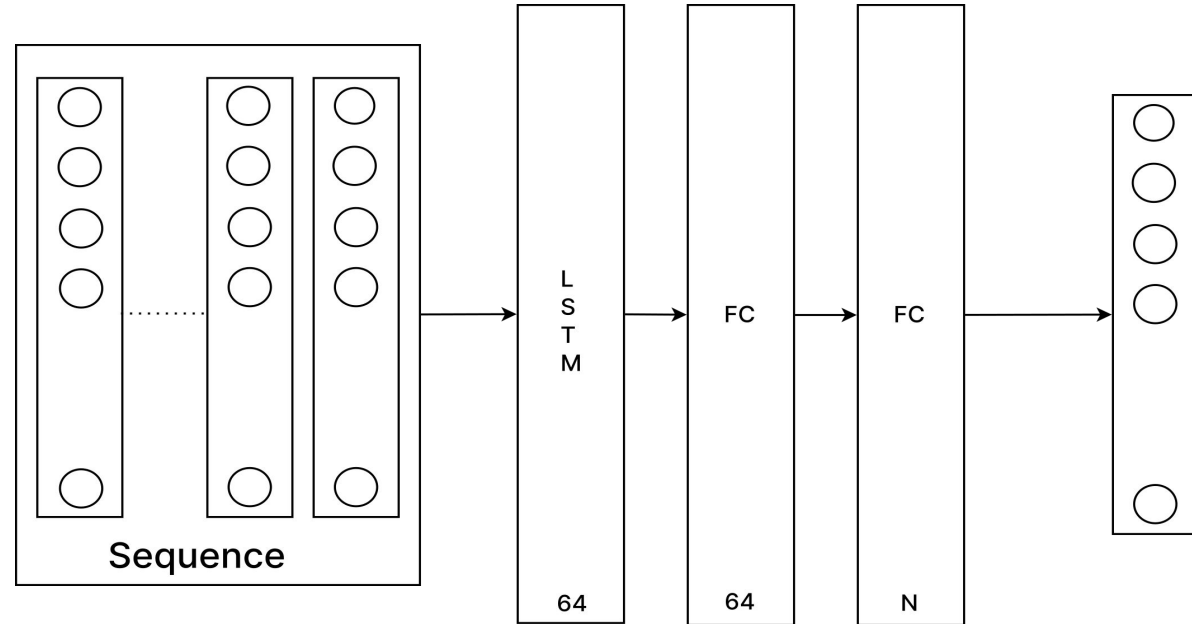
- Locations that are often frequented are identified.
- K-means used as clustering algorithm.
- Issue here is that the required manual process in choosing the appropriate number of clusters.



Methodology

Sequence models are used to predict the next cluster/location within the home based on the previous clusters/ locations.

- Recurrent Neural Networks (RNN) used as algorithm.



Results and Discussion

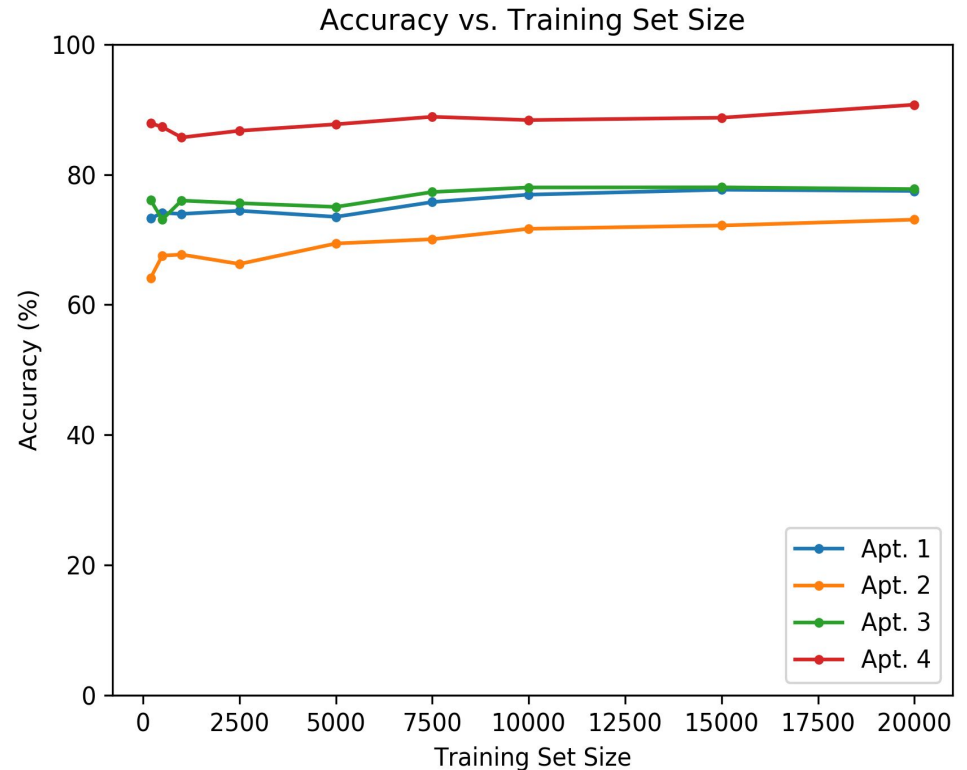
Results and Discussion

- **Between six and twelve clusters per room are found to be optimal.**
- **Accuracies between 73% - 91% for the prediction of the next cluster/ location in the sequence.**

Results And Discussions

Amount of data needed.

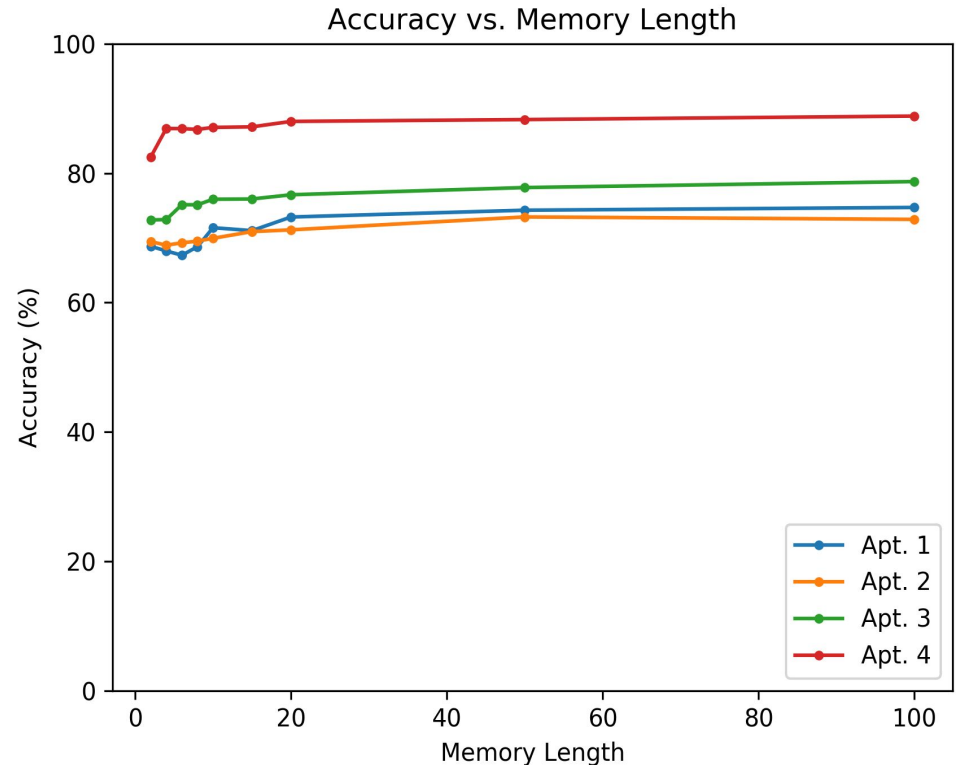
- Good results already at small dataset sizes □ Shows the effectiveness of the method at identifying locations that enable prediction.
- Improvement trend with increasing data size – hence, results better accuracy possible with more data.
- Using other features like time of day might be useful for further improvement.



Results And Discussions

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.



Future Work

- **Apply method to different apartment sizes.**
- **Find a method to automatically optimize number of clusters.**
- **Look into features in addition to the sequence of previous locations.**

Thank you!

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