B. Kröse, T. van Kasteren, C. Gibson, T. van den Dool. Care: context awareness in residences for elderly. Gerontechnology 2008; 7(2):146. To make it possible for elders to safely continue to live their lives at home, some form of automatic health monitoring is required. A good indicator of the health status of elderly, particularly their cognitive status, is the ability to perform activities of daily living (ADLs). Examples of such ADL's are bathing, cleaning, cooking. Usually, questionnaires are used to assess the performance of the elder. For automatic analysis systems, non-intrusive sensors and intelligent pattern recognition methods have been proposed and tested in laboratory settings. Tapia et al. use a naive Bayes model for classifying activities[1]. Different features are used, such as whether a sensor fired, or whether a sensor fired before another sensor within a particular time interval. Wilson and Atkeson incorporate state transitions in their model, making it a typical hidden Markov model (HMM)[2]. In this paper, we describe our experiments in which an unsupervised data analysis was carried out on the data and show that distinctive clusters of activities can be found. **Methods** The chosen system utilizes simple switch sensors mounted on doors, cupboards and the toilet, transmitting data through a low power wireless network to a database server. The choice of simple reed switch sensors was dictated by the need to create a non-intrusive system of sensors which would not impact unduly on the daily life of the residents being monitored. The system generates a binary multidimensional signal x(t). The signal was transformed into a time series x_k by quantizing the time in periods Δt of 300 s. An element of x is 1 if a sensor changed value at least once in Δt. To model the sequence x{1:K} we used a HMM, where the hidden state represents the activity, that was trained using an EM method[3]. **Experiments and discussion** The sensor network consisted of 11 sensors, and was mounted in the home of a 72 year old woman. Sensor data was collected during 6 days. For the unsupervised clustering method, we ran experiments for different number of clusters, to determine which number of clusters best fits the data. A plot of the likelihood of the data with respect to the number of classes is shown in Figure 1. Both the figure and inspection of the parameters show that four clusters best fits the data. When examining the sensor data related to these clusters, the different clusters can be interpreted as toileting, leaving the house, feeding the neighbourhood cat and being idle.

References

1. Tapia EM, Intille SS, Larson K. Pervasive 2004; pp 158-175
2. Wilson D, Atkeson C.S. Pervasive 2005; pp 62-79
3. Rabiner LR. Proceedings of the IEEE 1989;77:257-286

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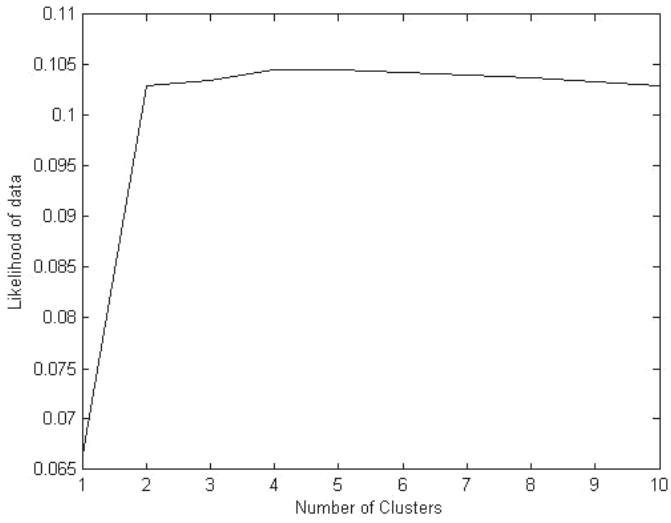

Figure 1: Likelihood of data as a function of number of clusters