M. Eldib, F. Deboeverie, D. van Haerenborgh, S. Ben Allouch, W. Philips, H. Aghajan. **Out-of-home activity analysis using a low-resolution visual sensor.** *Gerontechnology 2016; 15(suppl):79s*; doi:10.4017/gt.2016.15.s.825.00 **Purpose** Loneliness and social isolation are probably the most prevalent psychosocial problems related to aging. One critical component in assessing social isolation in an unobtrusive manner is to measure the out-of-home activity levels, as social isolation often goes along with decreased physical activity, decreased motoric functioning, and a decline in activities of daily living, all of which may lead to a reduction in the amount of time spent out-of-home. The socialization level and loneliness have been studied previously[1] by detecting visitors. **Method** In this work, we propose to use a single visual sensor for detecting out-of-home activity. The visual sensor has a very low spatial resolution (900 pixels), which is a key feature to ensure a cheap technology and to maintain the user's privacy. The low-resolution visual sensor has shown promising results for analyzing the activities of senior citizens[2-5]. Firstly, the visual sensor is installed in a top view setup at the door entrance. Secondly, a correlation-based foreground detection method is used to extract the foreground. Thirdly, an Extra Trees Classifier (ETC) is trained to classify the directionality of the person (in/out) based on the motion of the foreground pixels. Due to the nature of variability of the out-of-home activity, the relative frequency of the directionality (in/out) is measured over a window of 3 seconds to determine the final result. **Results & Discussion** We installed our system in 9 different service flats in the UK, Belgium and France where the same ETC model is used. We evaluated our method on video sequences captured in real-life environments from the different setups, where the persons' out-of-home routines are recorded. *Table 1* shows the comparison between the ground truth and estimated results of two service flats in Belgium and one service flat in the UK. The results show that our approach of detecting out-of-home activity achieves an accuracy of 91.30%. We plan to collect more data from the other service flats for a long-term out-of-home analysis.

References

1. Eldib M, Deboeverie F, Van Haerenborgh D, Philips W, Aghajan H. Detection of visitors in elderly care using a low-resolution visual sensor network. In: Proceedings 9th ACM international conference on Distributed Smart Cameras. 2015; p 6; doi:10.1145/2789116.2789137
2. Eldib M, Deboeverie F, Philips W, Aghajan H. Sleep analysis for elderly care using a low-resolution visual sensor network. LNCS 2015;9277:26-38; doi:10.1007/978-3-319-24195-1_3
3. Eldib M, Deboeverie F, Philips W, Aghajan H. Behavior analysis for elderly care using a network of low-resolution visual sensors. Journal of Electronic Imaging 2016;25(4); article ID041003; doi:10.1117/1.JEI.25.4.041003
4. Eldib M, Bo NB, Deboeverie F, Nino J, Guan J, Velde S van de, Steendam H, Aghajan H, Philips W. A low resolution multi-camera system for person tracking. IEEE International Conference on Image Processing (ICIP); 2014; pp 378-382; doi:10.1109/ICIP.2014.7025075
5. Nyan BB, Deboeverie F, Eldib M, Guan J, Xie X, Niño Castañeda J, Van Haerenborgh D, Slebrouck M, Van de Velde S, Steendam H, Veelaert P, Kleihorst R, Aghajan H, Philips W. Human mobility monitoring in very low resolution visual sensor network. Sensors 2014;14(11):20800–20824; doi:10.3390/s141120800

Table 1: Confusion matrix for out-of-home analysis

Location	Coming in		Going out	
	Ground truth	Estimated	Ground truth	Estimated
Belgium 1	3	3	3	3
Belgium 2	10	9	9	8
UK 1	11	11	11	8