P.C. Chung, W.H. Wang, W.K. Hung. ***Behavior analysis with privacy protectied video for a care center.*** *Gerontechnology 2016;15(suppl):10s*; doi:10.4017/gt.2016.15.s.880.00 **Purpose** Using video images is one of the most effective approach for monitoring patient safety. However, traditional surveillance using the CCTVs generates concerns to patients' privacy and can be used only in the public area, not in the room. Unfortunately, patients spend quite a lot of time in the room, especially in the night. Therefore, caregivers need to spend her/his time checking the room regularly. Meanwhile, the intermittent between checking also poses as a safety dead zone period. This paper presents the use of thermal images as a privacy-protected video for safety monitoring and develops methods for detecting patients' activities. **Method** A thermal camera is used to monitor the room. The image from the thermal camera is a grey scale image, with brighter pixel indicating higher temperature. *Figure 1* shows an example of thermal images. The human body has higher temperature so that the pixels are brighter than the background. First, Background model[1] is used for foreground objects. Second, Base on foreground objects, motion history map[2] is used for features of behaviors. Last, Principal Component Analysis (PCA), Discriminative Locality Alignment (DLA) and K Nearest Neighbor (K-NN)[3] are used for behavior analysis. Four behaviors can be identified, including going into the room, going out of the room, going to bed and getting out of bed. **Results & Discussion** The results (*Table 1*) show that we have good recognition rate. Most importantly, the behavior analysis system can be used for summarizing the night time activities. The system is now set up in a care center for further testing of its effectiveness in real situations.

References

1. Haritaoglu I, Harwood D, David LS. W4 Real-Time Surveillance of People and Their Activities. IEEE Transactions on Pattern Analysis and Machine Intelligence 2000;22(8):809-830; doi:10.1109/34.868683
2. Liu CD, Chung Y-N, Chung P-C. An Interaction-Embedded HMM Framework for Human Behavior Understanding: With Nursing Environments as Examples. IEEE Transactions on Information Technology in Biomedicine 2010;14(5):1236-1246; doi:10.1109/TITB.2010.2052061
3. Zhang L, Zhang L, Tao D, Du B. A sparse and discriminative tensor to vector projection for human gait feature representation. Signal Processing 2015;106(C):245-252; doi:10.1016/j.sigpro.2014.08.005

Figure 1. A grey image from the thermal camera; the brighter pixel indicates a higher temperature

Keywords: behavior analysis, thermal image

Address: National Cheng Kung University, Tainan, Taiwan;
E: pcchung@ee.ncku.edu.tw

Table 1. Overview of the results as True-positive/False-positive; K-NN=K Nearest Neighbor; PCA=Principle Component Analysis; DLA=Discriminative Locality Alignment

Calculation	Behavior				Dimension	Accuracy %
	Go to bed	Get out of bed	Get into room	Leave room		
K-NN	11/0	10/0	14/8	5/0	32136	83.34
PCA+K-NN	11/0	10/0	14/8	5/0	49	83.34
PCA+DLA+K-NN	10/0	10/1	12/3	10/2	32	87.5