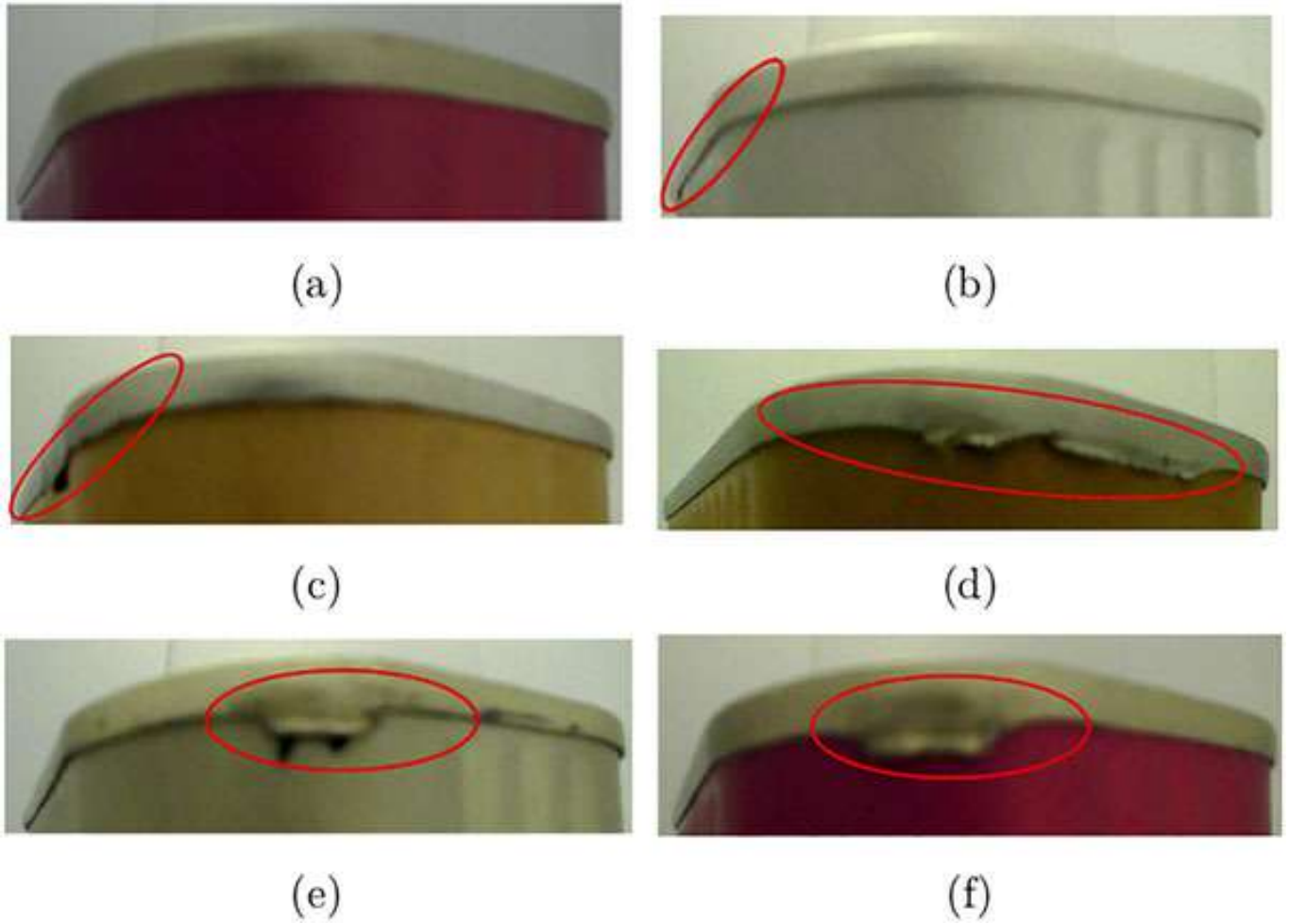
CASE STUDIES OF SIGNAL PROCESSING APPLICATIONS

Dr TIAN Jing

tianjing@nus.edu.sg

Example: Classification of manufacturing defects

Images: (a) without defect, (b)-(c) with small defects, and (d)-(f) with big defects.



Source: O. Essid, H. Laga, C. Samir, Automatic detection and classification of manufacturing defects in metal boxes using deep neural networks, *PLOS ONE*, Nov. 2018, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0203192

Example: Anomaly detection of time series sound data

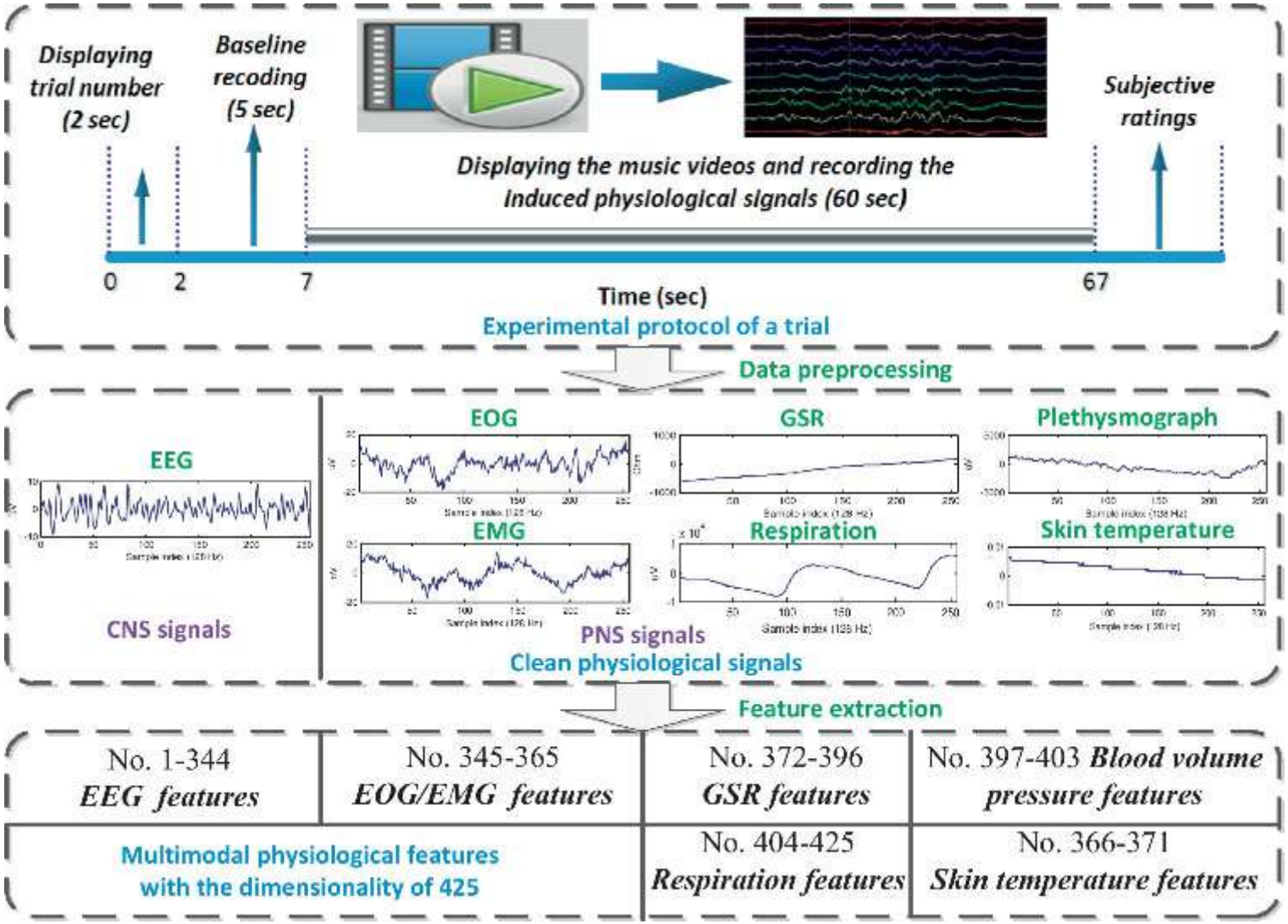
Sound data is acquired from SMD assembly machine with 192 kHz of sampling rate. The data collection process is shown in (a). Sequential machine operational sound data are collected from an operating SMD assembly machine placing a microphone as indicated by the red bounding box in (b).

(a) the Surface Mounted Device (SMD) assembly machine

(b) the microphone for collecting data

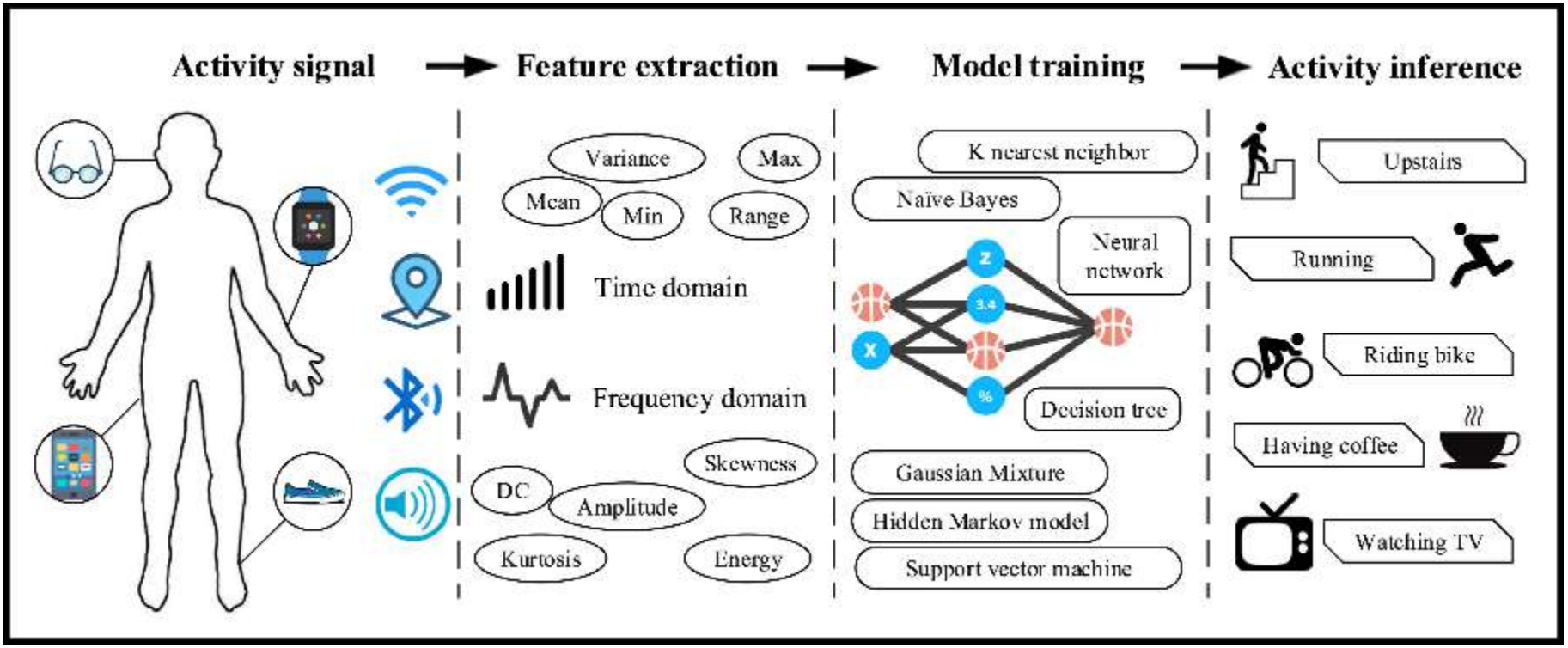
Source: Y. Park and I. Yun, Fast Adaptive RNN Encoder–Decoder for Anomaly Detection in SMD Assembly Machine, *Sensors*, Oct. 2018, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6211082/

Example: Human emotion recognition



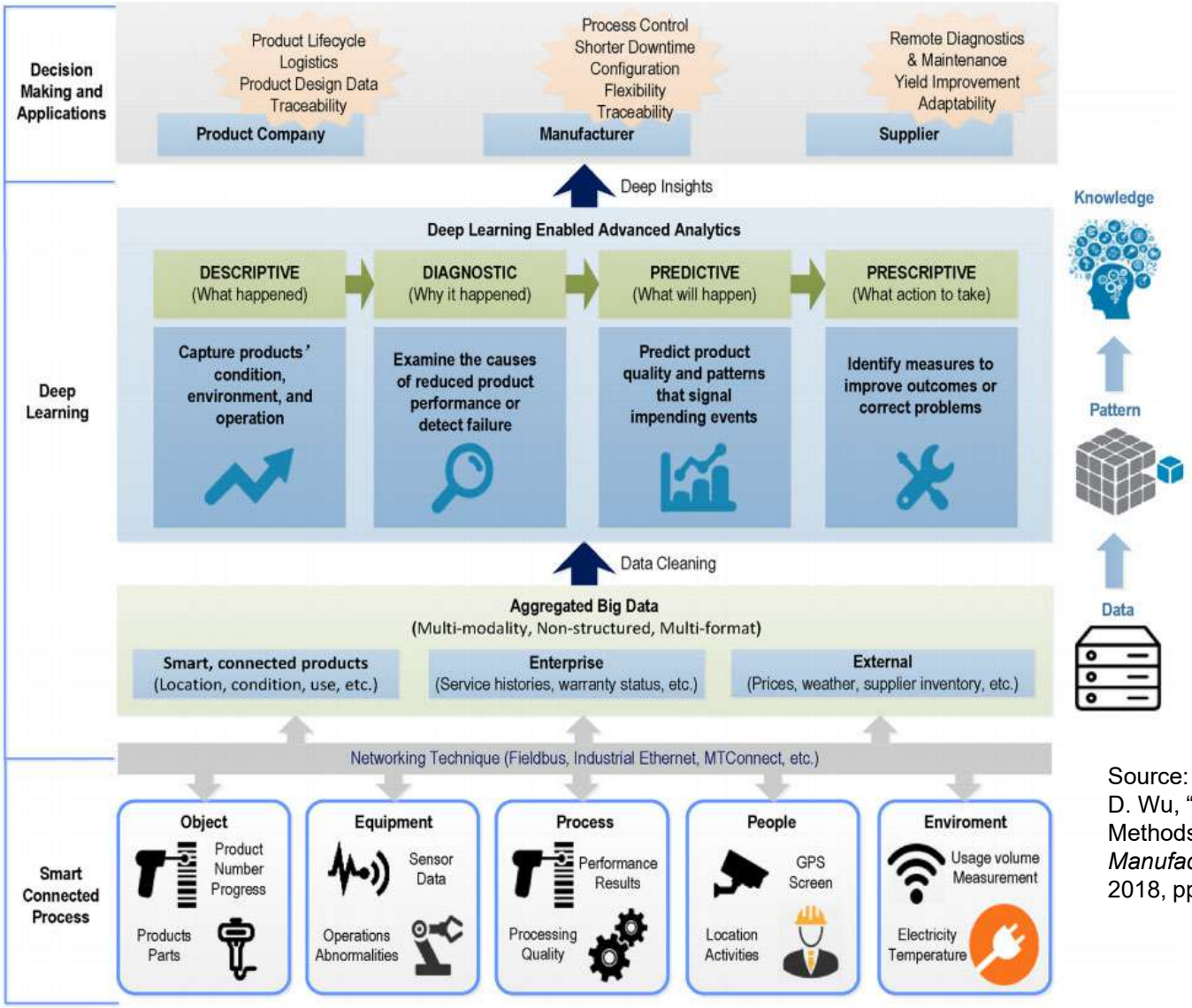
Source: Z. Yin, M. Zhao, Y. Wang, J. Yang, J. Zhang, "Recognition of emotions using multimodal physiological signals and an ensemble deep learning model," *Computer Methods and Programs in Biomedicine*, Vol. 140, Mar. 2017, pp. 93-110.

Example: Sensor-based human activity recognition



Source: J. Wang, Y. Chen, S. Hao, X. Peng, and L. Hu, "Deep learning for sensor-based activity recognition: A survey," *Pattern Recognition Letters*, Vol. 119, Mar. 2019, pp. 3-11.

Example: Smart manufacture



Source: J. Wang, Y. Ma, L. Zhang, R. Gao, and D. Wu, "Deep learning for smart manufacturing: Methods and applications," *Journal of Manufacturing Systems*, Vol. 48, Part C, Jul. 2018, pp. 144-156

Example: Smart living

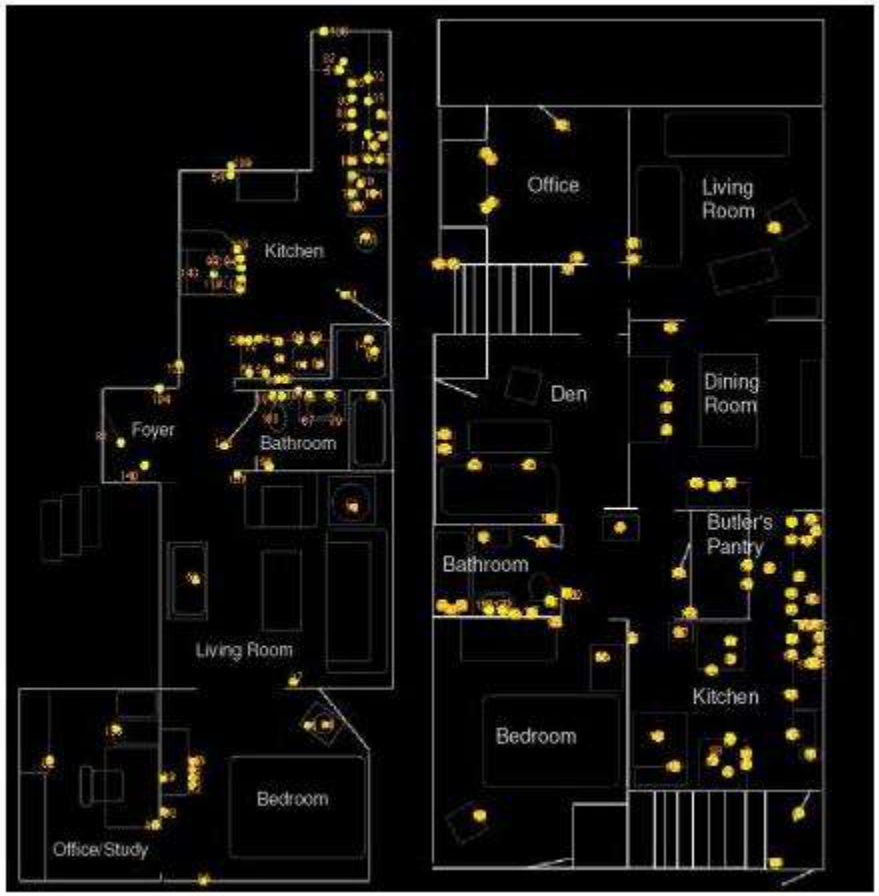
- Activity Recognition in Home Using Ubiquitous Sensors, http://courses.media.mit.edu/2004fall/mas622j/04.projects/home
- Sensor: Switch sensor
- Description: Around 80 sensor data collection boards equipped with reed switch sensors were installed in two single-person apartments for two weeks. The sensors were installed in everyday objects such as drawers, refrigerators, containers, etc. to record opening-closing events (activation deactivation events) as the subject carried out everyday activities.

Source: http://courses.media.mit.edu/2004fall/mas622j/04.projects/home

Example: Smart living

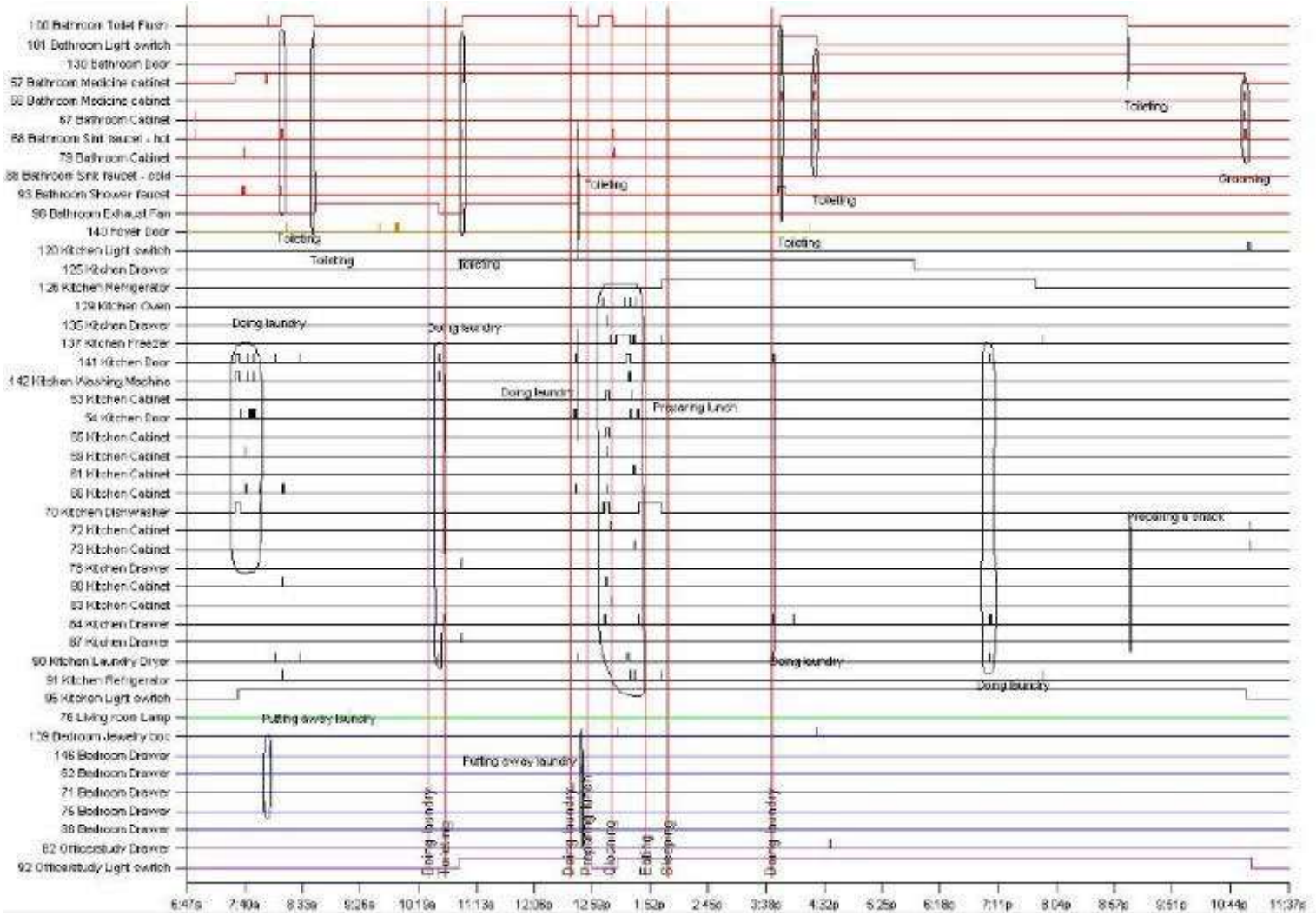
Example data

Number of Examples per Class		
Activity	Subject 1	Subject 2
Preparing dinner	8	14
Preparing lunch	17	20
Listening to music	-	18
Taking medication	-	14
Toileting	85	40
Preparing breakfast	14	18
Washing dishes	7	21
Preparing a snack	14	16
Watching TV	-	15
Bathing	18	-
Going out to work	12	-
Dressing	24	-
Grooming	37	-
Preparing a beverage	15	-
Doing laundry	19	-
cleaning	8	-



Example: Smart living

Example data



Summary

- Case studies on designing an intelligent sensing system

Thank you!

Dr TIAN Jing
Email: tianjing@nus.edu.sg