**AI In-Home Motion Monitoring for Elderly Care**

**Problem**

The shortage of caretakers and institutions increases the challenge of elderly care. More senior citizens want to age in their home and live independently. Sekisui House is one of the largest home builders in Japan and wants to create value beyond construction services by offering smart home products that tailor to elderly care in an unintrusive manner.

How do we know what the person is doing at what time in what place, and further detect anomalous behaviors with signal data?

**Data**

- 24-hour data stream collected from the test room, 13 motions from controlled experiments, 15 motions from self-reported activities

**Methodology**

**Phase I** Supervised Multi-Output Classification

- We extract 2 types of labels from meta information
- We treat signal input data as image (2D)

**Shared ResNet Layer:**

Learn shared representation of signal patterns from multiple sensors

2 Output:

Independent output channels predict activity and location simultaneously

**Phase II** Unsupervised Contrastive Learning

- We treat a record of signals as video (3D) to maintain the spatial and temporal information

**Contrastive Loss:**

Differentiate between similar and dissimilar pairs of data

**Encoder:**

Learn both spatial (CNN 2D) and temporal information (LSTM)

**Output:**

- Independent output channels predict activity and location simultaneously

**Future Works**

**Short term:**

- Improvement on web interface
- Combine Phase I and II: Use the change point prediction as new labels for multi-output classification
- Anomaly Detection: Collect or simulate more anomalous behaviors and develop algorithm

**Long term:**

- Implementation: Real time monitoring with our model
- Integration: Use our model as foundational steps for Sekisui House’s post-construction services, including medical assistance and accident alerts

**Impact**

**Interactive Web Interface:** a working demo for the internal team at Sekisui House

**High adaptability:** our model can be further applied to Sekisui House’s new data

**Downstream Algorithms:** our model facilitates the downstream algorithm of anomaly detection and Early Detection System