

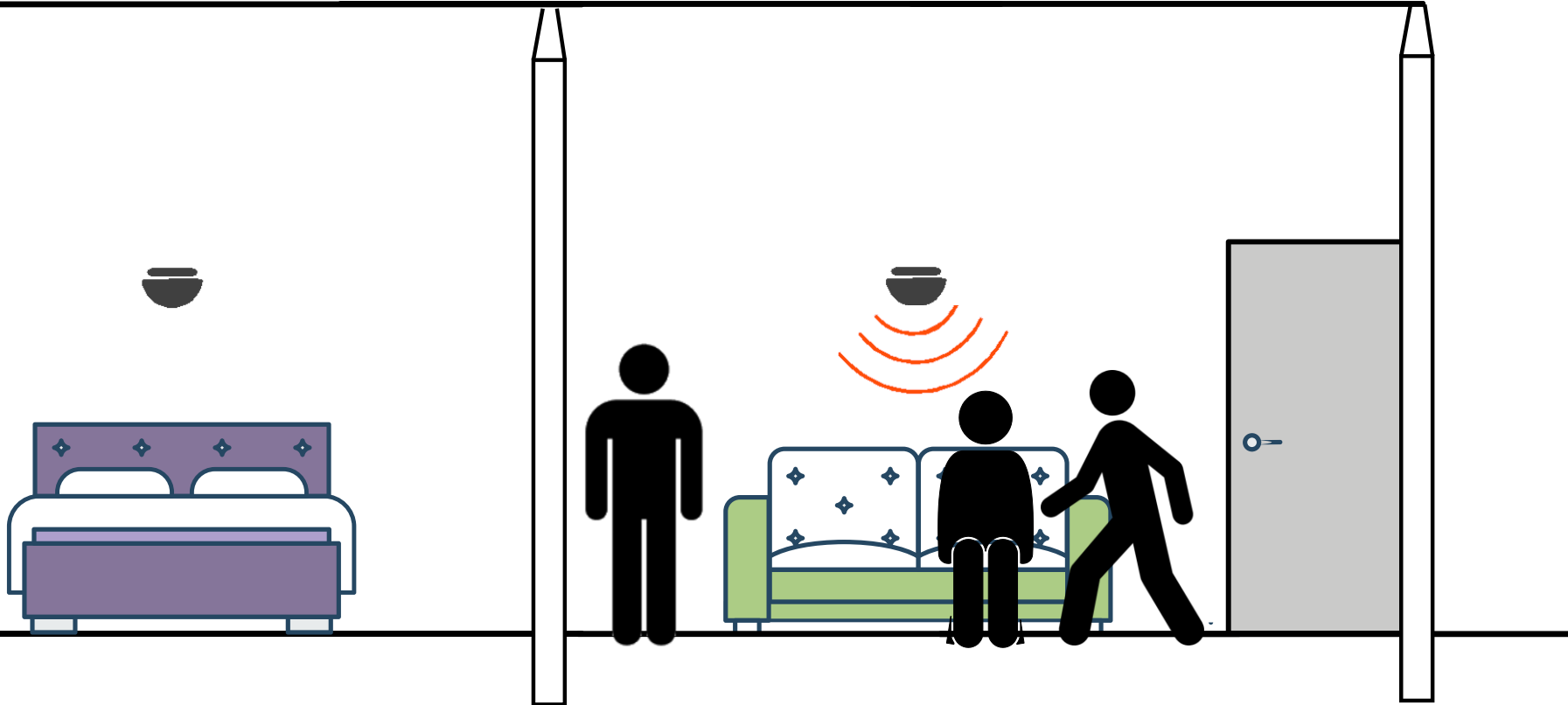
# WalkSense: Classifying Home Occupancy States Using Walkway Sensing

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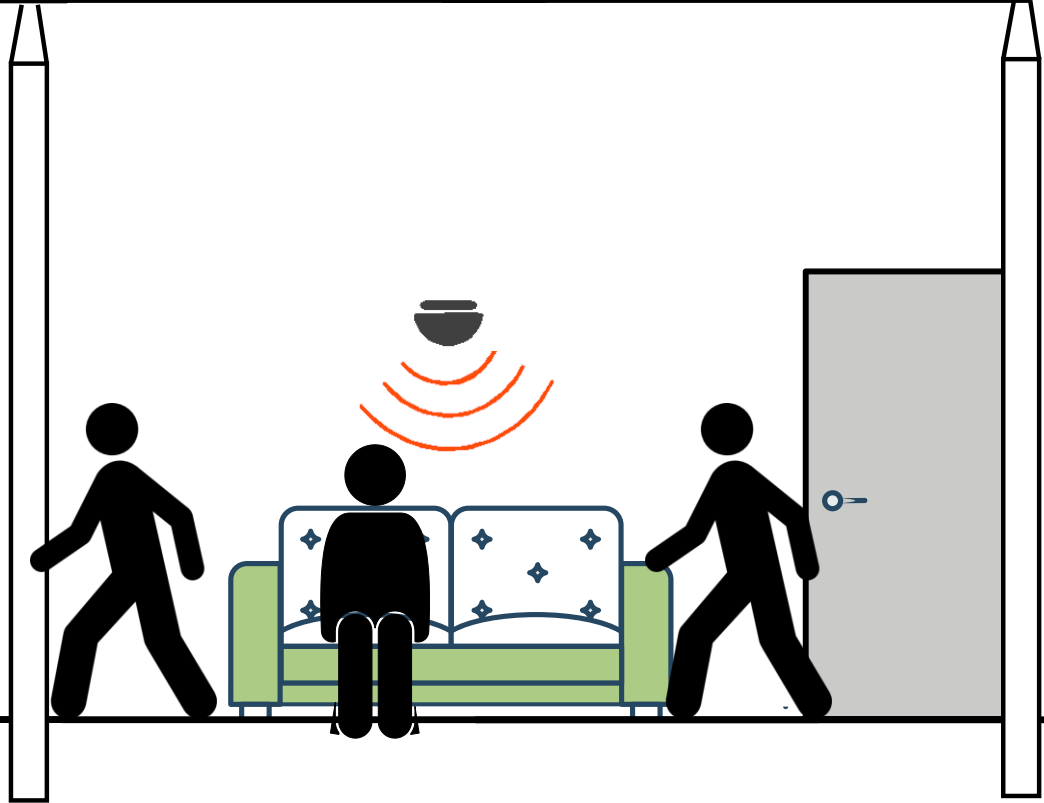
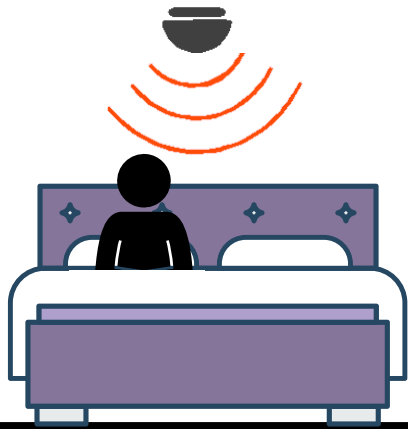
# Motion $\neq$ Occupancy

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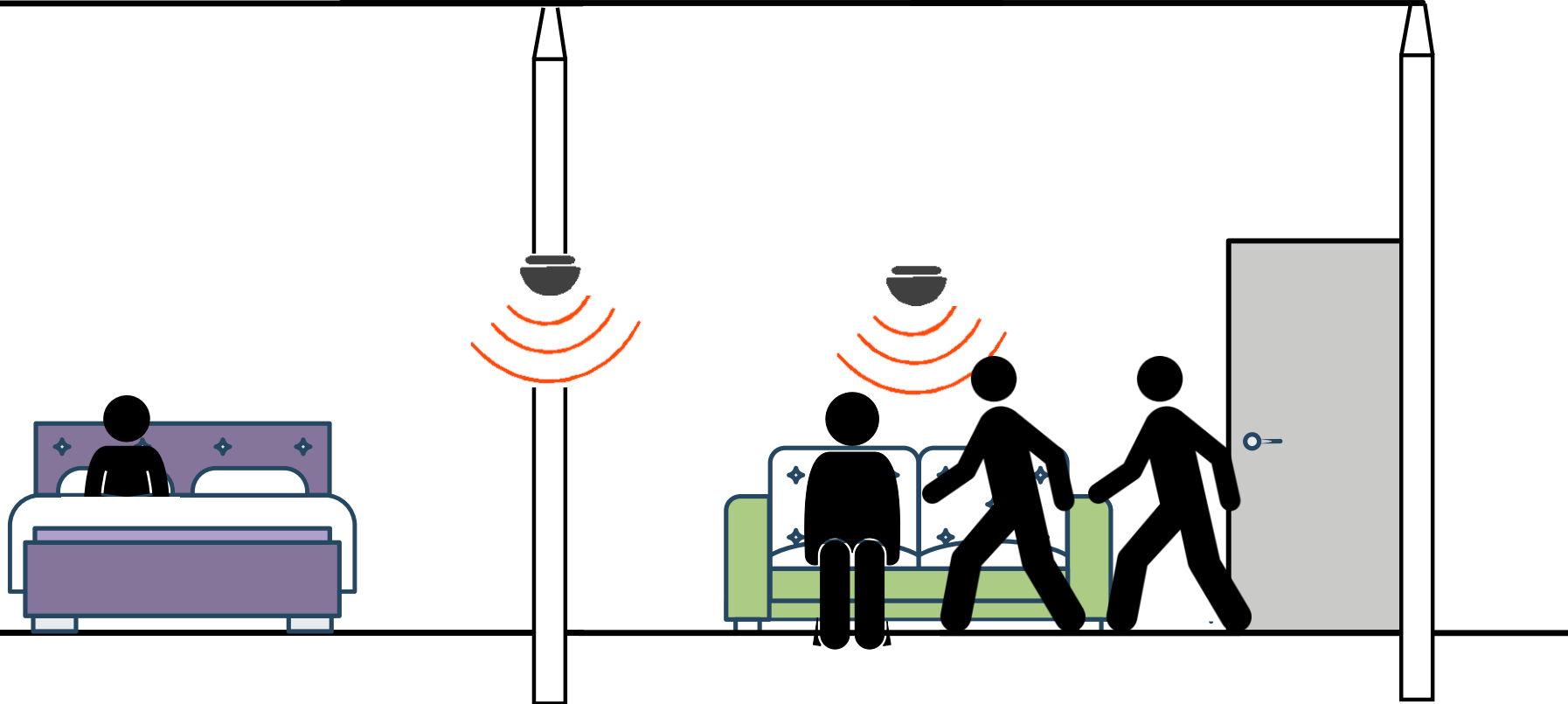
# Motion $\neq$ Occupancy

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# Walkway Sensing

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# Overview

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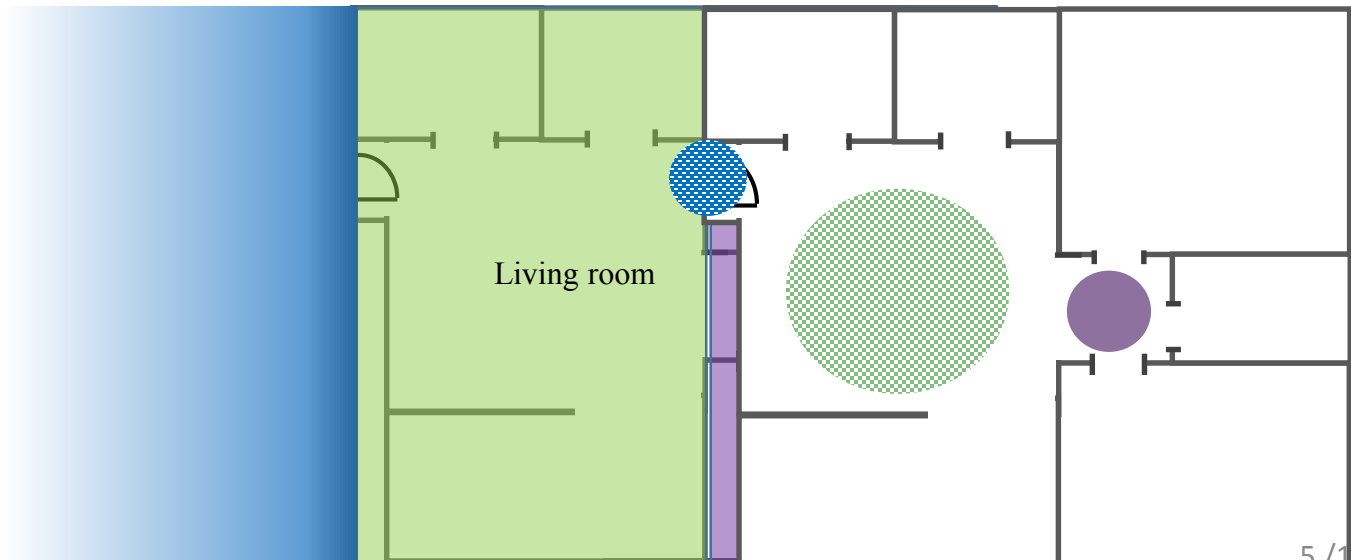
Away



Active



Sleep



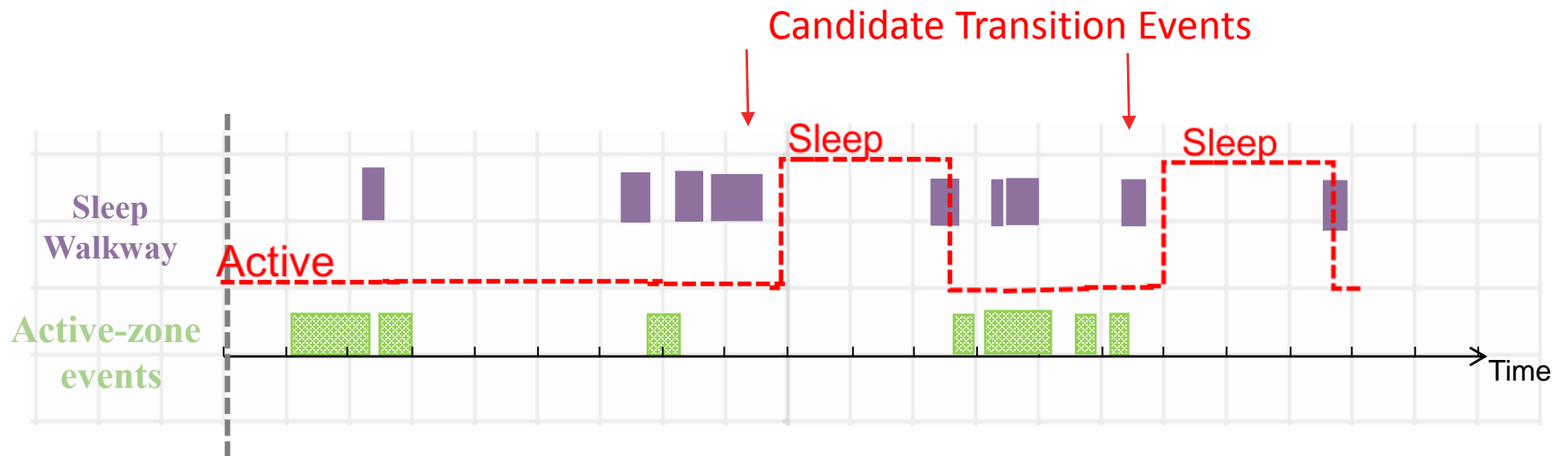
# Outline

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- WalkSense: Occupancy detection algorithm
- Automatic training feature
- Evaluation

# WalkSense

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# Training WalkSense

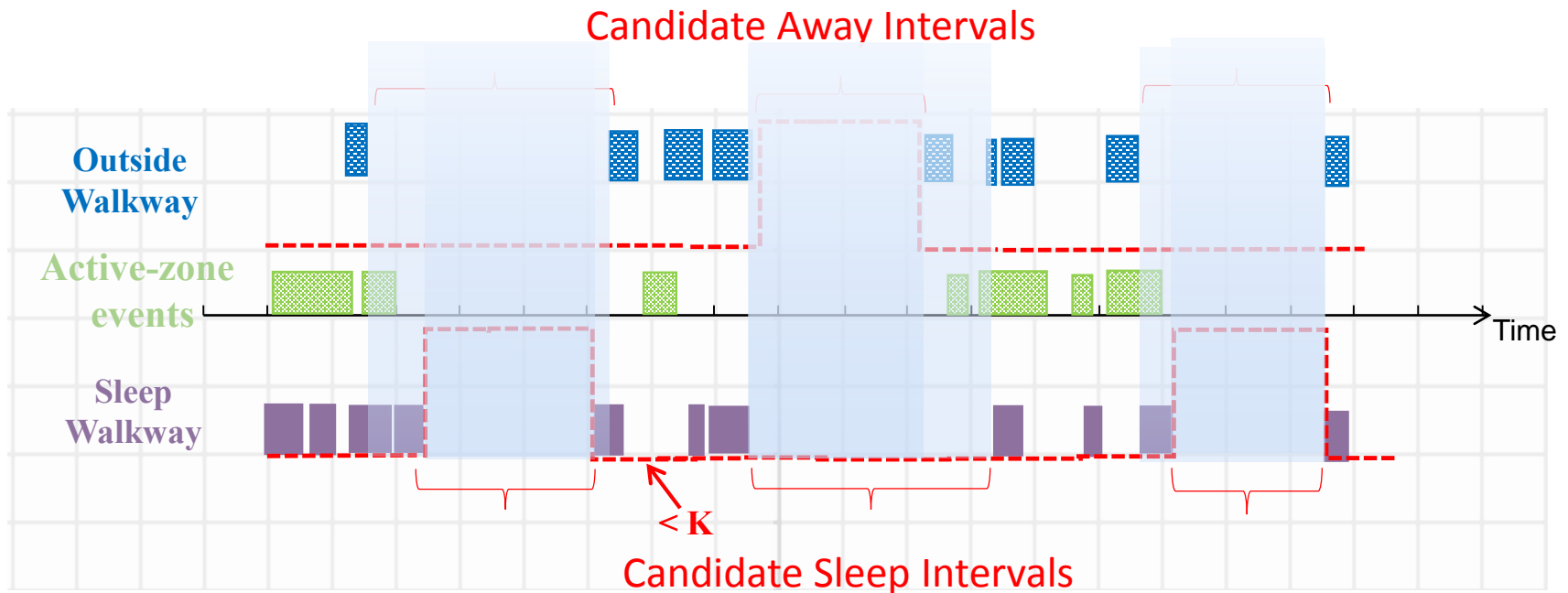
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How to train the models?

By exploiting the WalkSense in **offline mode**

# Training WalkSense

- Candidate Sleep/Away Intervals: Inactivity longer than  $K$

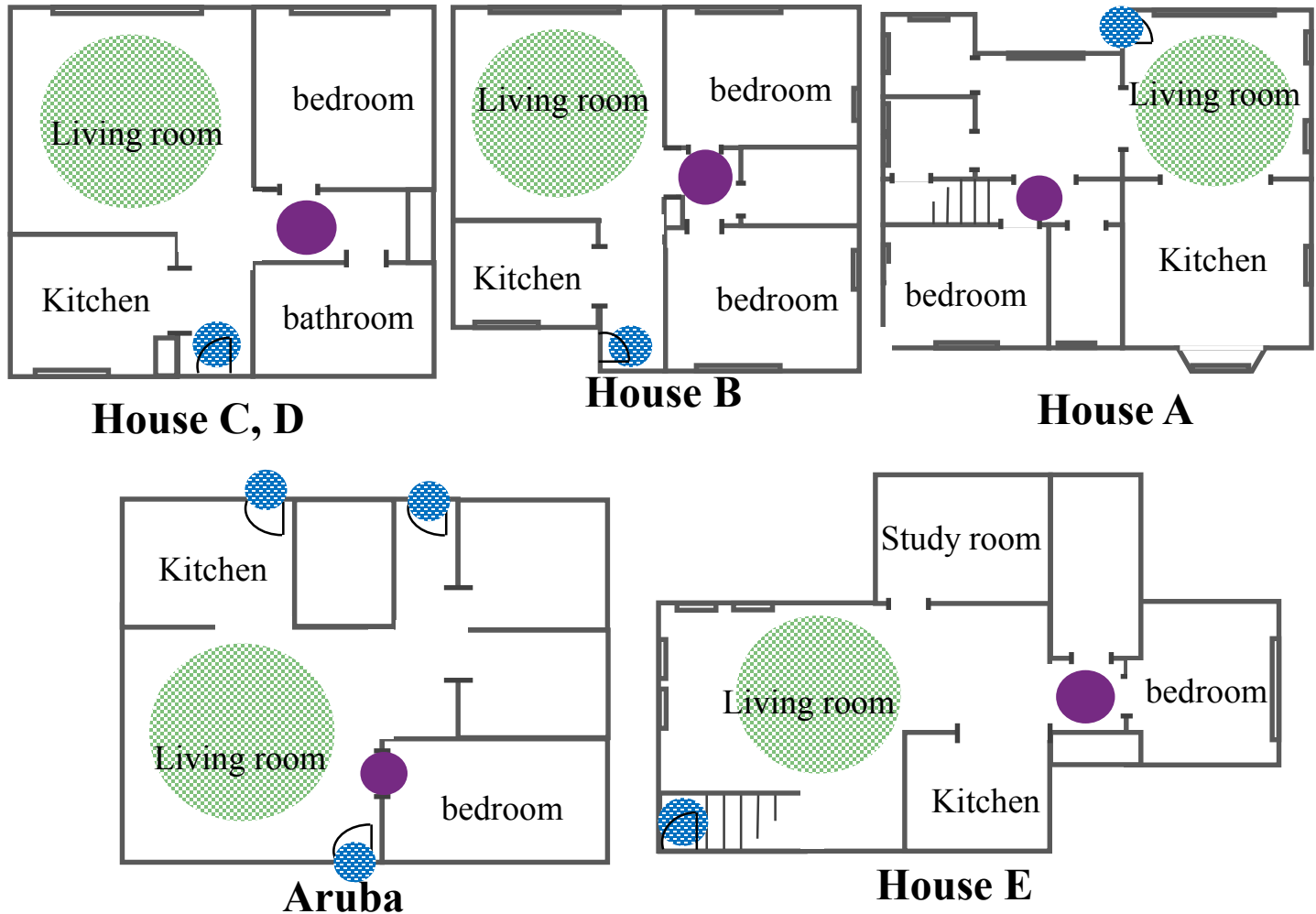


Automatic Labeling → No user involvement

Incremental Training → Improve detection model over time

# Experimental Setup

- 350 days worth of data

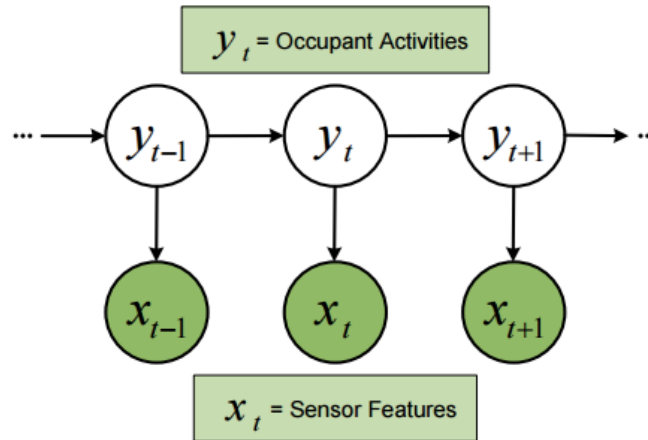


● Active Sensing Zone ● Outside Walkway Zone ● Sleep Walkway Zone

# Experimental Setup

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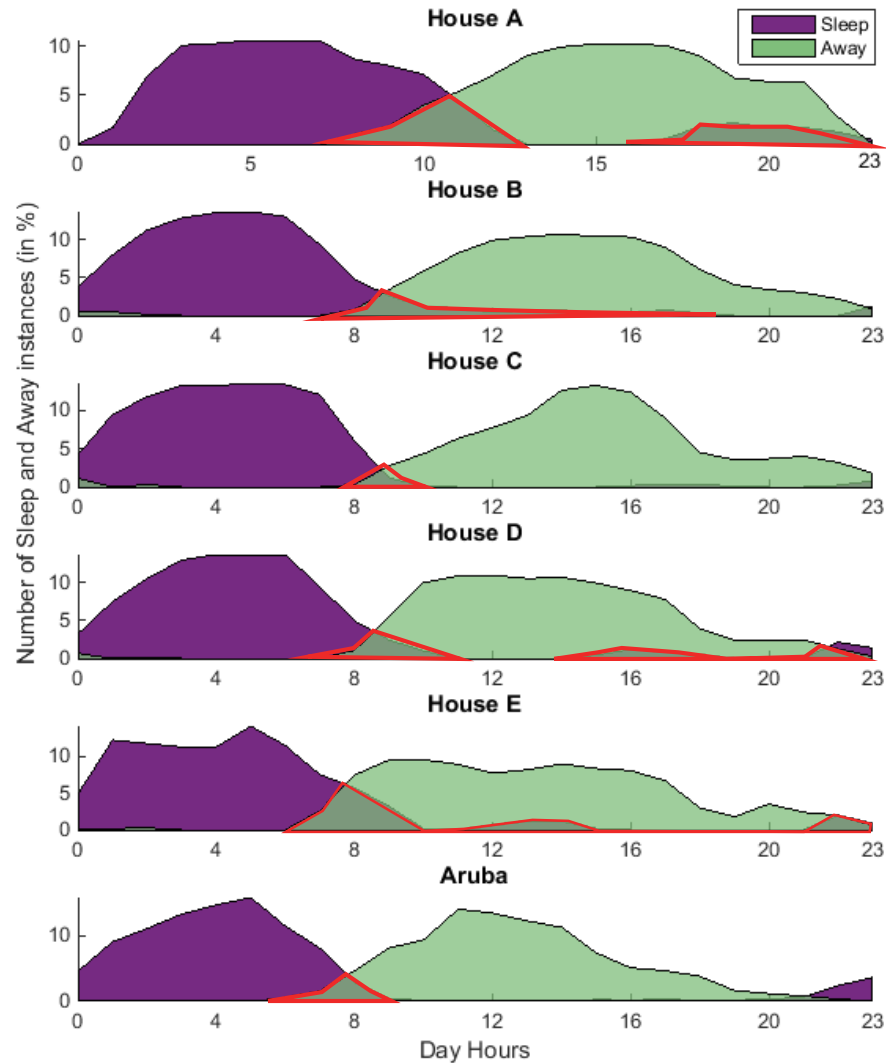
- Baseline: HMM-base



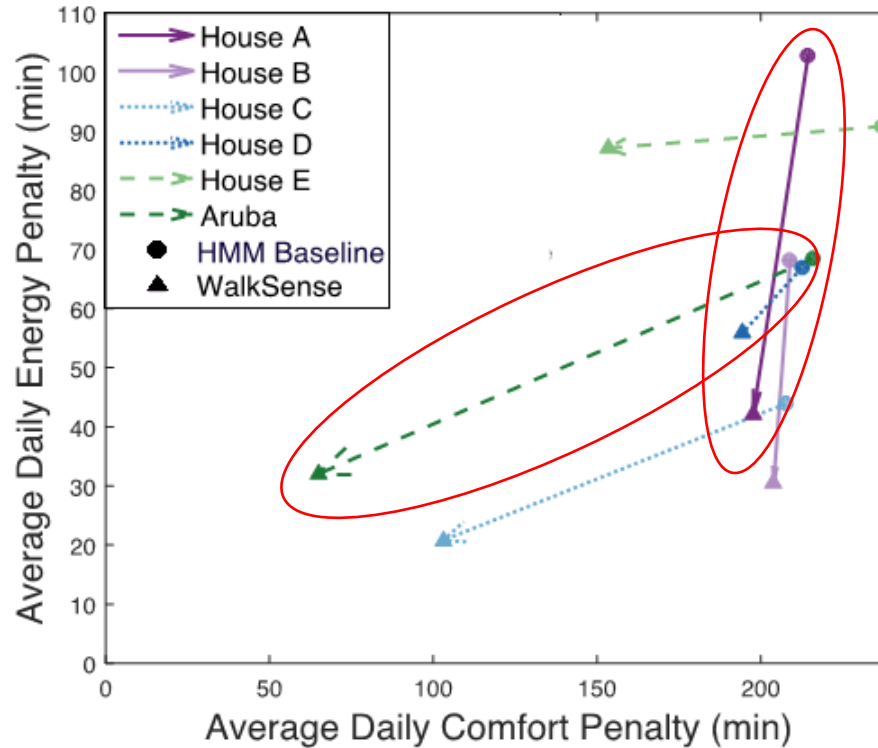
- Evaluation Metrics
  - Energy penalty: **away** or **sleep** periods are wrongly detected as **Active**
  - Comfort penalty: **Active** periods are wrongly detected as **Sleep** or **Away**

# Experimental Setup

61% of the day outside home, or sleep

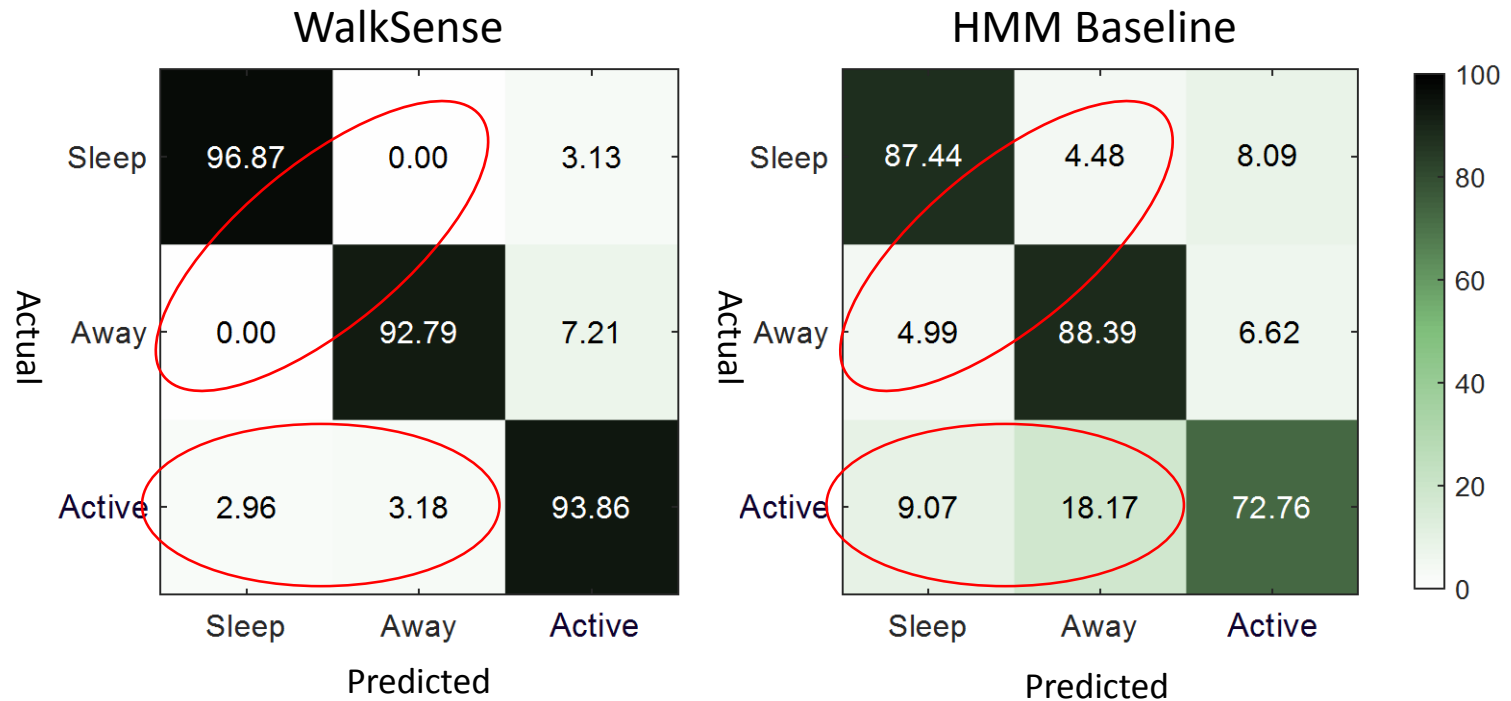


# Evaluation



30% lower energy penalty  
32% lower comfort penalty

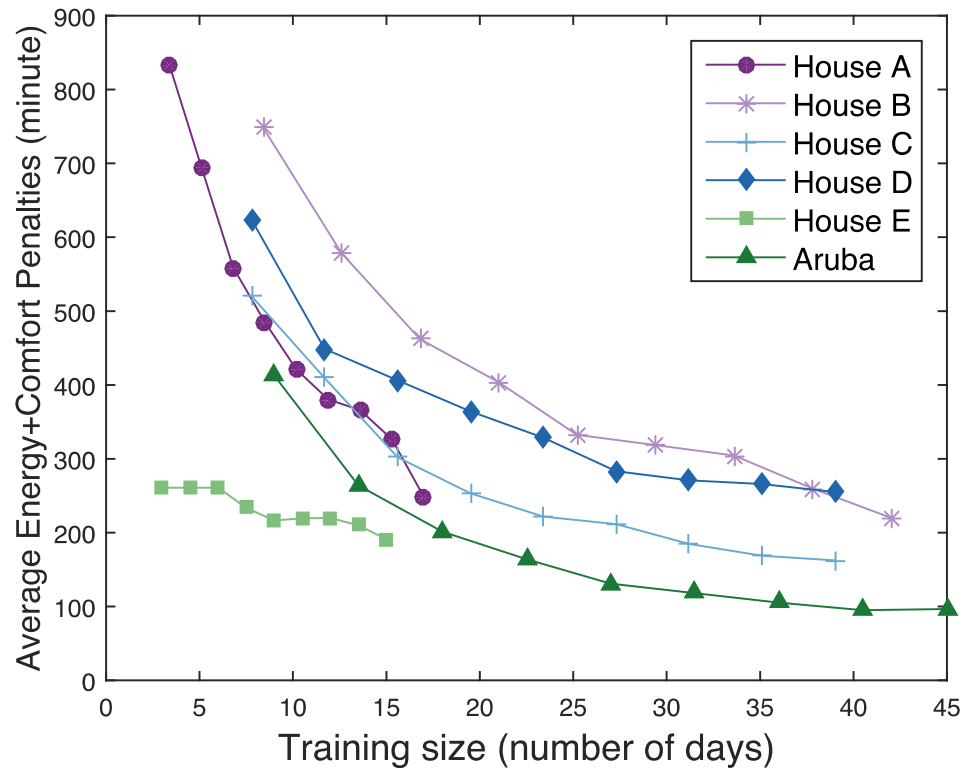
# Evaluation



95% vs. 83% Accuracy

# Analysis

Training Size Effect



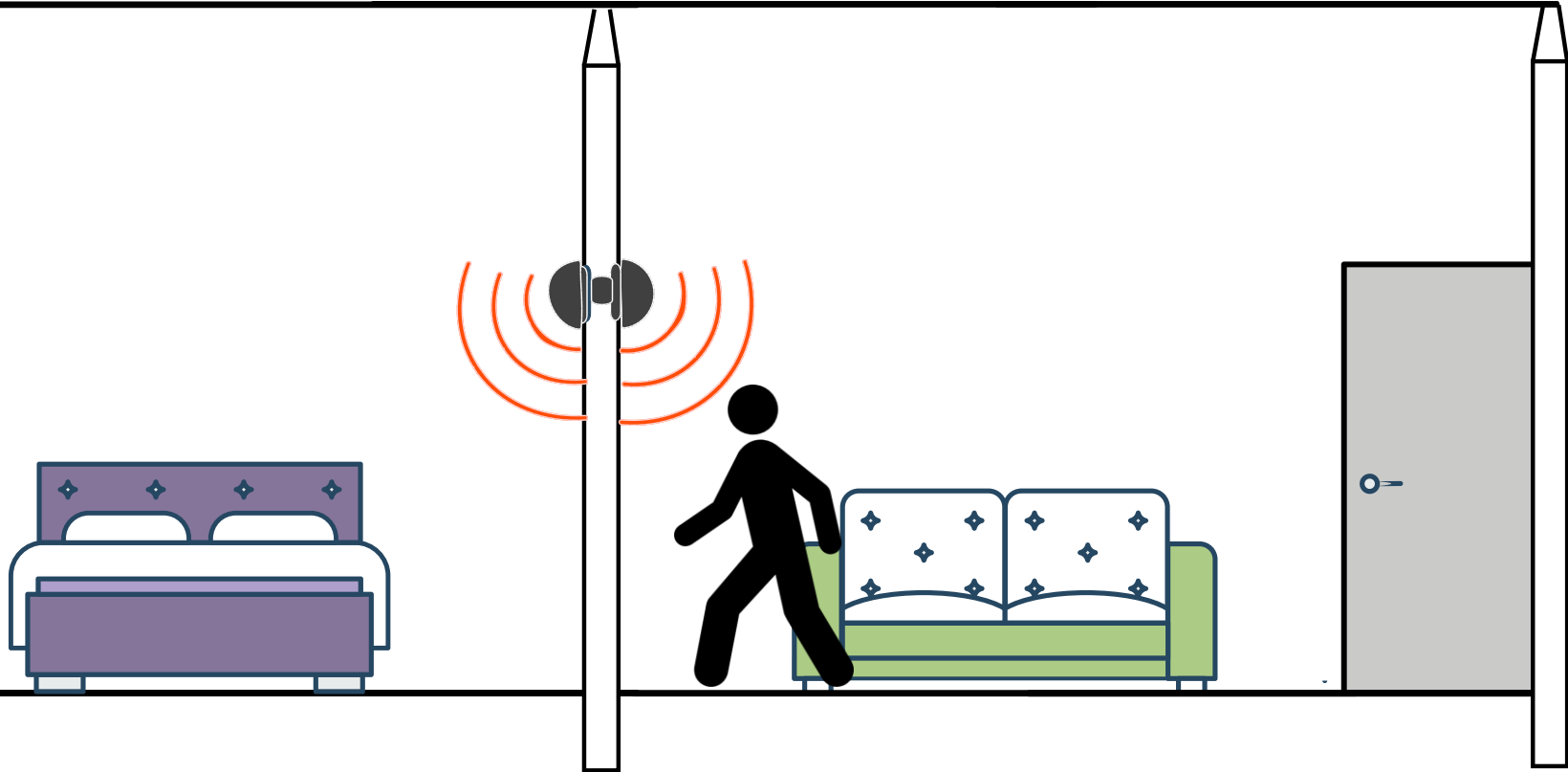
# Conclusion

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- ***WalkSense: Occupancy Detection algorithm based on Walkway Sensing***
  - Higher Accuracy
  - *Fewer Sensors*
  
- **96%** Accuracy with 30% and 32% lower energy and comfort penalty
  
- **Limitation:** Assumes direct relationship between  
Occupancy States & Occupancy zones.
  - TV
  - Study Desk

# Conclusion: Generalizable

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Thank You!