

Kelsey Cairns / Dr. Schmitter-Edgecombe / Dr. Cook

Smart Environments, Computer Science

Background: Actigraphy



- Wearable accelerometers measure daily movement.
- Movement levels are recorded per time interval, usually one minute.
- Reliable detection of sleep and circadian rhythms.

Most actigraphs can be worn like watches

The Goal

- Incorporate neural networks into actigraph data analysis
- Detect different levels of physical activity based on gathered activity data.
- Measure daily sedentary behavior, where subjects show movement, but aren't involved in physical activity.

Approach

- Training data was collected from five students who wore actigraphs and kept activity logs.
- Actigraphs recorded data in Zero Crossing Mode, counting number of accelerations per minute.
- University of Waikato's WEKA software was used to train Neural Networks.
- Several neural networks were trained using various data attributes.
- Neural nets were cross validated on training data sets, and validated on unbridged data sets.

Trials

Each neural network was trained using a different set of attributes to define each instance. Instances always included the activity counts for the current and surrounding epochs, but including other variables affected the data. Other variables included:

- Standard deviation of surrounding epochs counts
- Range of surrounding epochs
- Percentage of surrounding epochs with the same classification (Uniformity)
- Whether or not the subject reported being in bed

Results

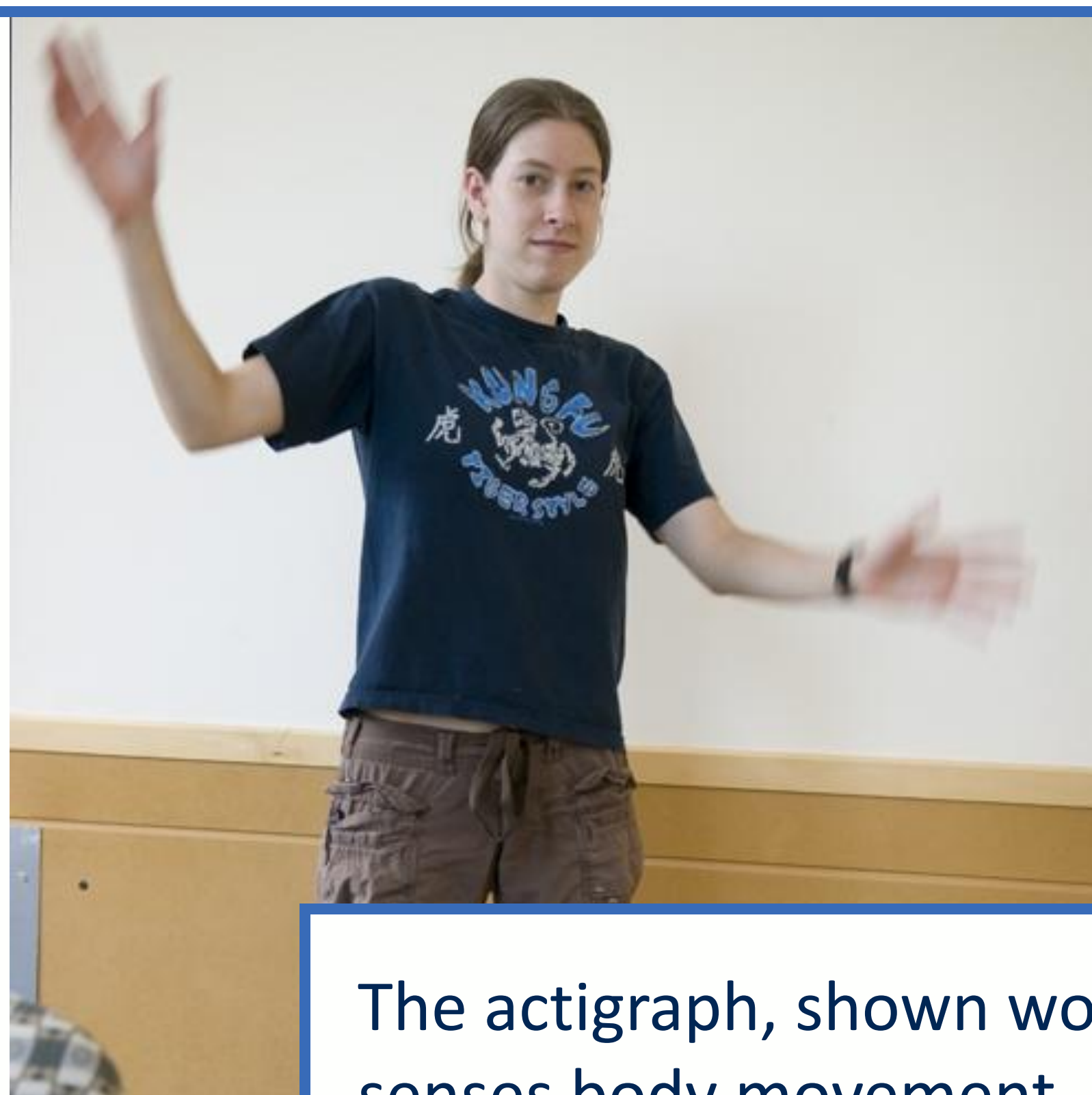
- Neural nets successfully classified most activity levels.
- Networks trained with variables other than activity counts generalized better than those using only activity counts.

Parameters	Cross-Validation % Accuracy	Unbridged Data % Accuracy
Activity Counts Only	83.69	83.69
Activity Counts Limited by Range	90.34	80.7
Activity counts and Standard Deviation	83.42	83
Uniformity and Standard Deviation	85.66	86
Activity Counts and Count Uniformity	84.88	85

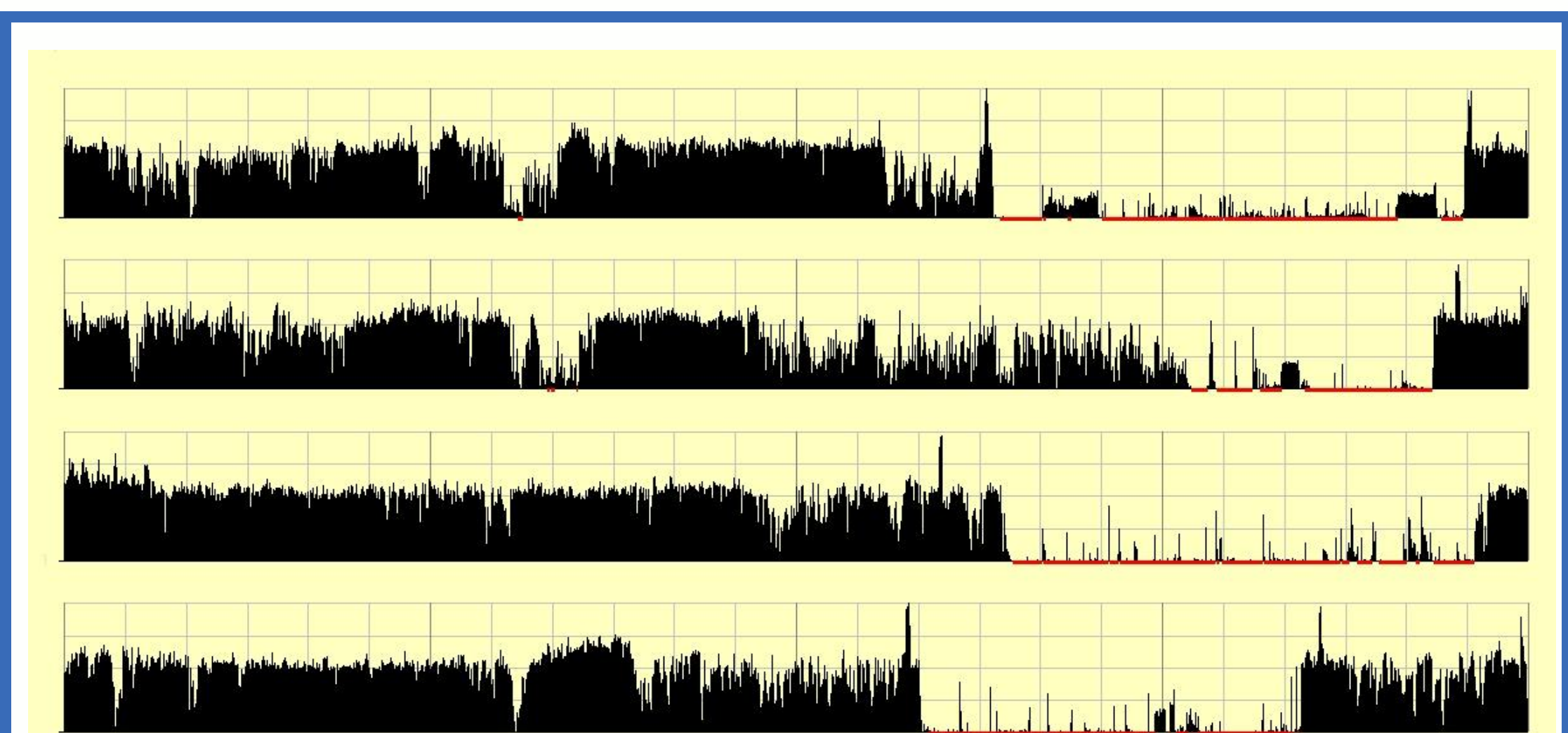
Discussion

The ability to categorize physical activity will allow researchers to examine other correlations. Some aspects with which daily activity level could be associated:

- Time spent in bed
- Quality of sleep
- Cognitive functioning
- Physical health over extended time periods



The actigraph, shown worn on the wrist, senses body movement.



Raw actigraph data recorded over four days