**Greeting**

* Good morning, dear members of the examination committee (and dear audience).
* My name is Martin Beneš.
* Welcome to my bachelor thesis defense.

**Assignment**

* Study the PIR sensors and recognition/classification.
* On basis of this knowledge design a theoretical system
  + Predefined fuzzy logic / artificial learning system
* With PIR sensor data scan the situation
  + Possibly the count of people.
* Implement the described algorithm.
  + Verify its functionality on real situation.

**Design**

* Client-server structure
* Client = sensor device
  + Responsibilities sensing and homogenous segmentation
  + Implemented with PIR STD (B+B Sensors) + NodeMCU
    - Advantage of ESP8266 on the board = WiFi embedded
    - Programmed using C++/Arduino
    - Configuration via HTTP API
  + Writes data to multicast channel
* Server = classification server (Monitor)
  + Responsibilities classification, presentation (and fusion)
  + Implemented in Python3 (easy prototyping)
    - Due to a number of libraries (NumPy, SciPy, MatPlotLib)

**Feature extraction**

* Let’s continue to method description.
* Signal undergoes processing pipeline consisting of
  + Feature extraction + classification itself
* Signal is segmented into parts (artefacts) with similar character
  + The features are statistical attributes of each artefact
    - Mean, variance, interpolated line scale, length
  + To get those artefact
    - The edges were detected using CWT
    - Areas between edges formed primary segments
    - Neighboring segments merged with fuzzy logic

**Classifier**

* Based on linear regression
  + Multiple classifiers, each determining one attribute
    - Distance
    - Orientation
    - Side
* Spacial model of sensed area = matrix with fuzzy values
  + Formula for the index value is a polynome
    - Classifier outputs being variables
    - Coefficients characteristical for the index
  + Indices do not separate the space homogenously

**Training**

* Manual labelling
  + Reference of synchronized video frame
* Rather inaccurate
* Definitely a room for improvement

**Postprocessing**

* **Localization** = cluster analysis
  + K-means **vs.** Partitioning around medoids
* **Counting the people** = minimal within-cluster sum of squares

**Results**

* Posterior probability (percentage) of partial classifiers
* Evaluation:
  + How many positive samples were classified positive?
* Possible improvements to the future
  + Change the labelling method
  + Usage of multiple sensors
    - Fusion described theoretically, but not implemented