

Occupancy detection

According to indoor environmental measurements is it possible to accurately detect presence of people?

Author: Natasha Catunda



*"The accurate determination of occupancy detection in buildings has been recently estimated to save energy in the order of 30 to 42%. Experimental measurements reported that **energy savings** was 37% in and between 29% and 80% when **occupancy data** was used as an input for HVAC **control algorithms**."*

- Candanedo, L. and Feldheim, V.

ETH buildings has very **different occupancy patterns** on week and weekends. Due to security and image privacy reasons, there are not cameras in every room, but **there are sensors** for air quality reasons. The **output of the sensors** could be use to predict and analyse better the usage of the rooms in the different times of the day and the year - this could lead to enhanced recommendations for the management of the energy systems.

Unsupervised Learning

Dimension reduction + clustering

Mix between **continuous data** and **discrete data**

+

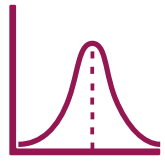
Unknown output

Data sets

Data set	N° of observations	Comment
Training	8143 of 7 variables	Measurements with door closed
Testing 1	2665 of 7 variables	Measurements with door closed
Testing 2	9752 of 7 variables	Measurements with door open

In Hönggerberg the public rooms used by students usually have their door open.

Data set



Humidity | Temperature | CO2



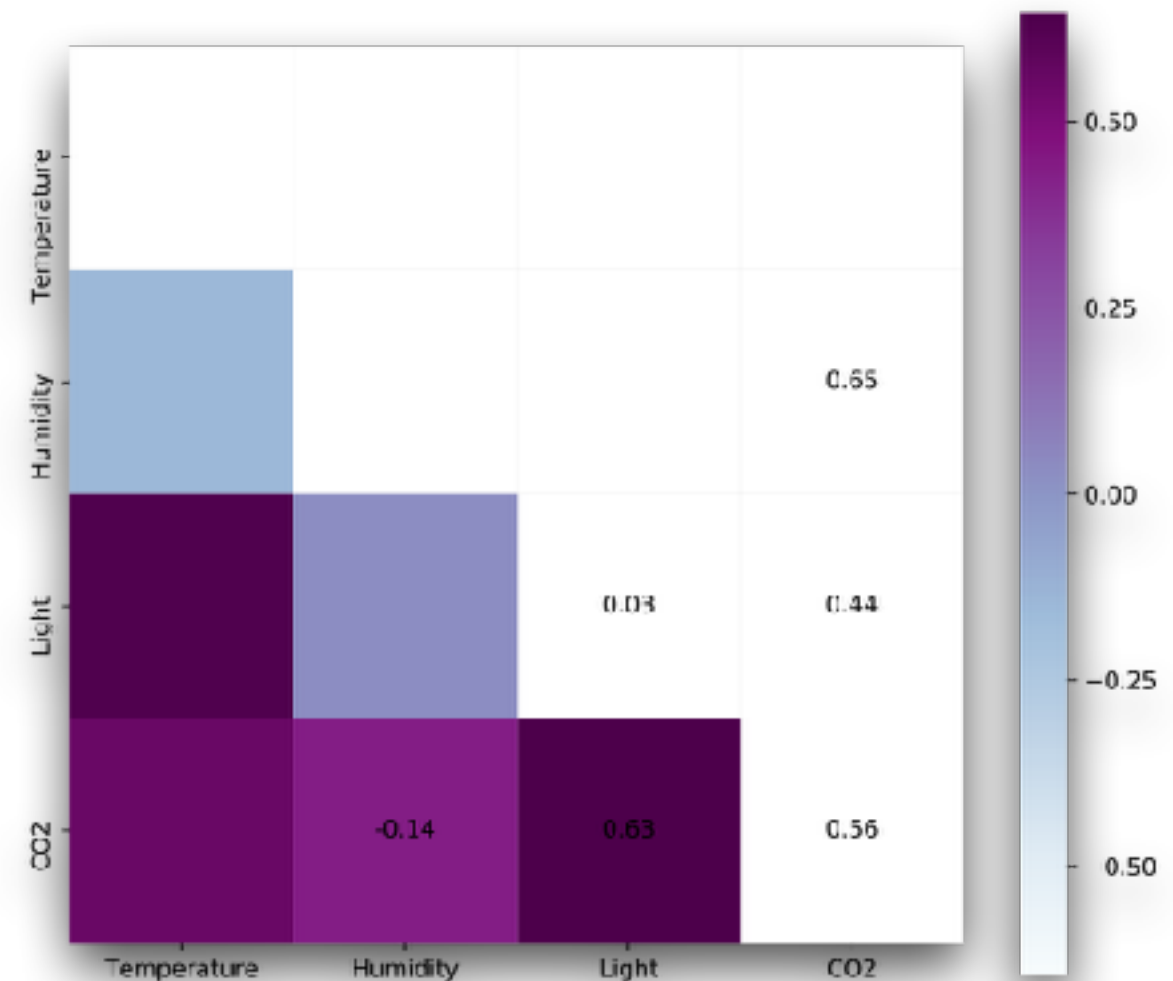
Light

Unknown output although **amount of cluster are known**



K-means clustering

Temperature	Humidity	Light	CO2
23.1	27.2	419	699
23	27.125	418.5	680.5
22.89	27.5	0	688
22.7	27.5	0	670
22.6	27.4267	0	658
22.39	27.29	0	639
22.39	27.5	0	625.5
22.29	27.39	0	621.5
22.29	27.29	0	605.5
22.2	27.2	0	595
22.1	27.245	0	584.5



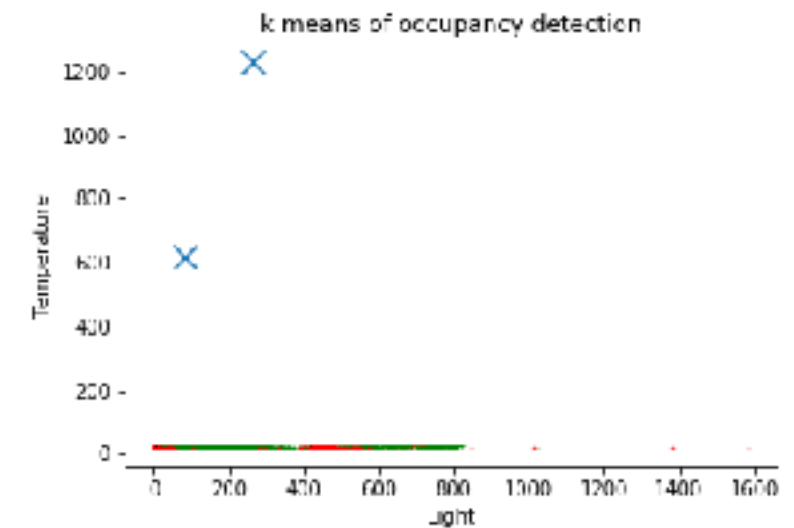
K-Means

💡 2 clusters

Plot 1

Light x Temperature

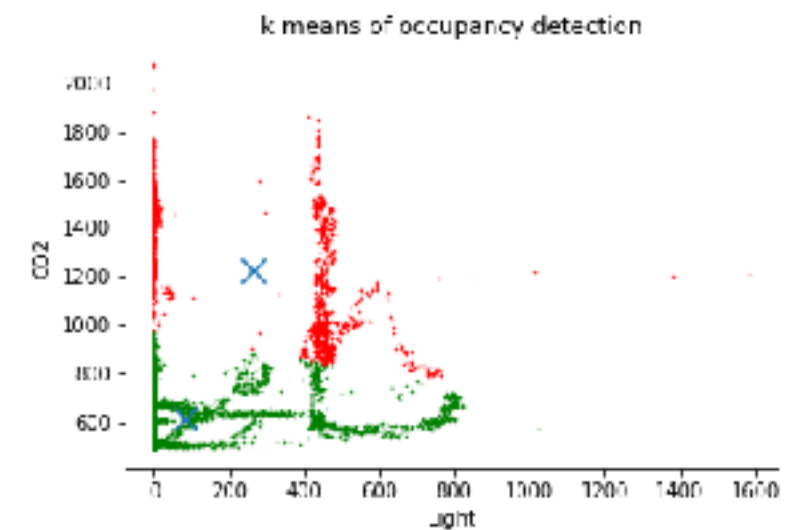
Score
0.61



Plot 2

Light x CO2

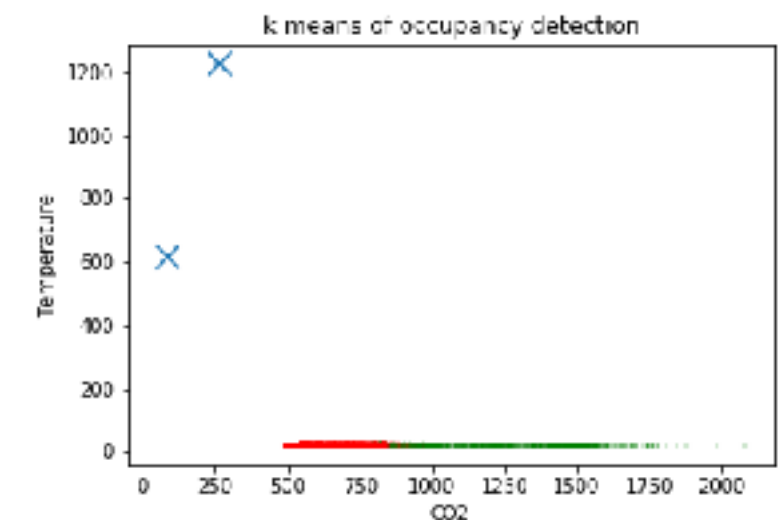
Score
0.61



Plot 3

Temperature x CO2

Score
0.61



- Credits of data set:

Candanedo, L. and Feldheim, V. (2016). **Accurate occupancy detection of an office room from light, temperature, humidity and CO 2 measurements using statistical learning models.** Energy and Buildings, 112, 15 January 2016, pp.28-39.