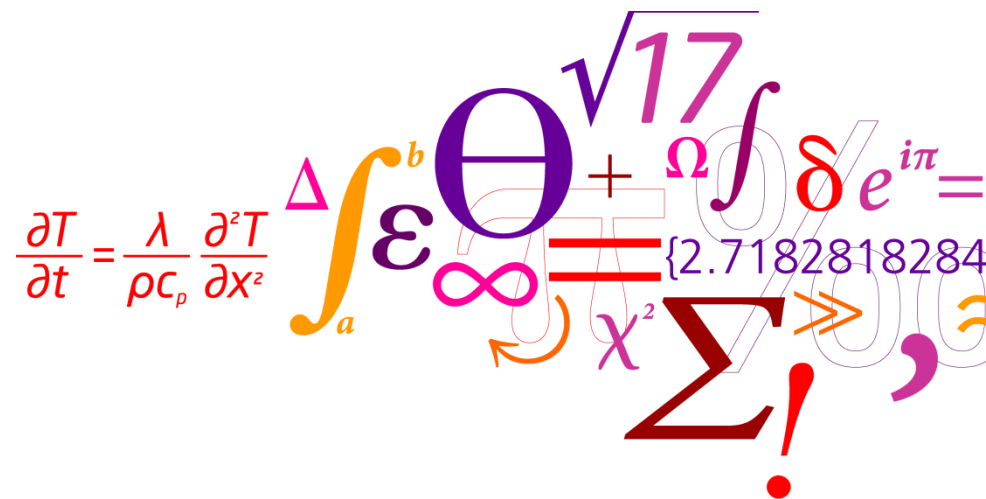




Demonstration of clustering

applied to AVA data

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Why clustering?

Data mining

- Present and analyze data for decision-makers
- Wealth of information (smart meter data)
- Prediction values of interest
- Finding patterns

Clustering segments a database into subsets or clusters.

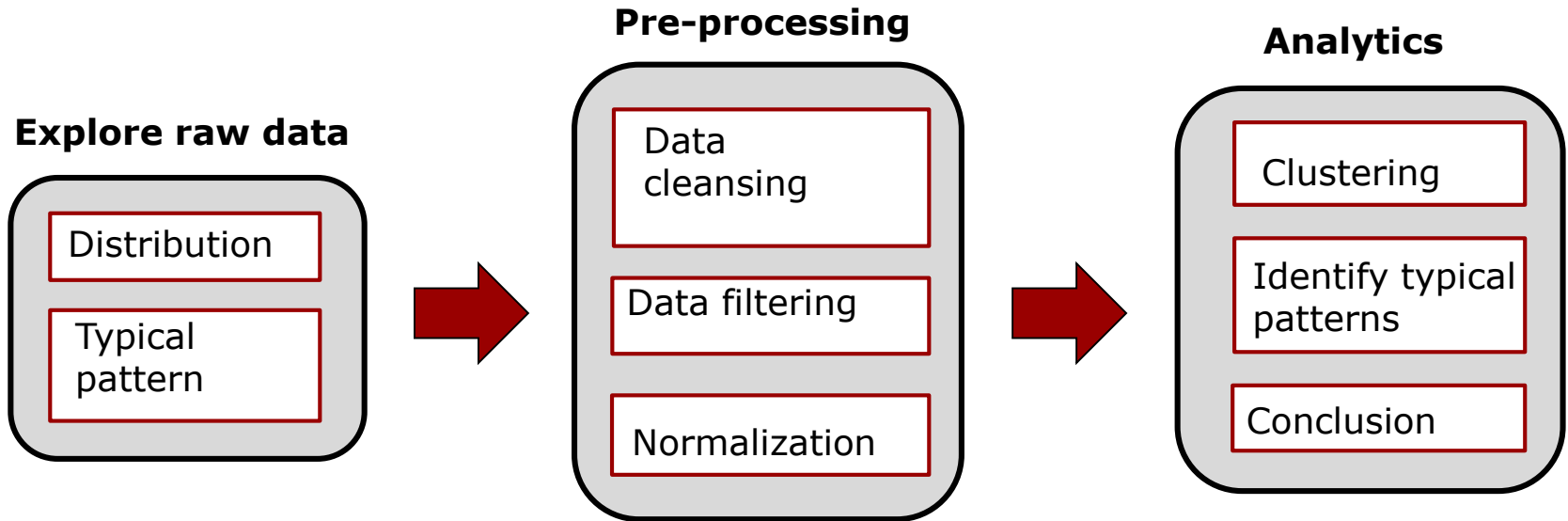


- to discover dense and sparse regions in a data set
- to identify important features about the data

Main categories of clustering

- ✓ Partitioning
- ✓ Hierarchical
- ✓ Density-based
- ✓ Model-based

Process model of clustering

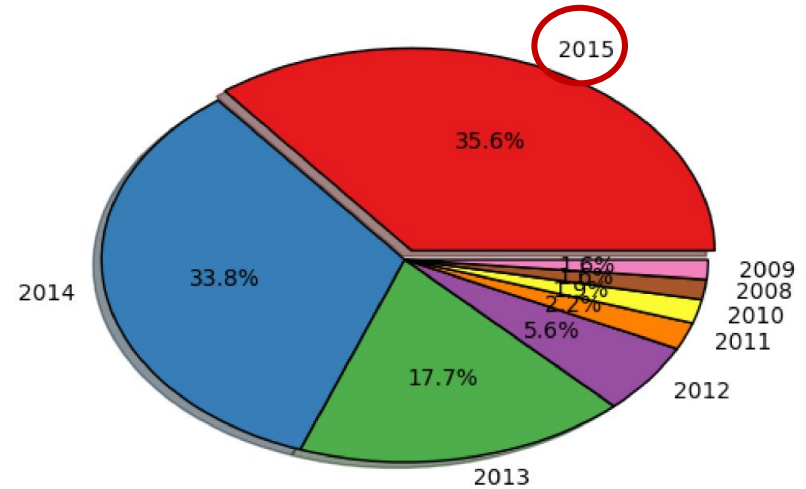


AVA smart meter data

- ❖ District heating (DH) consumption measurements
- ❖ 1 hour intervals
- ❖ 15,065 installations
- ❖ 9,051,636 hourly load profiles
- ❖ Data ranges from December 2008 to November 2015

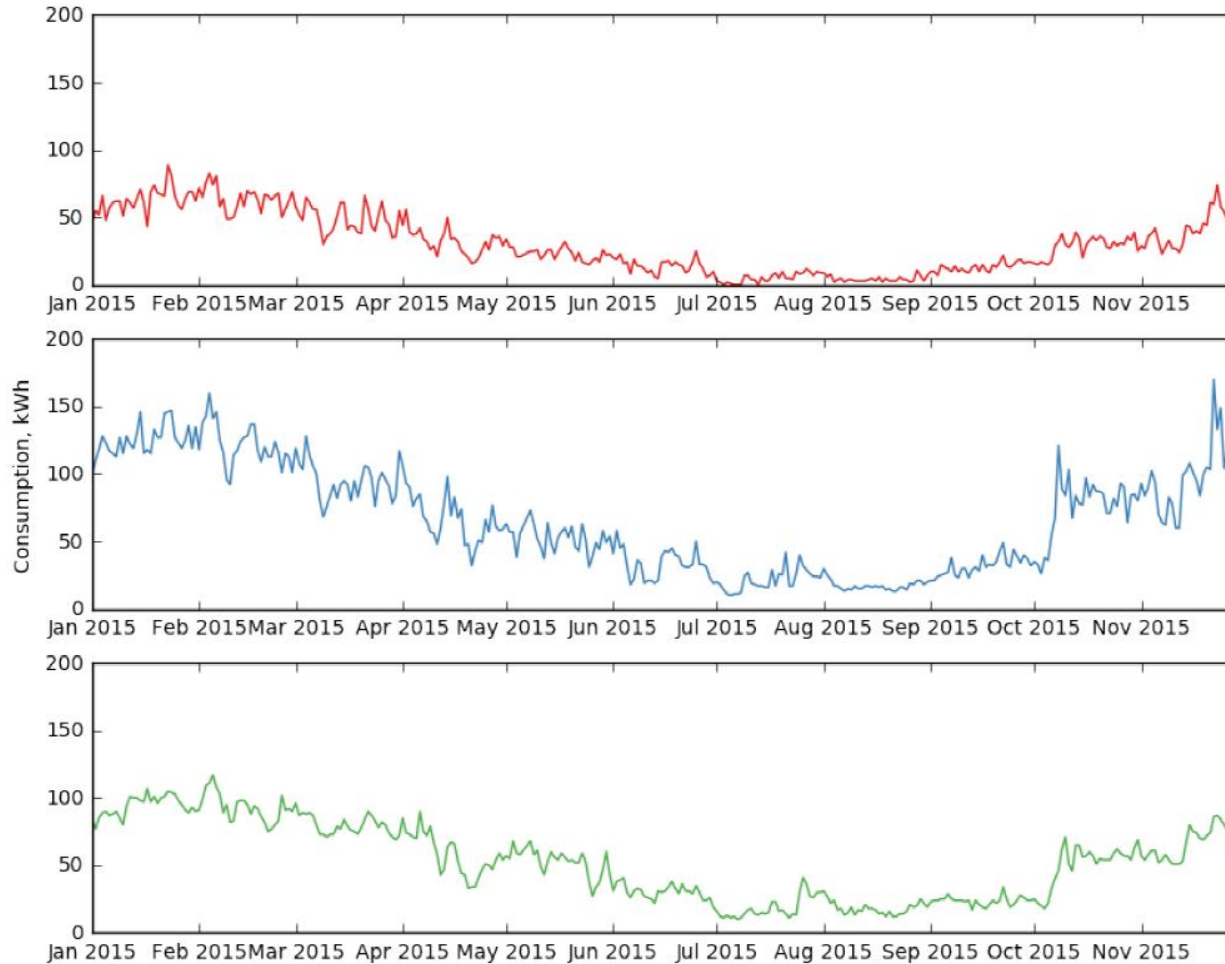
Case study

- ❖ We use the data of 2015
- ❖ We select measurements only from single-family houses



AVA case study

❖ Typical yearly DH consumption patterns

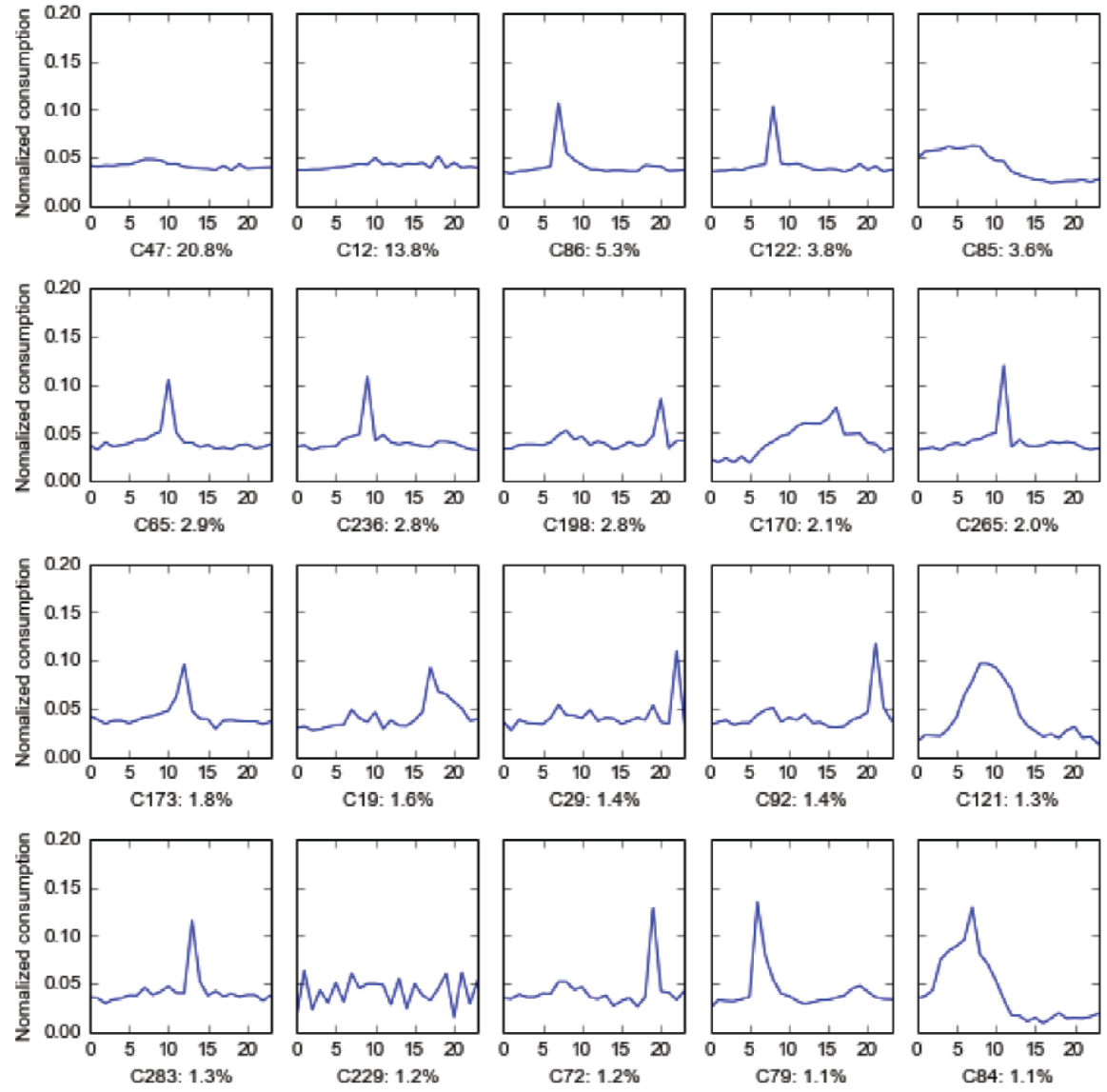


Methodology

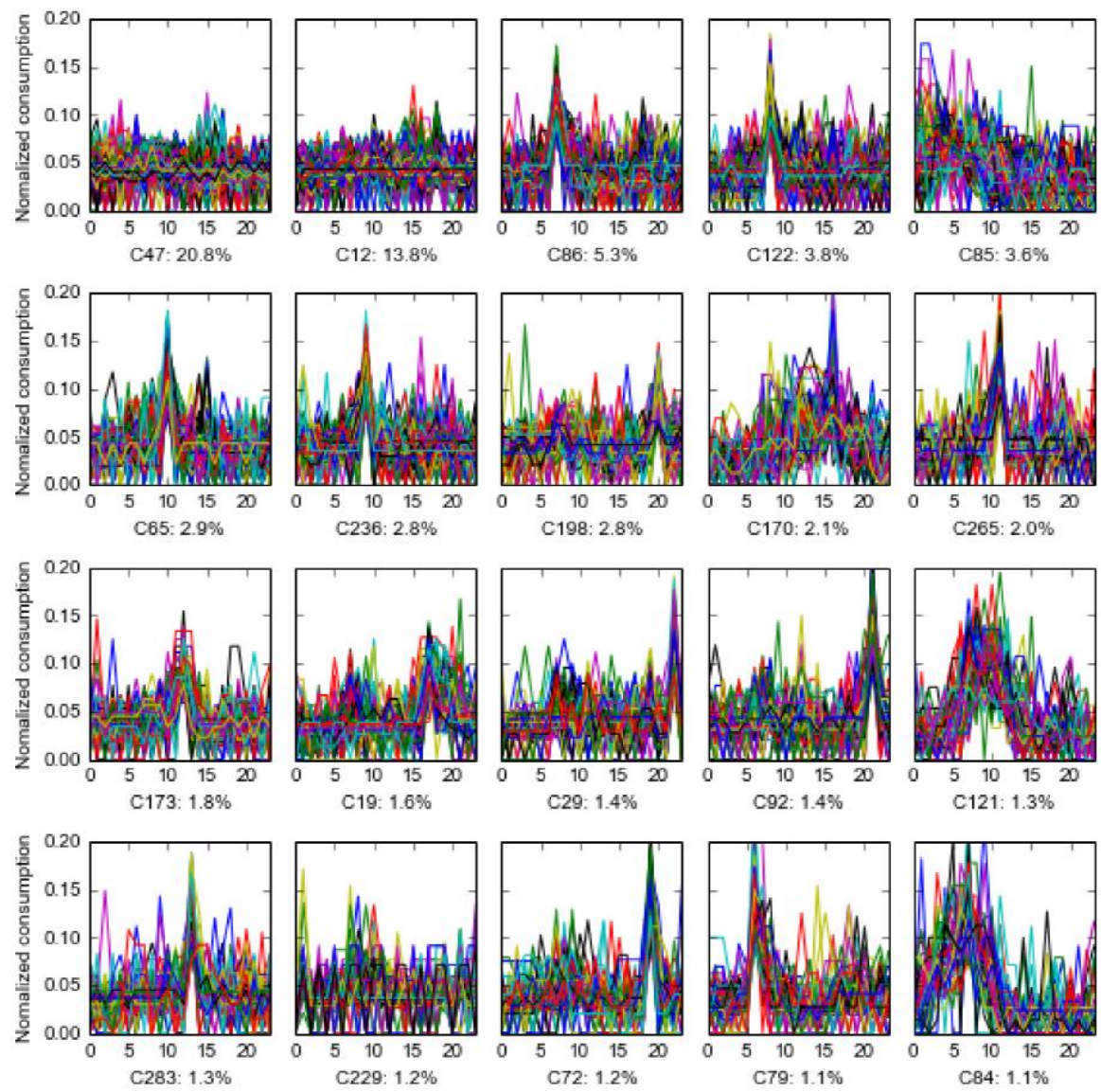
- ✓ Use of **normalized** load shape
- ✓ **Remove** outliers and very low values
- ✓ Find optimal number of **clusters**
- ✓ Apply **two-stage** clustering
- ✓ First implement adaptive K-means clustering → to find representative load shapes
- ✓ Then apply hierarchical clustering → to merge clusters whose centers are very close

Results

Top 20 clusters



Results



Conclusions

- It can be observed that households with similar load shapes are grouped at the same clusters.
- 20% of the load profiles have very small peaks, so when they are coupled, they end up in a rather smooth curve.
- One load peak during the morning time (10am) is mostly dominant.

Future work

- Correlate load patterns with occupancy information, such as schedules, move-in / move-out information etc.
- Predict eventually occupancy behavior
- Correlate with building features (envelope, construction age etc.)
- Clustering validity assessment

Thank you!

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