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# Improved Model for District Heat Consumption

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## A combined regression/clustering approach for modeling:

- The effect of outer temperature on heating power consumption.
- Dependence of the consumption on weekday and time.

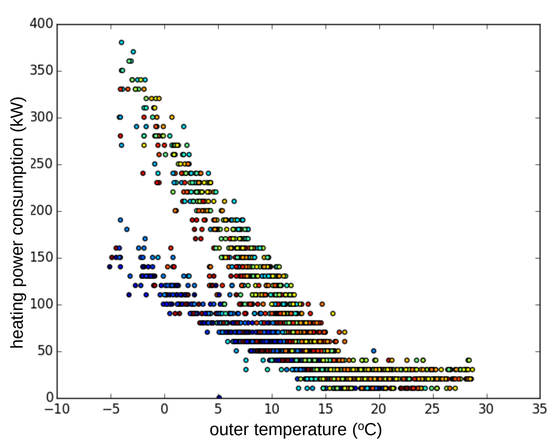
**The model:**

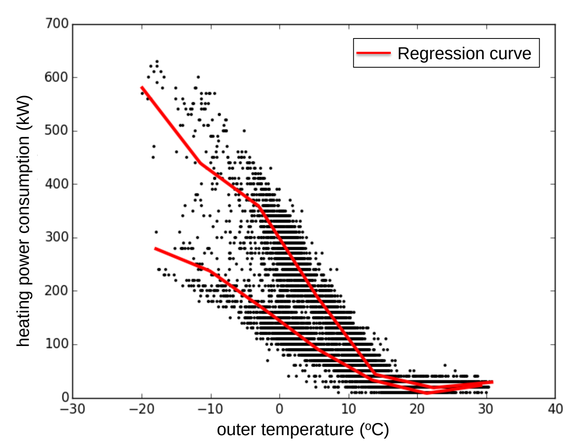
$$P \sim T + S + \varepsilon$$

P = heating power consumption
T = outer temperature
S = social model
E = residuals

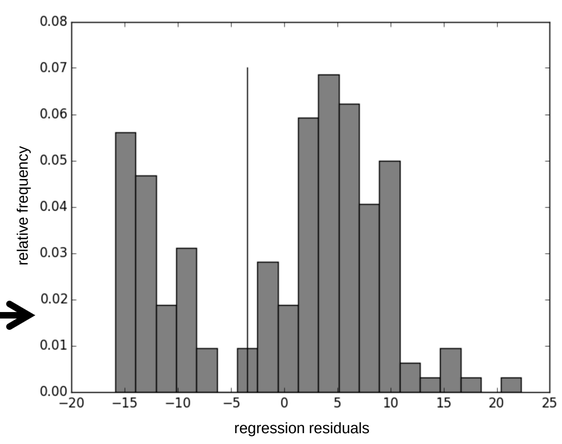
### Multiple regression modeling for different consumption profiles (e.g. day/night)

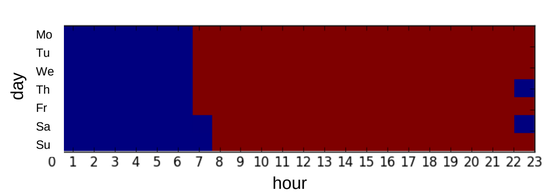
- Outer temperature is used as the predictor for piecewise regression (with 7 knot points).
- Usually there are different consumption profiles during day and night.
- A single regression model is fitted first, and the Hartigan dip test is done for the residuals.
- If the residuals have a two-peak distribution, the regression modeling is done separately for the two clusters. Splitting of the data is done by using the Otsu method.



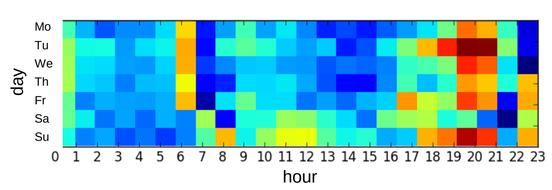




**blue=night, other colors=day**




**Blue=nightly, red=daily profile**




### The remaining variation (i.e. residuals) is modeled on a weekly/daily basis (social model)

- Average residual value is computed for each weekday/hour.
- The modeling is done separately for the clusters found above.
- Heating power consumption is strongly concentrated to certain weekdays/hours.

**Factors contributing to heating power consumption**