GBEx – towards Graph-Based Explanations

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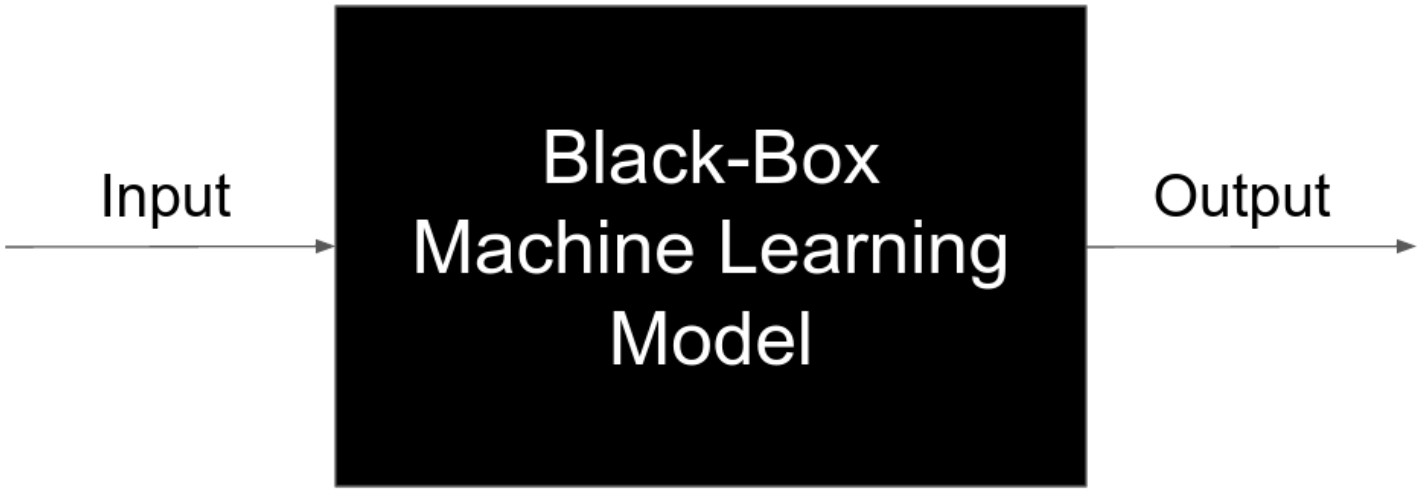
Outline

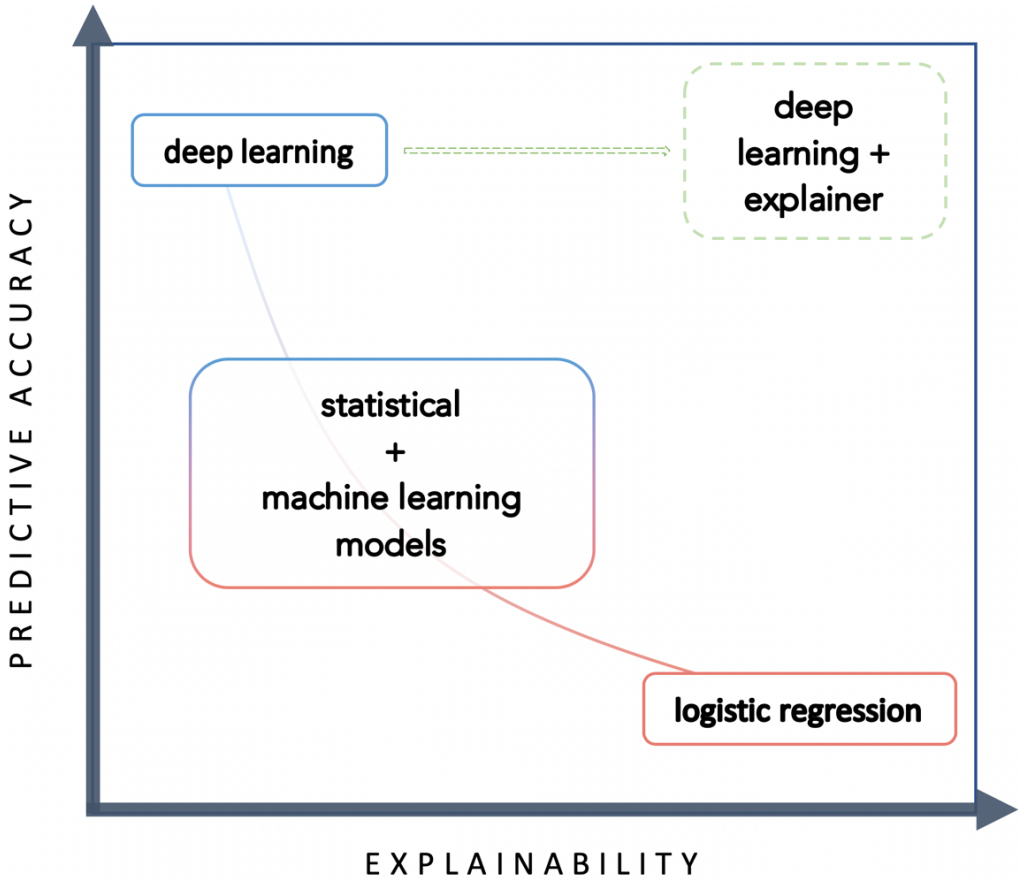
Black-box models



Why do we need explanations?

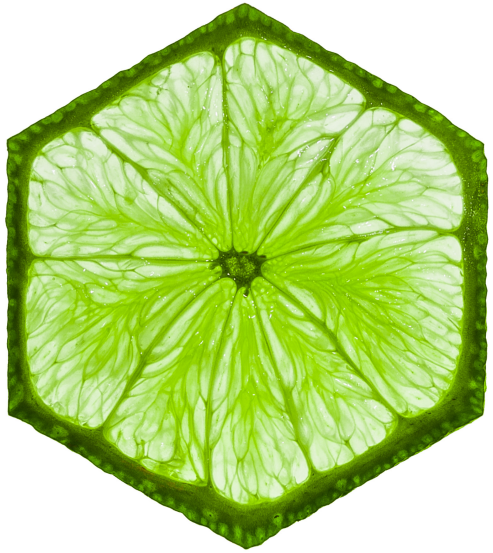
Source: *"Why Should I Trust You?": Explaining the Predictions of Any Classifier.*

Trade-off between explainability and accuracy



Source: *Characterising risk of in-hospital mortality following cardiac arrest using machine learning: A retrospective international registry study.*

State-of-the-art methods



Implementation and experiments

Main equation

$$\hat{y} = W^1\mu^1 + W^2\mu^2 + \beta \tag{1}$$

where:

- $\hat{y}$ – the vector to approximate or explain.
- W^1 – the input matrix of arguments.
- μ^1 – the vector of nodes importance.
- W^2 – the input matrix of connections.
- μ^2 – the vector of edge importance
- β – the base value.

Solving the equation

- Splitting equation in two parts
- Using heuristic methods
- Combine it into one big equation to solve

$$W^0 = [W^1 \;\; W^2] \tag{2}$$

$$\mu^0 = \begin{bmatrix} \mu^1 \\ \mu^2 \end{bmatrix} \tag{3}$$

The Equation 1 could be transformed to the following form:

$$\hat{y} = W^0 \mu^0 + \beta \tag{4}$$

Preparing data and presenting results

Preparing data

- GBEx can handle only categorized data
- To approach real numbers as input we performed clustering

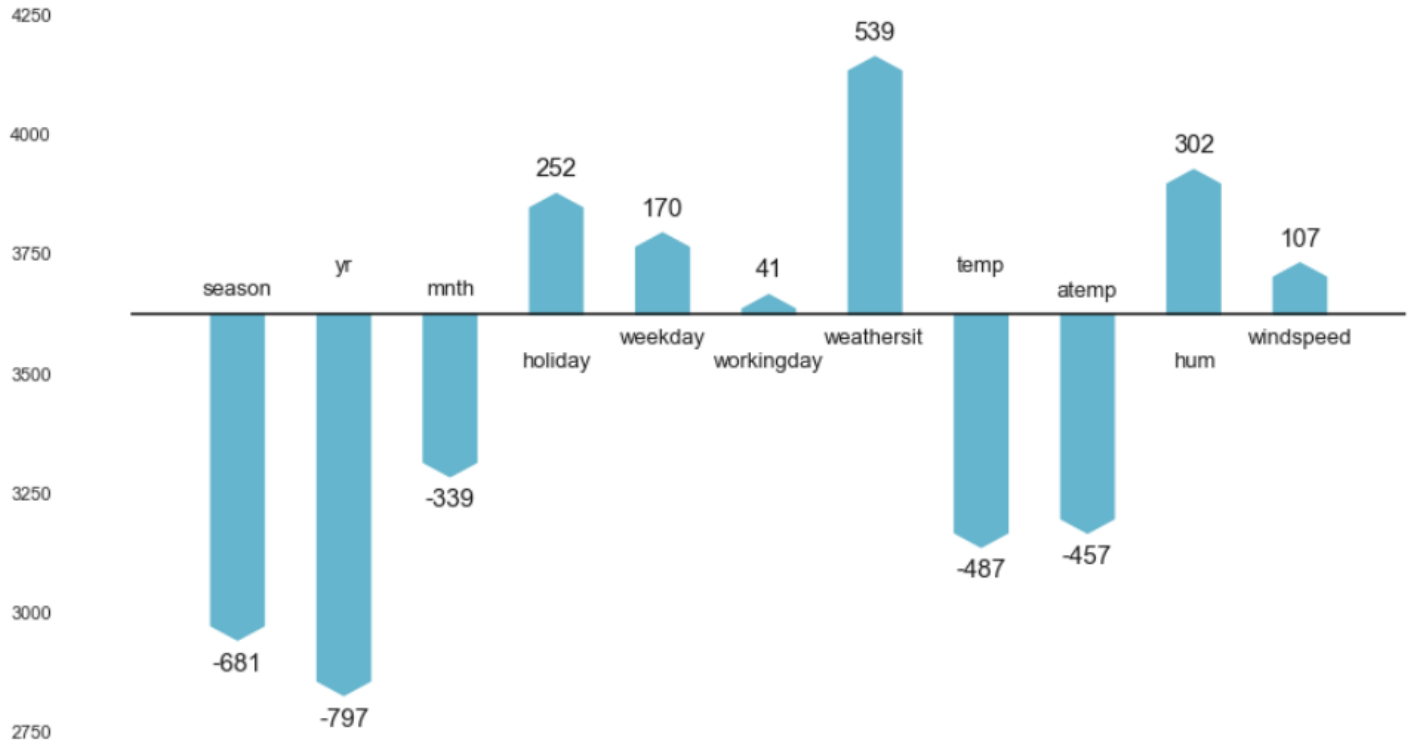
Presenting results

- Single case - bar-chart, heatmap
- Single case - graph
- General explanation - pie-chart, heatmap
- General explanation - graph

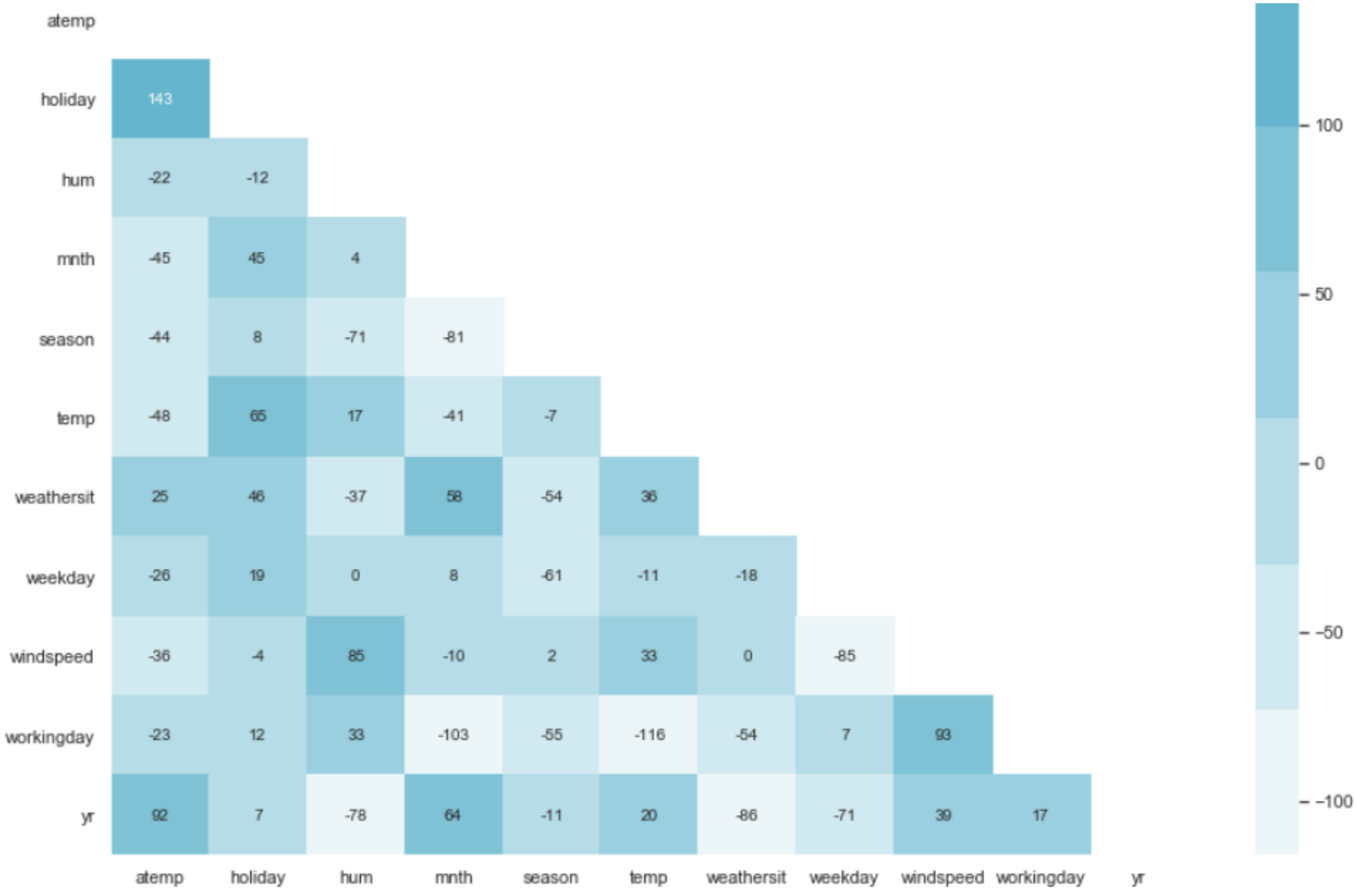
Values achieved in experiment

- Date = 24.12.2011
- Ground truth = 1011.
- MLP Regressor = 2026.
- Base value = 3624.
- GBEx = 1939.
- GBEx (without interactions) = 2274.

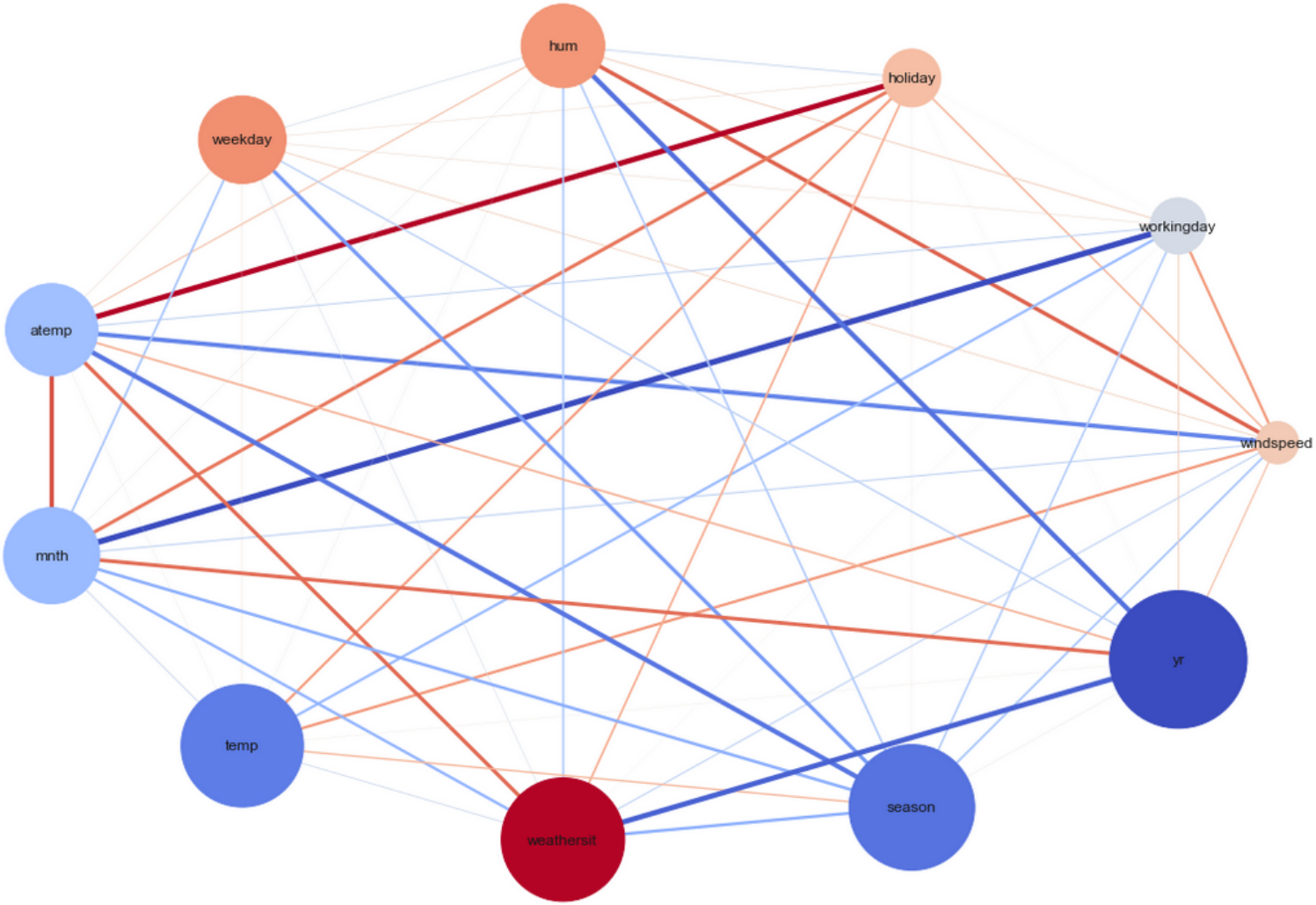
Single case explanation - bar chart



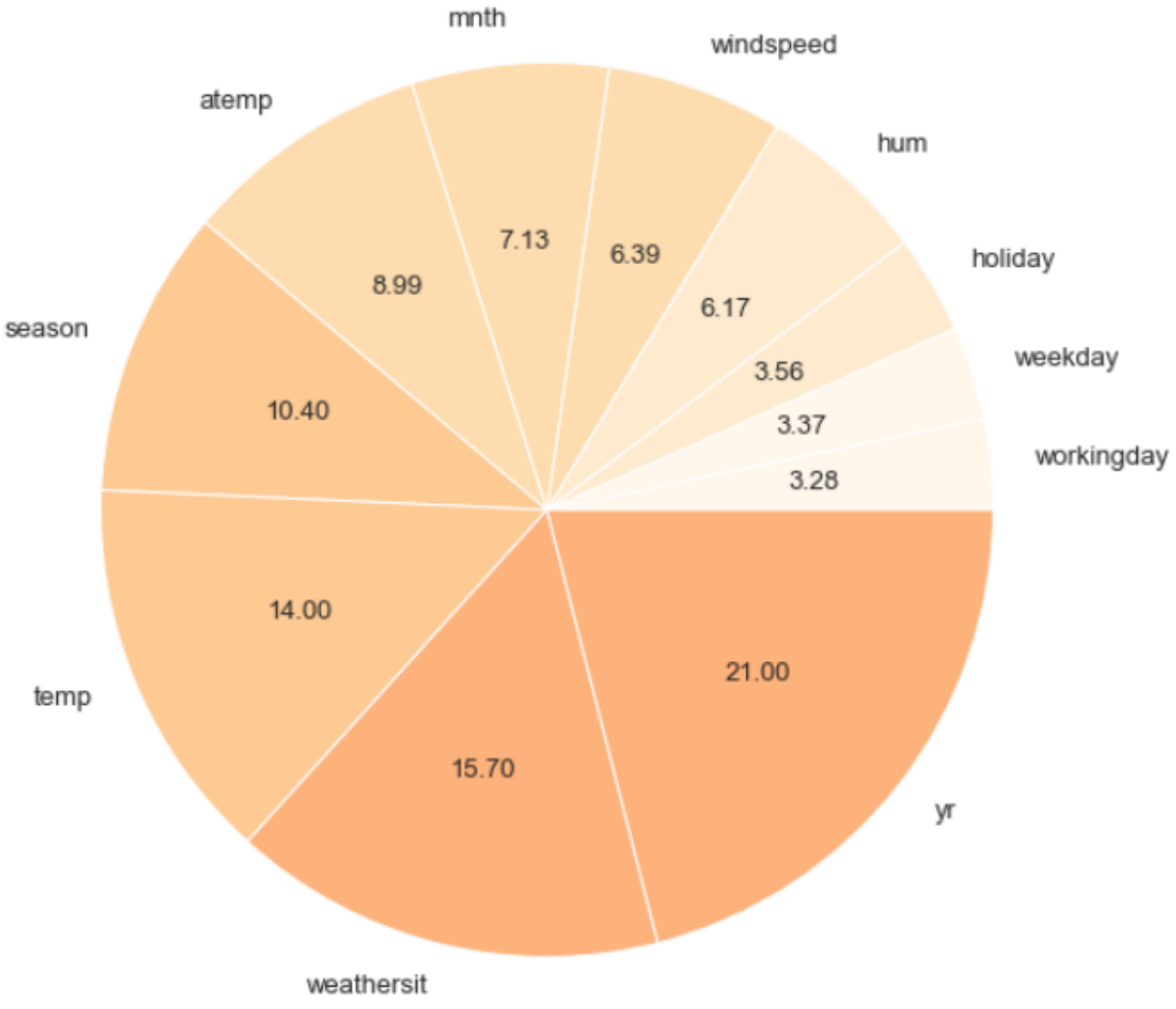
Single case explanation - heatmap



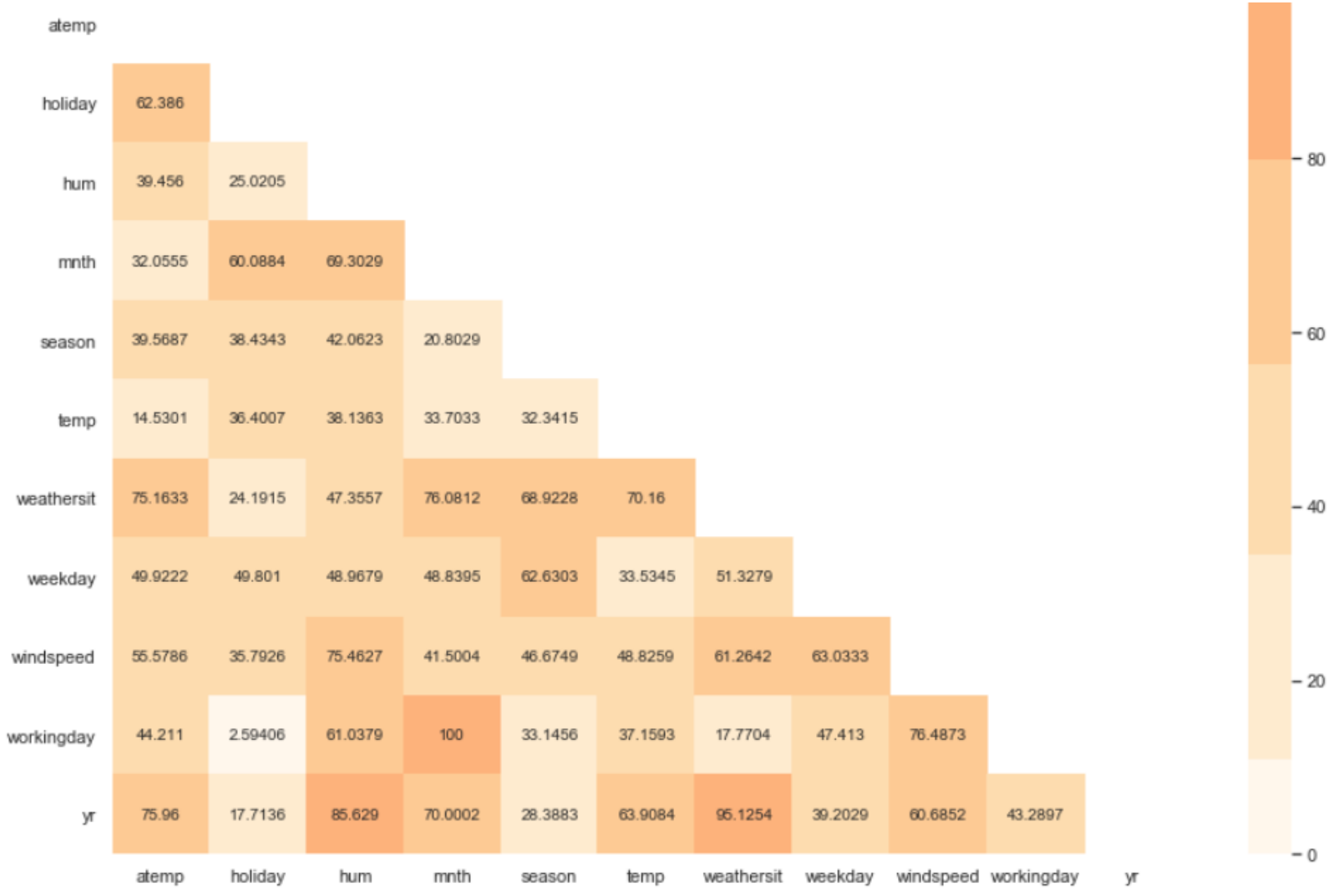
Single case explanation - graph



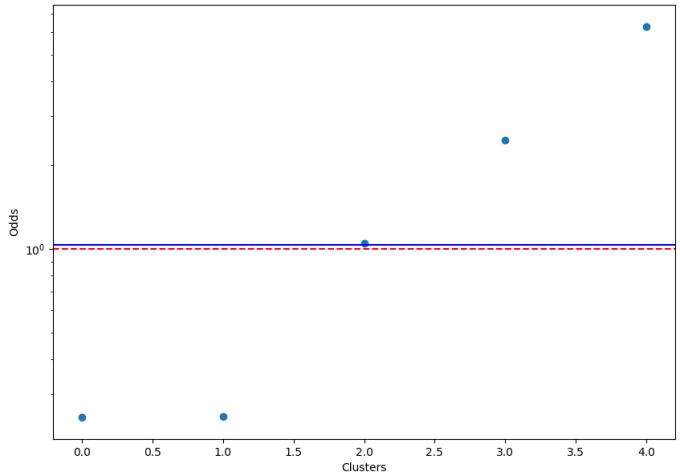
General explanation - pie chart



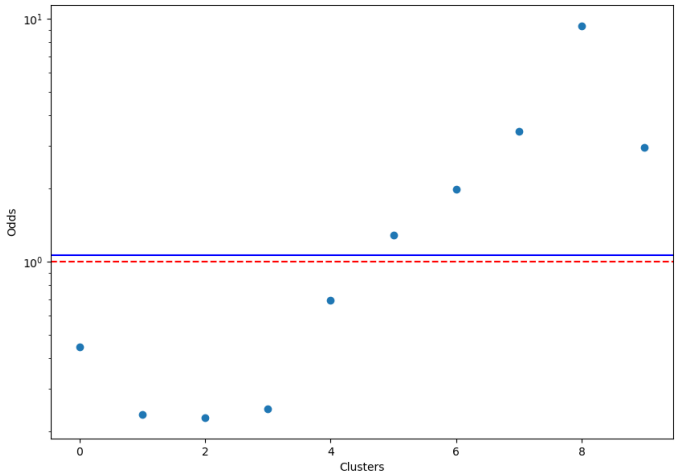
General explanation - heatmap



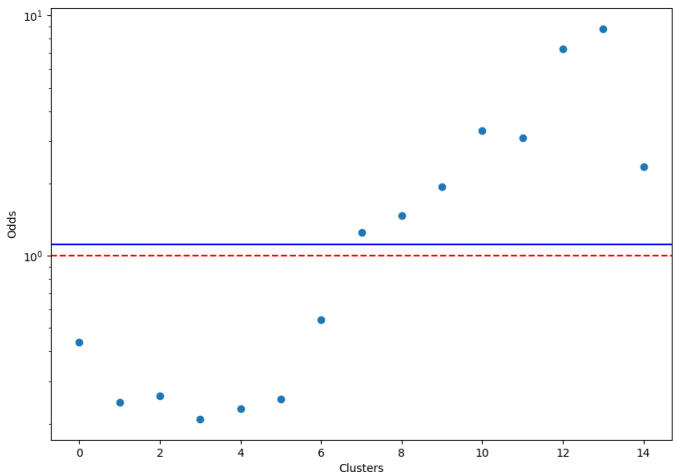
Feature analysis



(a) 5 clusters.



(b) 10 clusters.



(c) 15 clusters.

Conclusions and Future Work

Future Work

- Work on scalability and efficiency of the algorithm
- Verify explainability on some real life example with users
- Research some methods to obtain optimal number of clusters

The End

Thank you for your attention!
Any questions?

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