Algorithmic attribution modelling

Using game theory to improve the measurability of omni-channel marketing

Ola Ottosson
Sebastian Ånerud

01 Attribution modelling intro

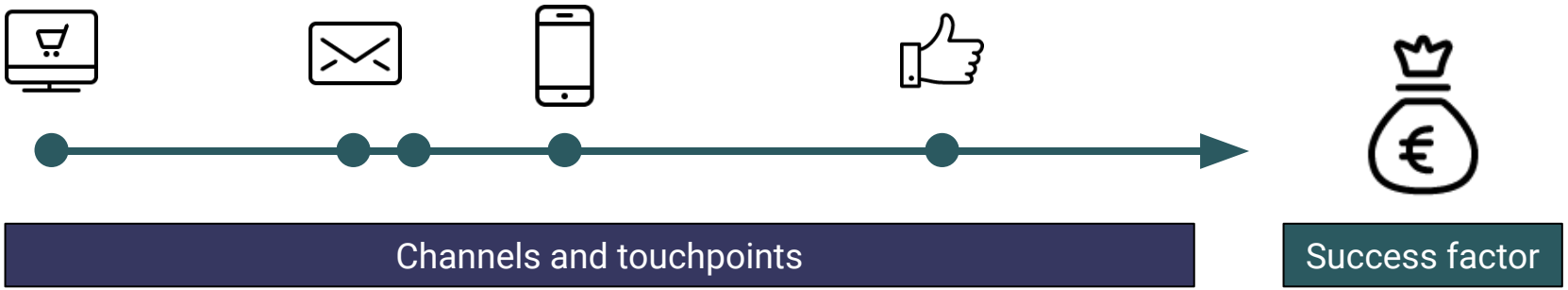
02 Standard approaches

03 Game theory: Shapley values

04 Modelling approach

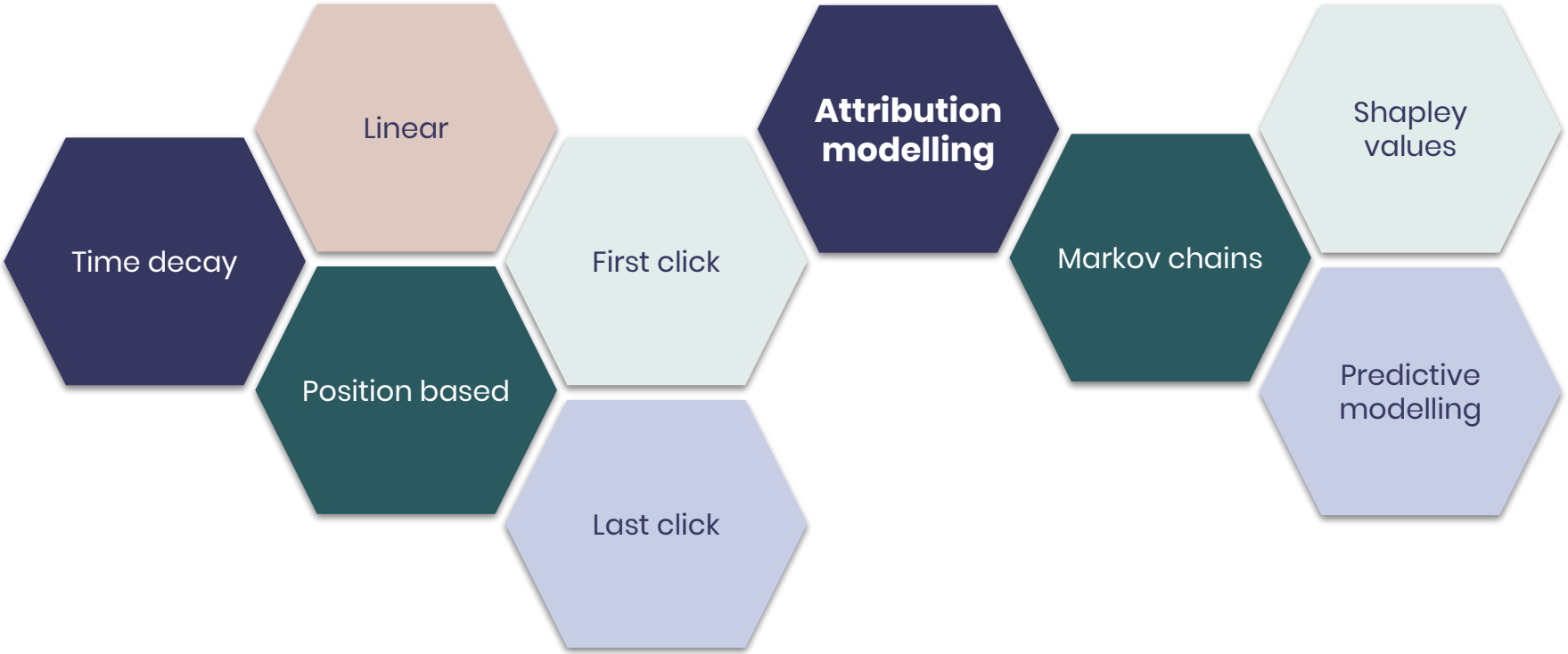
05 Questions

What is attribution modelling?



An attribution model measures the impact of different touchpoints on the success factor

The attribution modelling landscape



What are Shapley values?

To each cooperative game it assigns a unique distribution (among the players) of a total surplus generated by the coalition of all players.

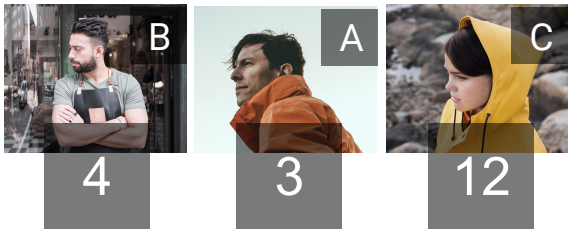
Or in plain text...

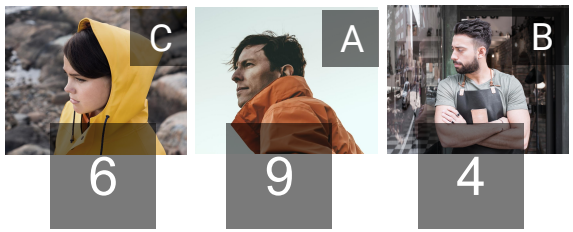
Give fair credit to each player.

What are Shapley values?

All possible combination of players

Marginal value with consideration to entry order





(7+7+10+3+9+10) / 6 = ***7.67***

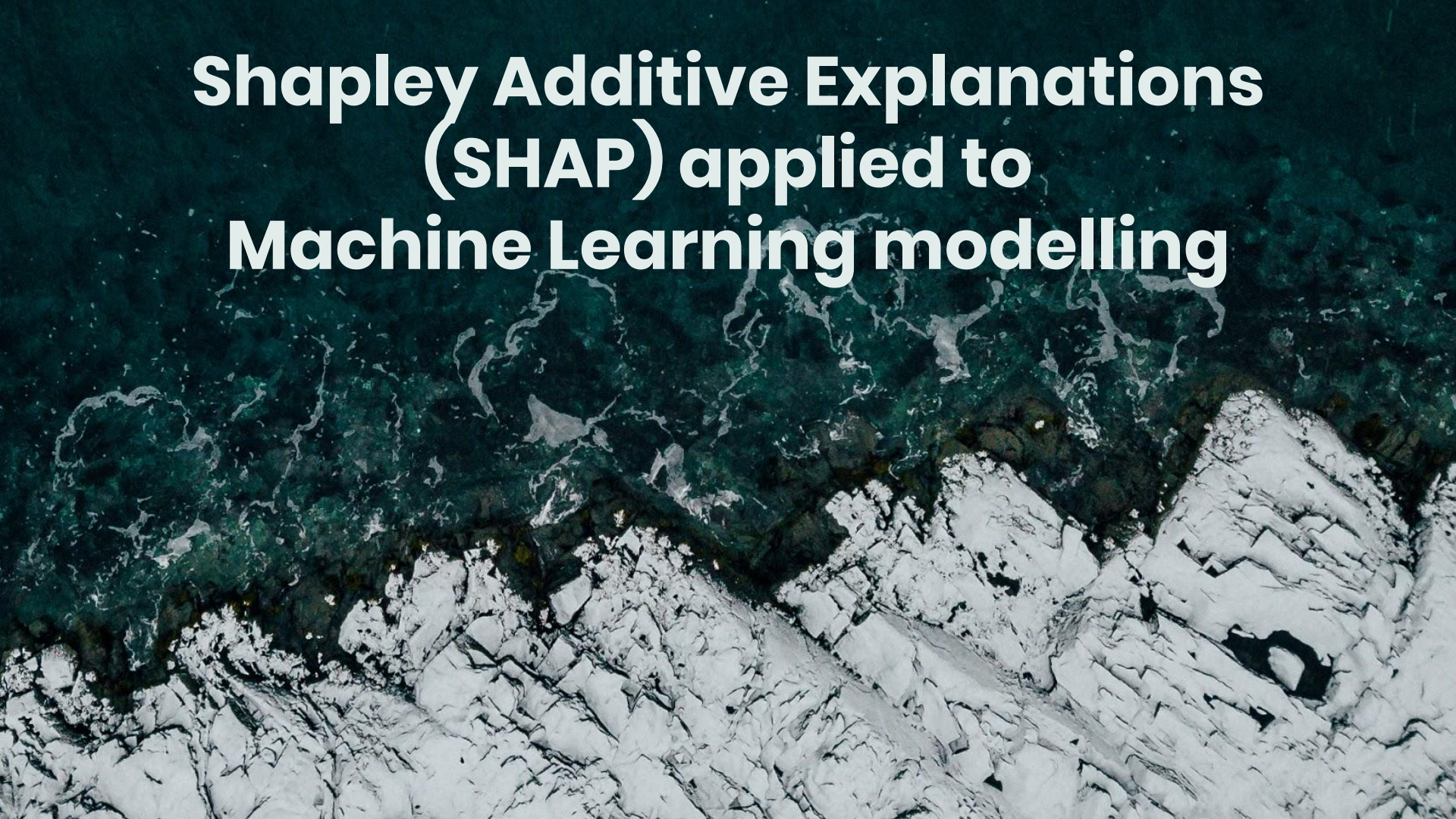
*(7+7+10+3+9+10) / 6 = **7.67***

3,17

8,17

19

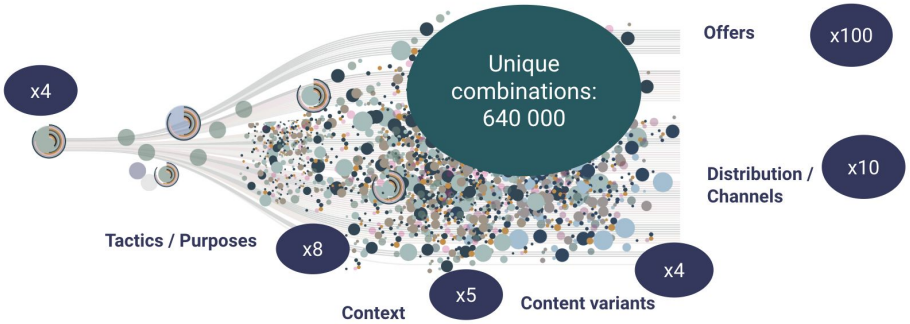
Shapley Additive Explanations (SHAP) applied to Machine Learning modelling



Why SHAP on ML models?

Complex attribution problem

- The number of channels are large
- You also want to model the order of the touchpoints
- You want to take continuous variables into account
  →
- Computationally heavy, exact shapley values cannot be computed and needs to be approximated in some way



Why SHAP on ML models?

Marketing mix model

- You already have, or are building, a ML model for simulating effects of marketing investments (marketing mix model)
- You want to understand the importance and effect of features for each individual observation
- You want a more fair feature attribution than standard implementations
- →
- SHAP package in python: **github.com/slundberg/shap**

Marketing mix modelling

Problem

- Understand how redirecting spend in different channels will affect conversion rates

Solution

- Given historical leads, their point of contacts and if they converted or not, try to model the relationship between touchpoints and conversion.

Standard feature importance approach

Features

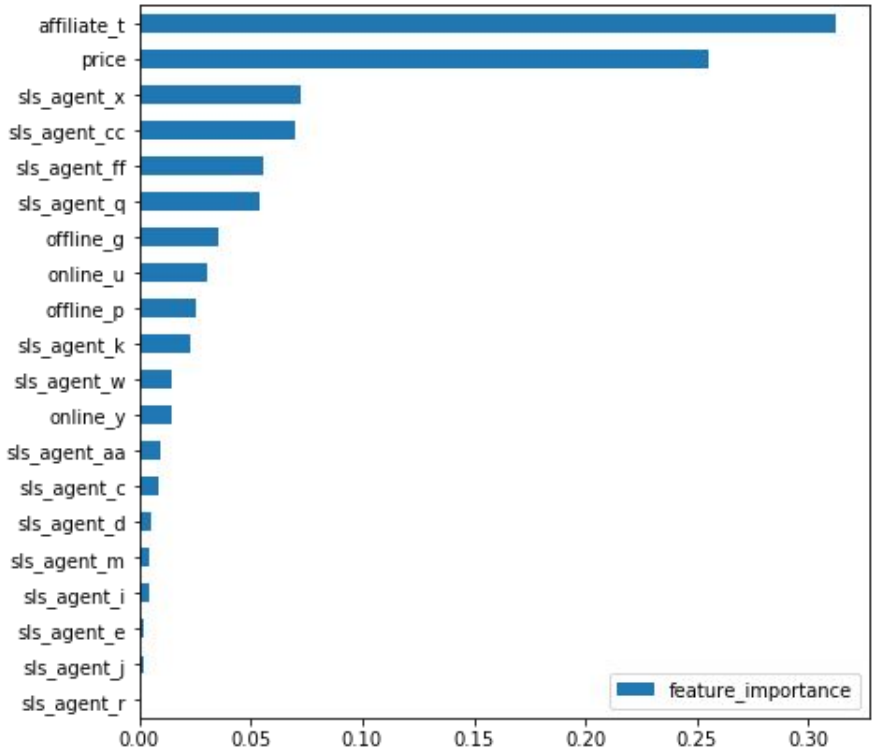
- Offered price
- Contact with an affiliate
- Contact with the different online/offline channels
- Contact with the different sales agents

Target label

- Converted or not

Model

- XGBoost (Gradient boosting)
- 100 Trees
- 0.1 learning rate



SHAP approach

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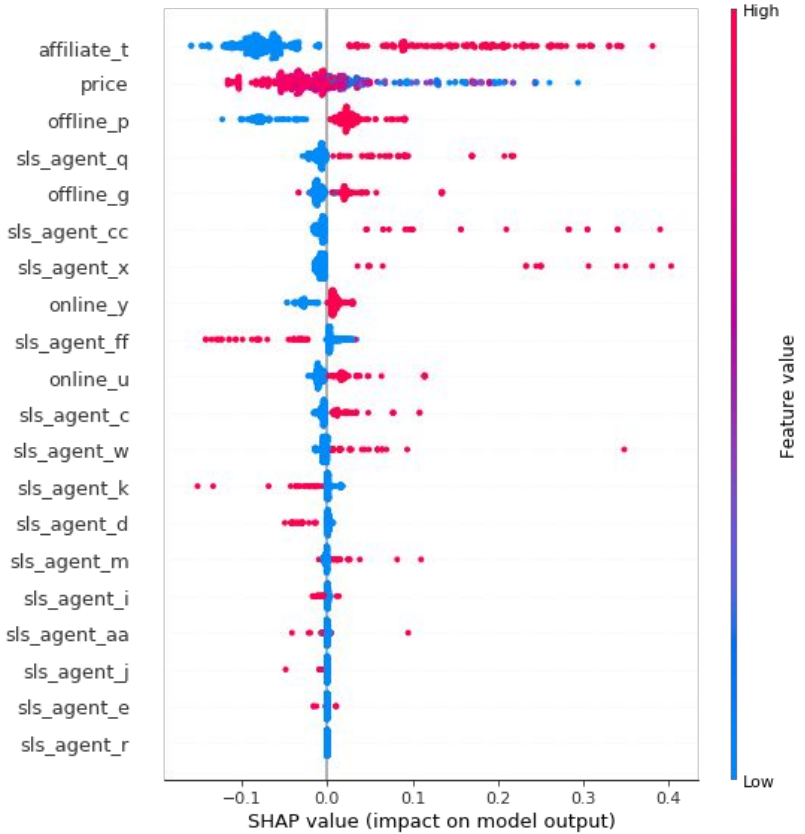

SHAP approach (“backwards compatible”)

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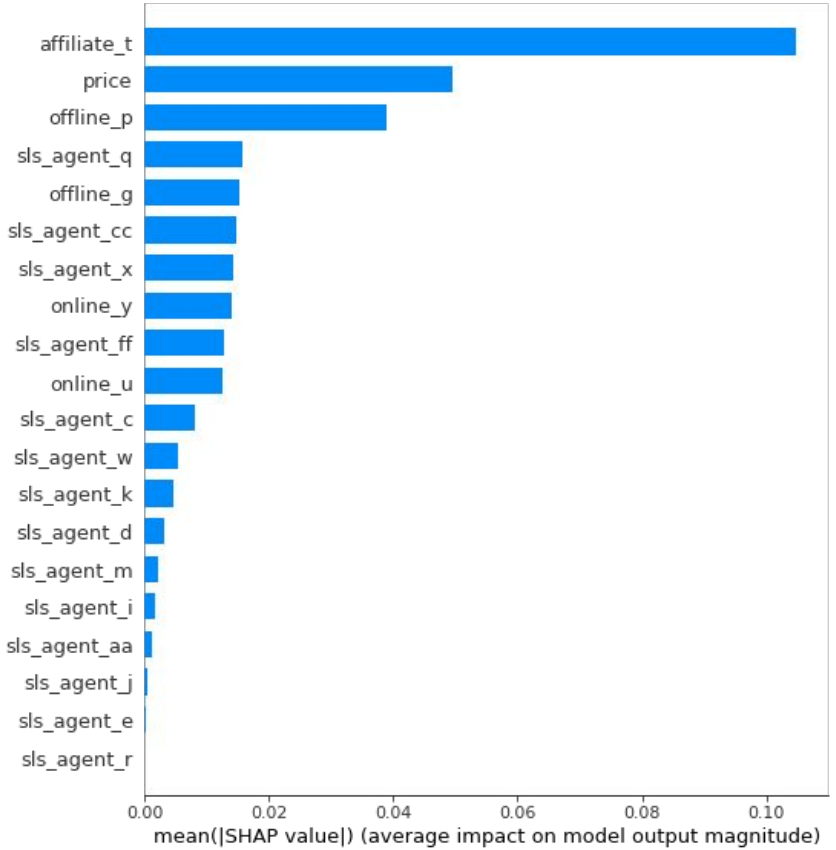


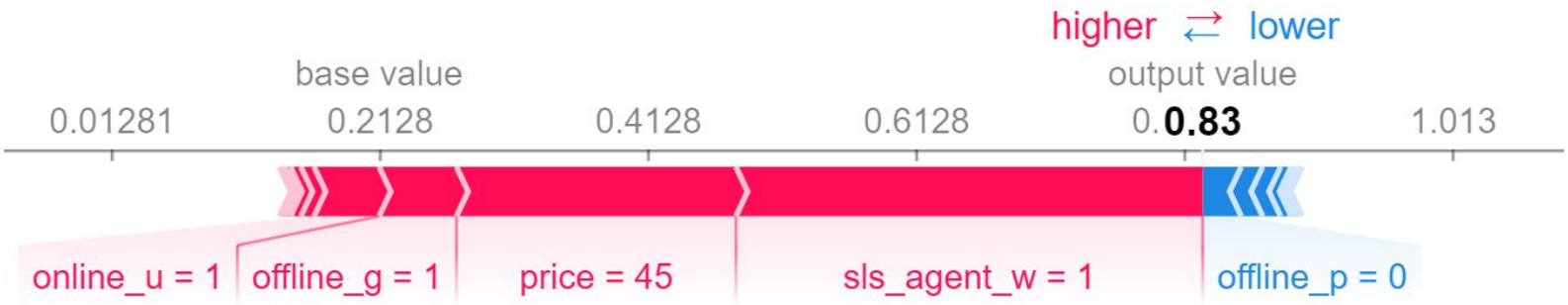
SHAP on an observation level

Feature values

- online_u = 1
- offline_g = 1
- price = 45
- sls_agent_w = 1
- ….

SHAP

- For each lead, how much did each feature moved the prediction up or down?



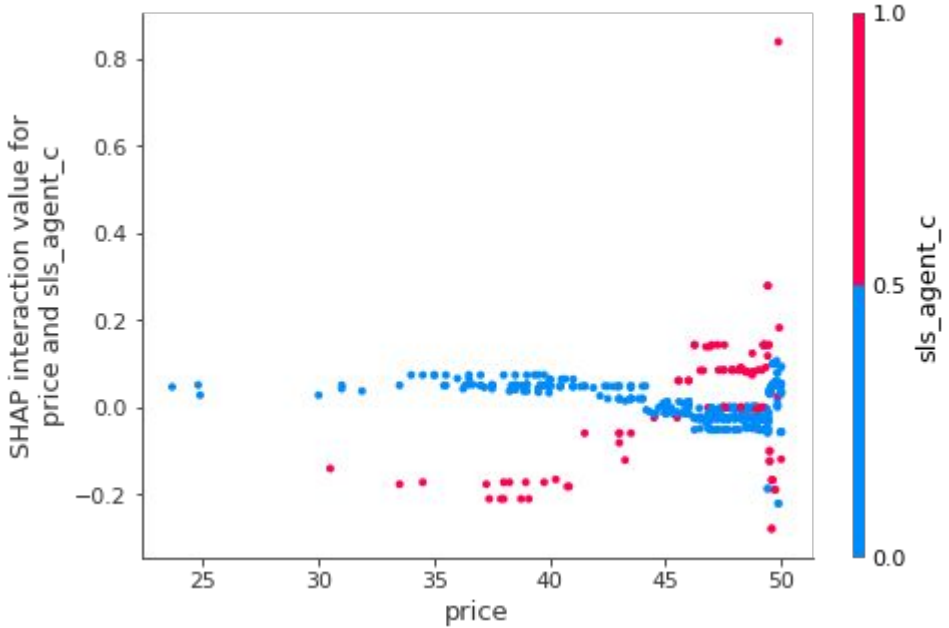
SHAP interactions

Feature interactions

- price
- sls_agent_c

Interpretation

- Sales agent c is not as good at selling at a low price as on higher prices



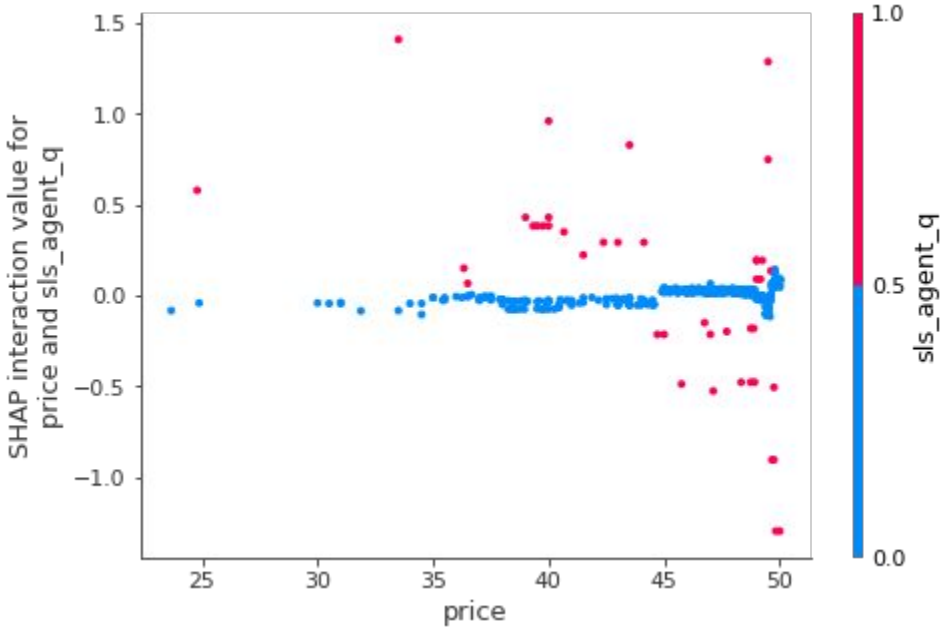
SHAP interactions

Feature interactions

- price
- sls_agent_q

Interpretation

- Sales agent q is not as good at selling at a high price as on lower prices



Ola Ottosson ola.ottosson@avaus.se
Sebastian Ånerud sebastian.anerud@avaus.se