

Case Studies 2022L

Break-Down method and Shapley Values

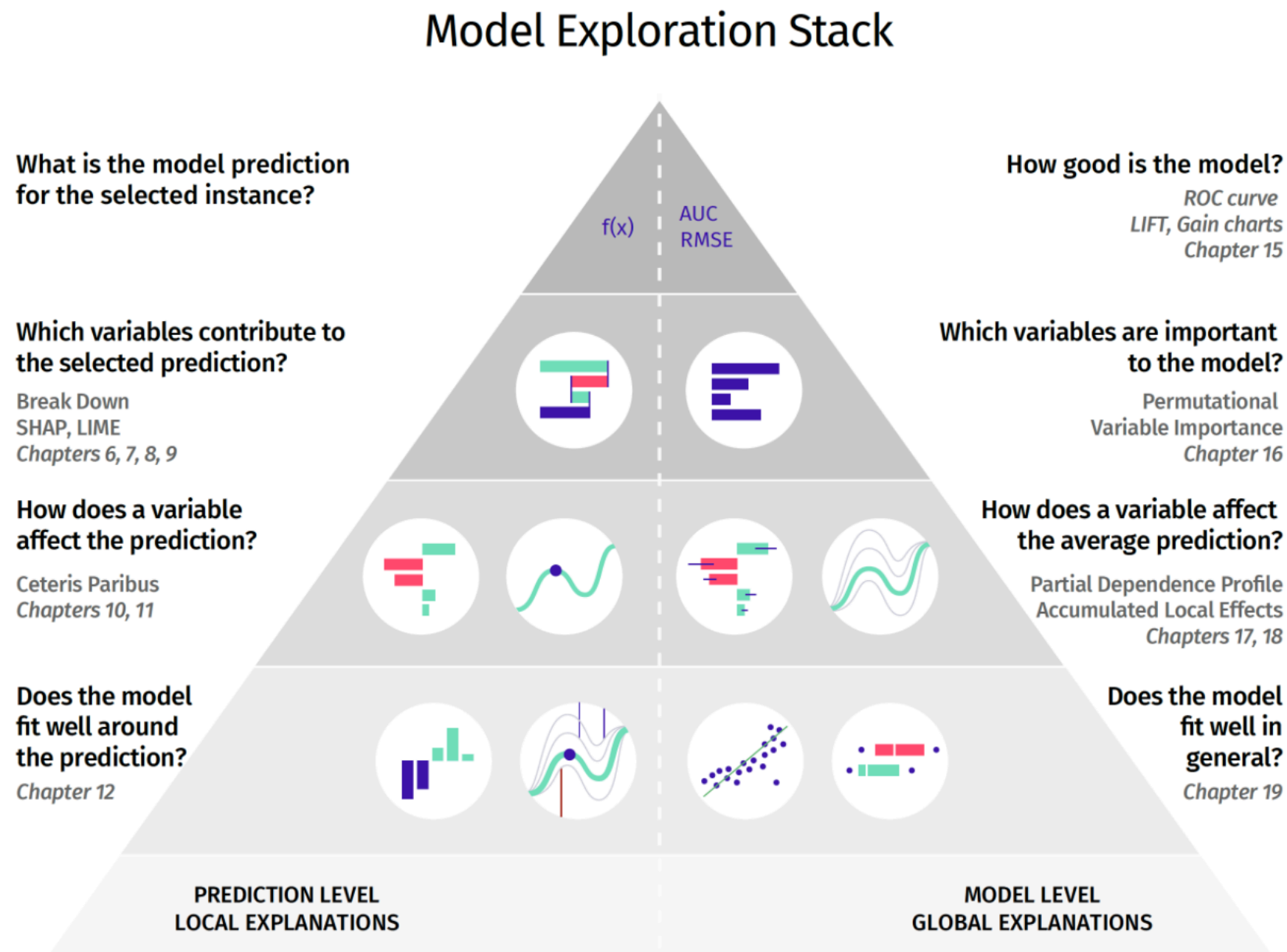
Mar 10, 2022

Starter

Case: Predicting the risk of heart attack based on a person's age, sex, and smoking habits.

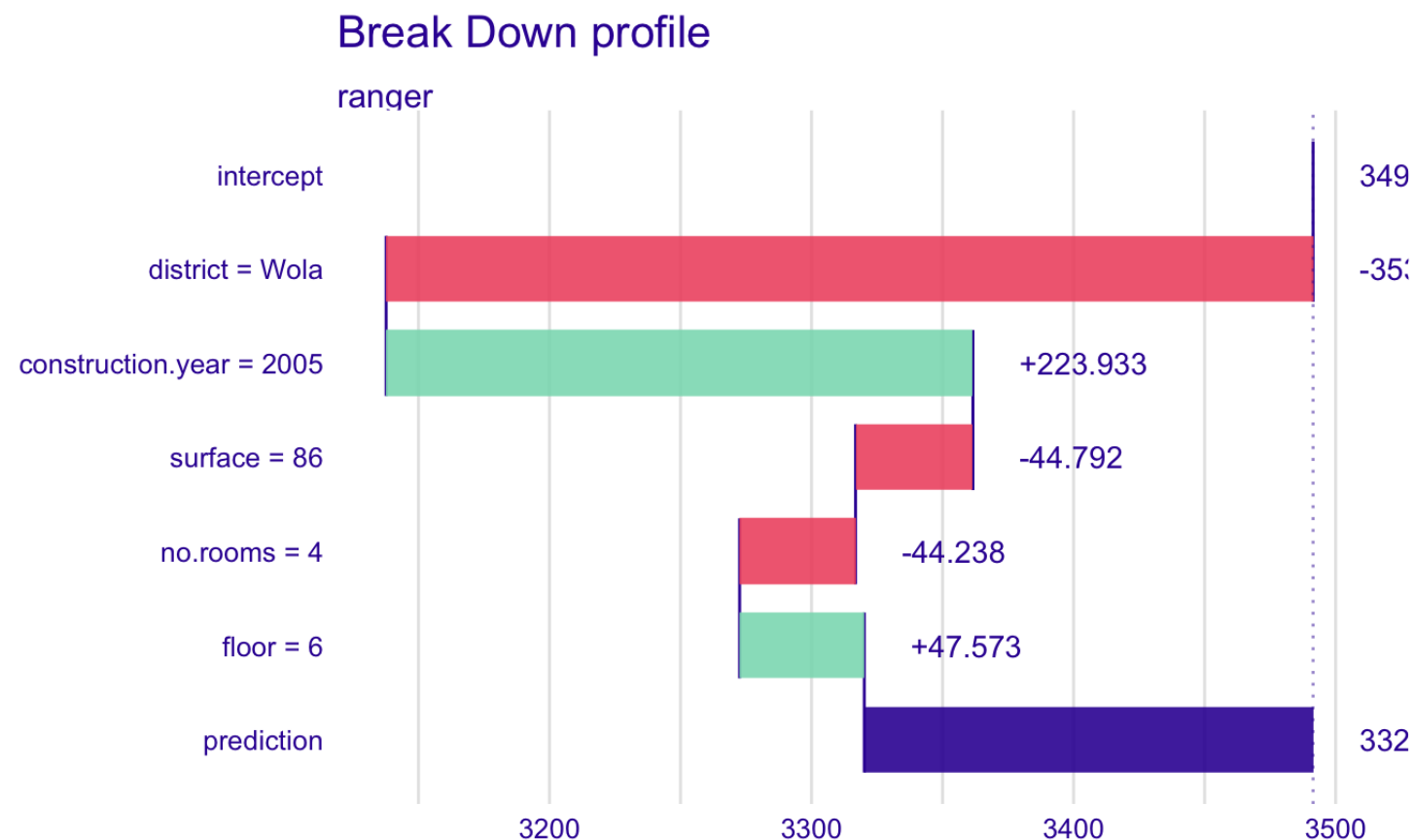
- How much do the different variables contribute to the score?
- How would the model's predictions change if values of some of the explanatory variables changed?
- What would be the predicted risk of heart attack if the patient cut the number of cigarettes smoked per day by half?
- Discovering that the model is providing incorrect predictions, and finding the reason.
- A patient with a very low risk-score experienced a heart attack. What has driven the wrong prediction?

Model exploration methods



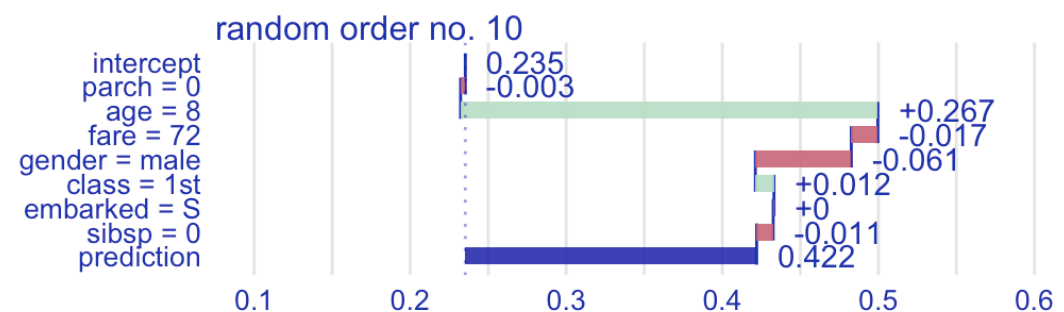
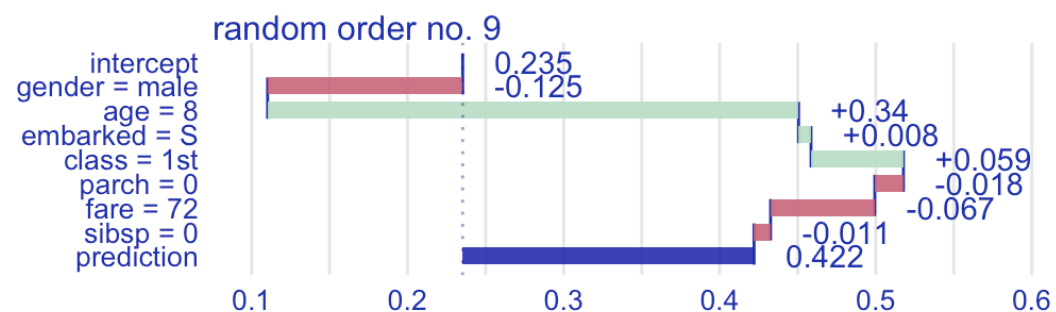
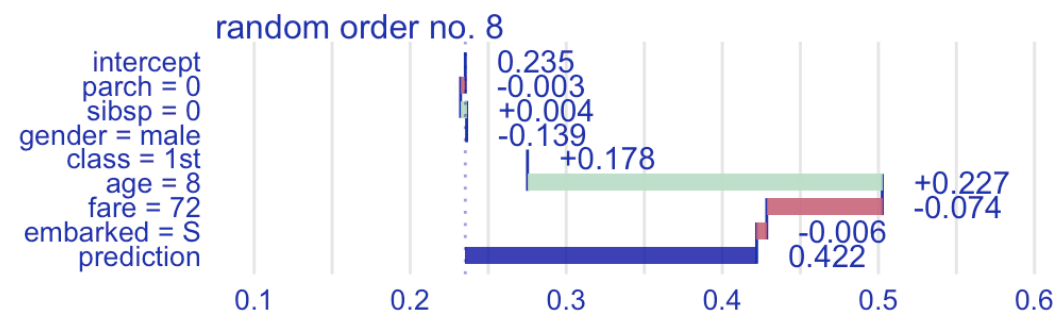
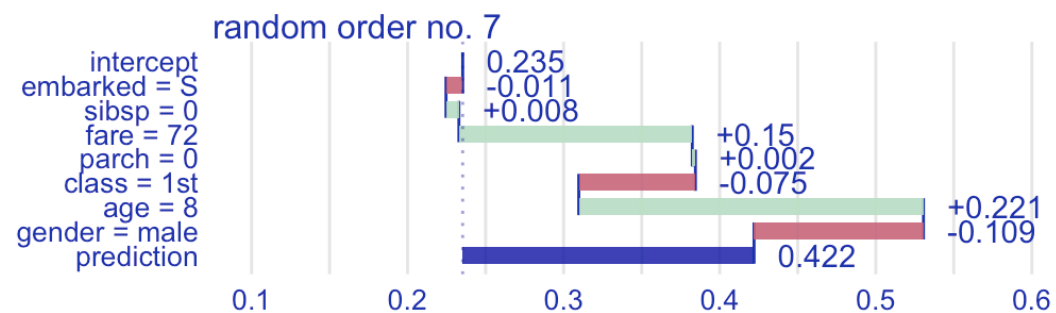
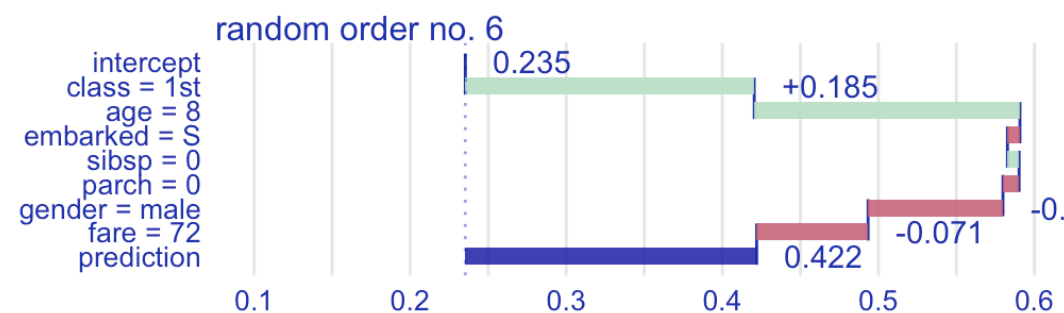
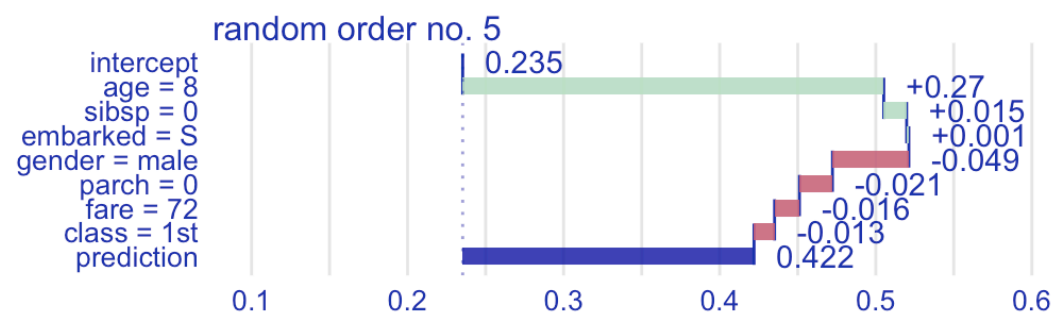
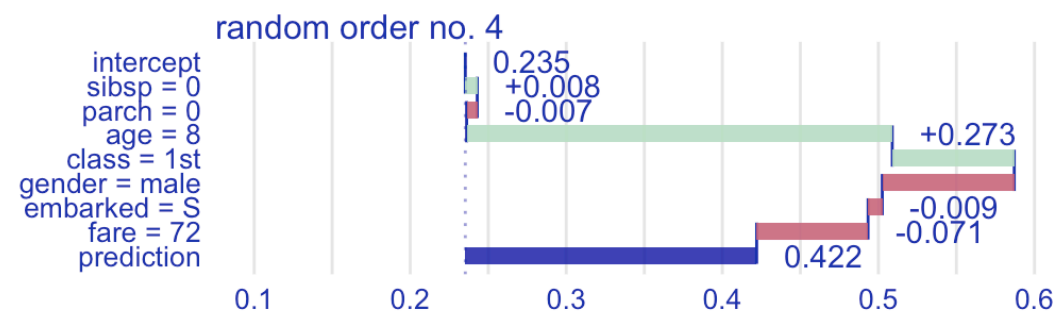
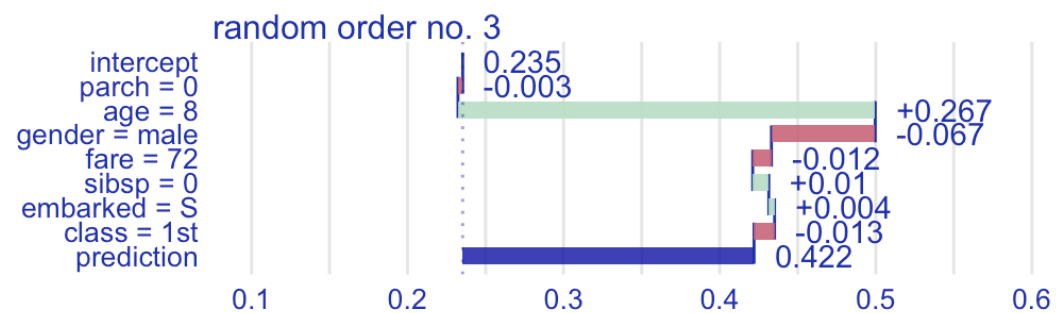
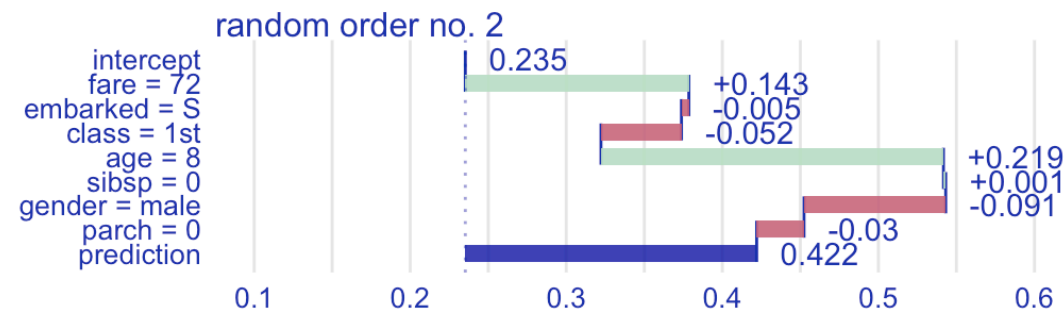
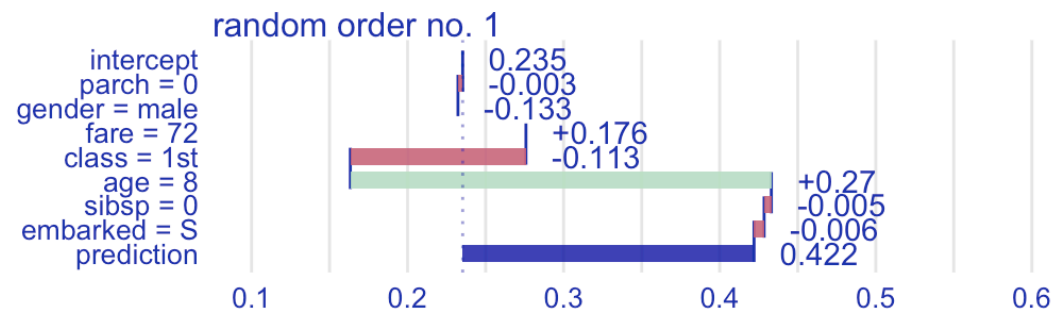
Break-down plots

The break-down (BD) plots are used to capture the contribution of an explanatory variable to the model's prediction by computing the shift in the expected value of the response, while fixing the values of other variables.



Pros and Cons

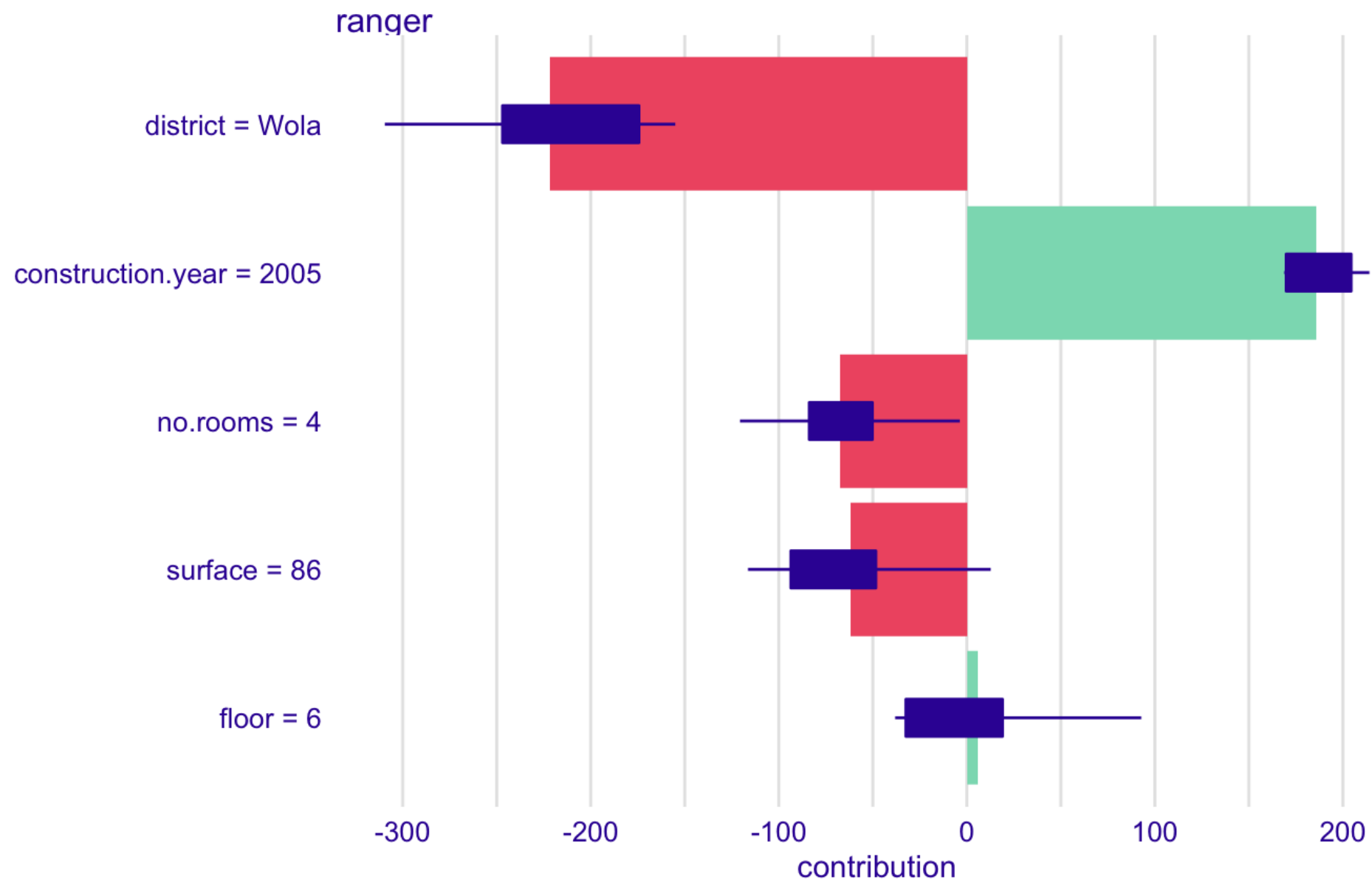
- + Model-agnostic
- + Easy-to-understand
- + Visualize
- Misleading for models including interactions*
- Complex for many explanatory variables



Shapley values

- A coalition of players cooperates and obtains a certain overall gain from the cooperation.
- Players are not identical, and different players may have different importance.
- Cooperation is beneficial, because it may bring more benefit than individual actions.
- The problem to solve is how to distribute the generated surplus among the players. Shapley values offer one possible fair answer to this question (Shapley 1953).

Shapley values



Pros and Cons

- + Insensitive to influence of the ordering of the variables.
- + Solving the issues faced on using the BD plot.
- If the model is not additive, then the Shapley values may be misleading.
- The calculation of Shapley values is time-consuming for large models.

Please feel free to send e-mail about your questions!



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