

MBAN 6500X Assignment 2 – Model interpretation

Overview

For this assignment, you will fit two models (a linear model and the best possible model) and then interpret them.

Submission

The task, learner, model performance and explanations should be presented in a written report. This assignment is due at 7:00 pm on March 5, 2024.

Tasks

Train two models

Use Kaggle's House Prices - Advance Regression Techniques data set. Train two models, a linear model and the (approximately) best possible model using any learner. To find the best model, you will need to do model selection (e.g. fit multiple models and try different hyperparameters).

Explain the models

Linear model Use the coefficients to explain the linear model.

Non-linear model Use the following three model-agnostic methods to explain your model. 1. Individual conditional expectation (ICE) plot 2. Feature importance; Either *permutation feature importance* (a model agnostic method) *decision tree or feature importance* (a model specific method). 3. Shapley values

Deliverable - a report

The report should be 2-3 pages of text (figures can be added in an appendix) and have the following sections:

1. Title page with title and author
2. Introduction that motivates and explains the goal of the analysis and provides a short description of the task.
3. Methodology:
 - A data set description (2-4 sentences).
 - A plot of the pair-wise feature correlation matrix (take it into consideration when interpreting the linear model).
 - Description of the learning algorithms (2-4 sentences per algorithm).
 - Interpretation methods used (2-4 sentences per method).
4. Results:

- A comparison of the models' performances (MSE and R2 on a test set) and their interpretations.
 - Two scatter plots (for the linear model and the best model) of predictions versus ground truth. The plots should be side-by-side and with the MSE for the respective models included in the plots.
 - A table with feature rankings (most to least important features) for both models shown side-by-side.
 - ICE plots for the two most important features for both models.
 - Interactions. Are there any interacting features? (Use Shapley values to investigate.) If yes, then describe the interactions.
 - Limitations. For example, what does the method not reveal?
5. Conclusions:
- Comment on whether the methods **and models** contradict each other. When comparing the different methods, only include the **five most important features** from each.
 - If there are contradictions, explain what they are, why they arise and what method is more reliable.

Figures should be legible and have legends that allow the reader to understand what the figure shows. Label the figures with numbers (e.g. Fig 1, Fig 2, etc.) and use those labels to refer to the figure in the main text (E.g. *"In Fig 1 it is apparent that ..."*). Do **NOT** include code or screenshots of code. The report should be submitted as a PDF document.