DATA7703 Tutorial 11

2021 Semester 2

1. We discussed various approaches to make machine learning models interpretable. For each pair of approaches below, describe their differences.

(a) The built-in approach and the post hoc approach.

(b) White-box methods and black-box methods.

(c) Model specific methods and model agnostic methods.

2. Assume that the output y is related to the features x_1, x_2, x_3 as follows:

$$y = 0.1x_1 + 0.2x_2 + 3x_3.$$

We can conclude that x_3 is the most important feature. True or false? Explain your answer.

3. Consider calculating the permutation importance of a variable x using a given dataset D with 3 examples. To do this, we need to construct multiple permuted datasets of the original dataset. In the table below, the first column shows the values of the feature x in D and in four other datasets with 3 examples too. Which of the four datasets cannot be a permuted dataset?

D	D_1	D_2	D_3	D_4
1	1	2	3	2
2	3	1	1	3
3	1	3	2	1

4. What is a Gaussian process? Give an example of a Gaussian process.

5. Let Y_1 and Y_2 be two random variables in a Gaussian process. It is known that $\begin{pmatrix} Y_1 \\ Y_2 \end{pmatrix} \sim N\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{pmatrix}\right)$.

(a) Write down the marginal distributions of Y_1 and Y_2.

(b) What's the correlation between Y_1 and Y_2?

(c) Compare the variance of Y_1 without any observation with the variance of Y_1 given that $Y_2 = y_2$ for some constant y_2. Which is smaller?