Assignment #1

Elements of Machine Learning

Saarland University – Winter Semester 2024/25

Rabin Adhikari
7072310
raad00002@stud.uni-saarland.de

Dhimitrios Duka
7059153
dhdu00001@stud.uni-saarland.de

Problem 1 (Parametric and Non-parametric models)

A parametric model reduces the problem of estimating a function f in finding a set of parameters θ that best fit the data. When such a model is used, we go through a two-step process. First, we assume the form of the function f. This assumption can be as simple as a linear function. Then, we use the training data to train the model, thus estimating the original function f. On the other hand, a non-parametric model doesn't make any assumptions for the form of the underlying function f. With such models, we aim to find the true form of the function, not an estimation of it.

In terms of complexity, parametric models exhibit a low complexity since the problem boils down to finding a fixed number of parameters, which doesn't increase with the increase in data points. In contrast, non-parametric models exhibit a high complexity because we aim to find the true form of the underlying function f. Therefore, the complexity of this model increases with the increase in the number of data points.

In terms of flexibility, non-parametric models are more flexible than parametric models. This means that non-parametric models can estimate a more complex family of functions without any prior assumptions. In contrast, parametric methods rely on making an assumption on the form of the underlying function f, for example, a simple linear assumption, and consequently, limit the family of functions that the model can estimate.

Parametric methods assume a specific form of target data distribution, such as a simple linear relationship in the case of linear models. In contrast, non-parametric models don't make this assumption, such as k-NN regression, resulting in a more flexible model.

For both parametric and non-parametric models, training on a small dataset wouldn't result in very good generalization. However, parametric models tend to generalize better since they rely only on a few number of parameters θ. On the other hand, having a large dataset would be beneficial for both model types. Both models, if used properly, would generalize to unseen data.