Introduction to Machine Learning

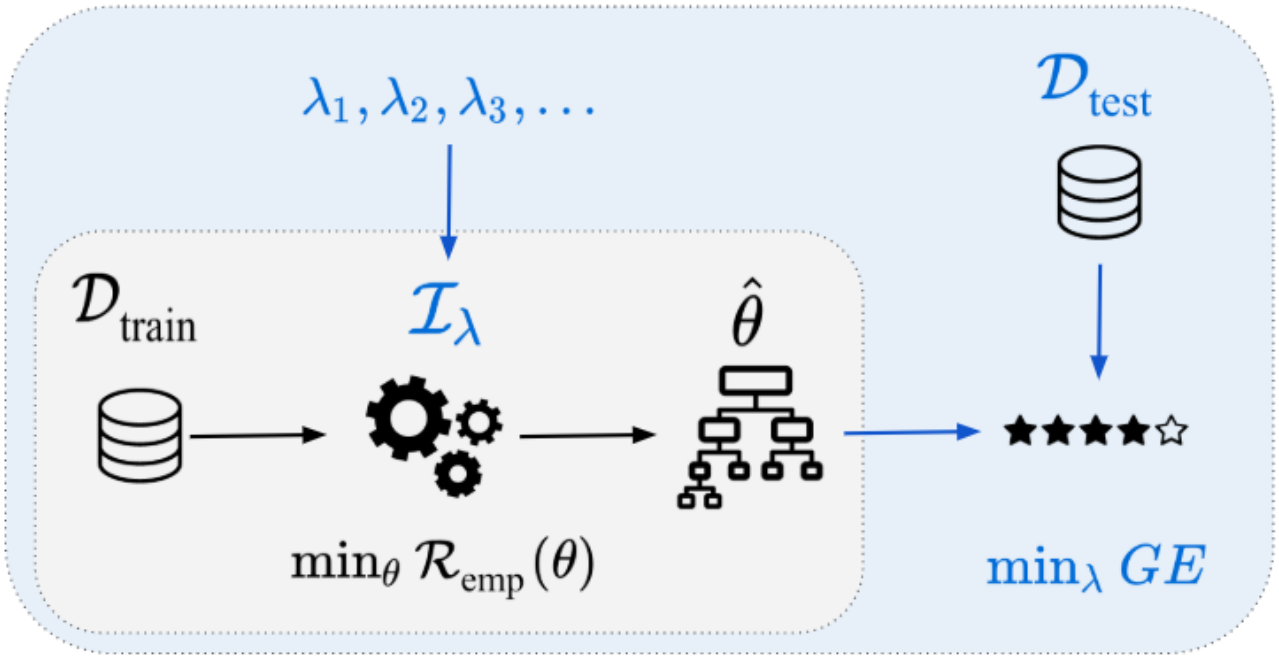
Tuning: In a Nutshell

Learning goals

- Understand the main idea behind tuning,
- why tuning matters,
- and why tuning is difficult

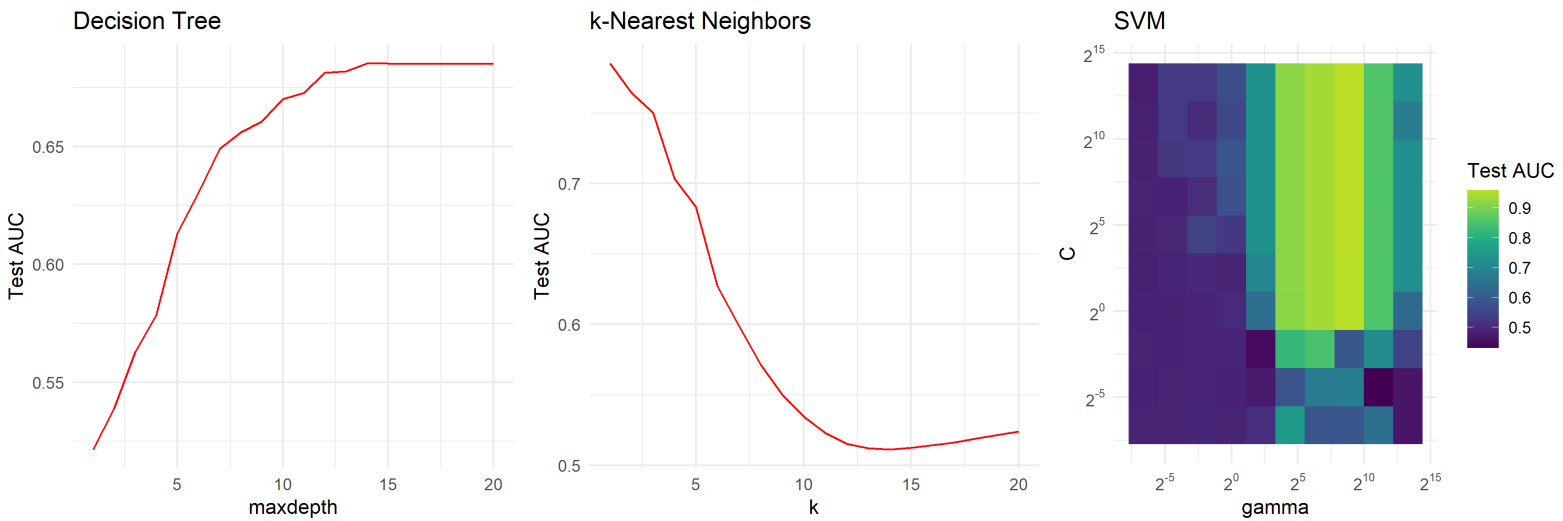
WHAT IS TUNING?

- Tuning is the process of selecting the best hyperparameters, denoted as λ, for a machine learning model
- Hyperparameters are the parameters of the learner (versus model parameters θ)
- Consider a guitar analogy: Hyperparameters are akin to the tuning pegs. Learning the best parameters $\hat{\boldsymbol{\theta}}$ - playing the guitar - is a separate process that depends on tuning!



WHY TUNING MATTERS

- Just like a guitar won't perform well when out-of-tune, properly tuning a learner can drastically improve the resulting model performance
- Tuning helps find a balance between underfitting and overfitting



HOW HARD COULD IT BE?

- Very difficult: There are lots of different configurations to choose from, known as the hyperparameter space, denoted by $\mathbf{\Lambda}$ (analogous to Θ)
- Black box: If one opts for a configuration $\boldsymbol{\lambda} \in \mathbf{\Lambda}$, how can its performance be measured (and compared)?
- Well-thought-out approaches - black box optimization techniques - are needed!