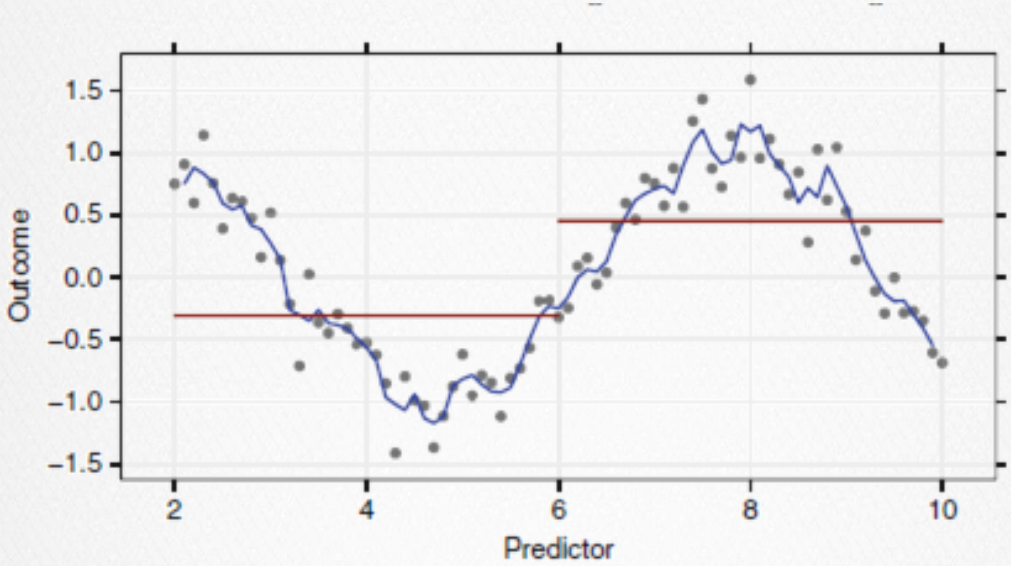
DECISION PATTERNS

Bias Variance Trade-off

Variance-Bias Trade-off



$$E[MSE] = \sigma^2 + (model\ bias)^2 + model\ variance$$

BIAS: How close the model comes to the true value. (High bias → poor fit)
VARIANCE: Stability of the model, susceptibility to new values (High variance →poor fit)

Variance-Bias Trade-off

- Very often an decrease in bias is accompanied by a increase in variance and vice versa.
- Many algorithms have tuning (aka complexity, meta) parameters that (often) trade-off bias and variance.
- The goal is to find the value of the tuning parameter that leads to the best solution.
- Tuning parameters need to be optimized

Model Tuning Parameters

- Are not data
- Affect how models are fit
- Often, *but not always,* control the variance-bias trade-off
- Are optimized by resampling using a range of tuning parameter values.