

# Cheat Sheet – Bias-Variance Tradeoff

## What is Bias?

$$bias = \mathbb{E}[f'(x)] - f(x)$$

- Error between average model prediction and ground truth
- The bias of the estimated function tells us the capacity of the underlying model to predict the values

## What is Variance?

$$variance = \mathbb{E} \left[ \left( f'(x) - \mathbb{E}[f'(x)] \right)^2 \right]$$

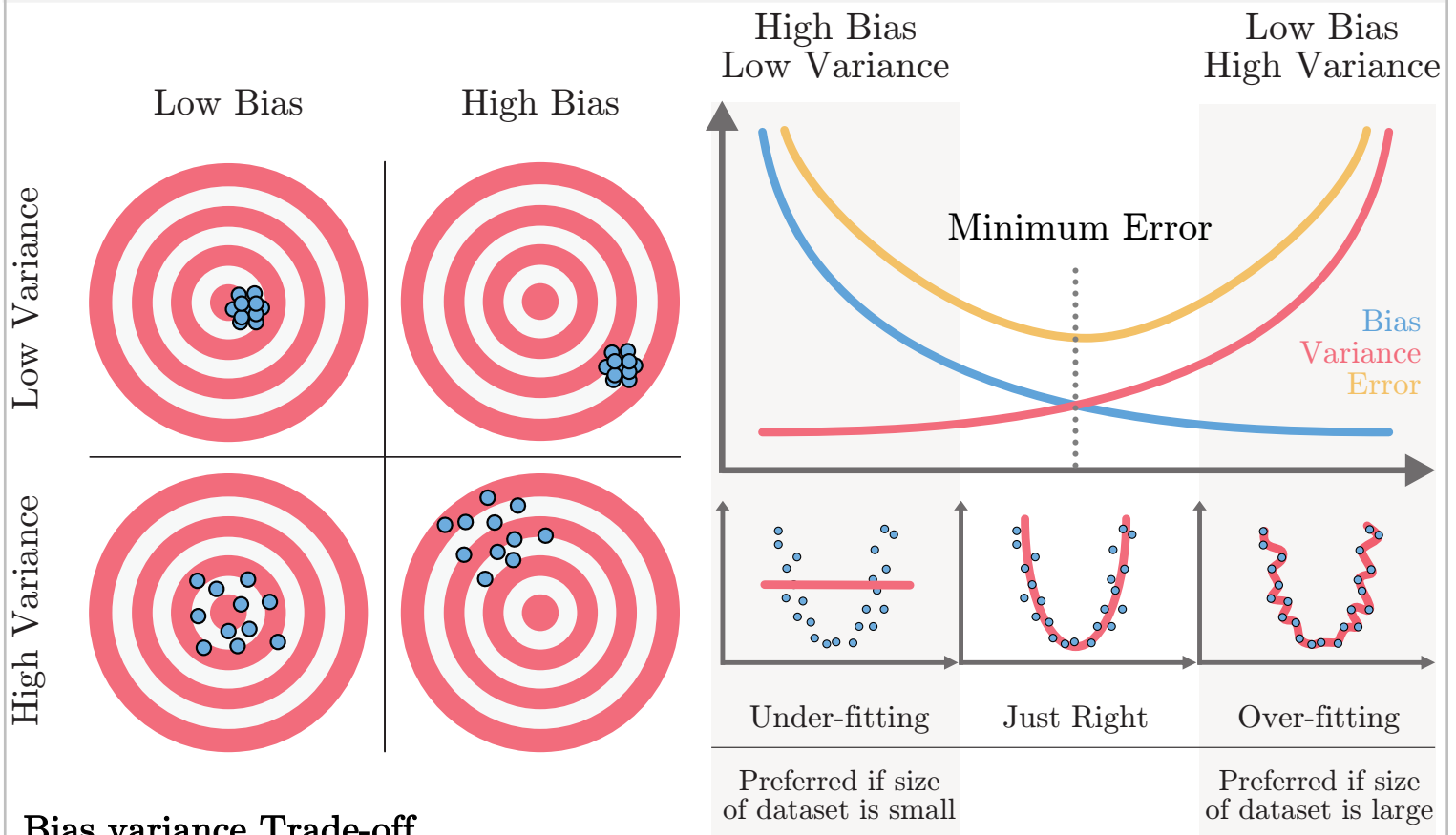
- Average variability in the model prediction for the given dataset
- The variance of the estimated function tells you how much the function can adjust to the change in the dataset

### High Bias

- Overly-simplified Model
- Under-fitting
- High error on both test and train data

### High Variance

- Overly-complex Model
- Over-fitting
- Low error on train data and high on test
- Starts modelling the noise in the input



## Bias variance Trade-off

- Increasing bias (not always) reduces variance and vice-versa
- Error = bias<sup>2</sup> + variance + irreducible error
- The best model is where the error is reduced.
- Compromise between bias and variance