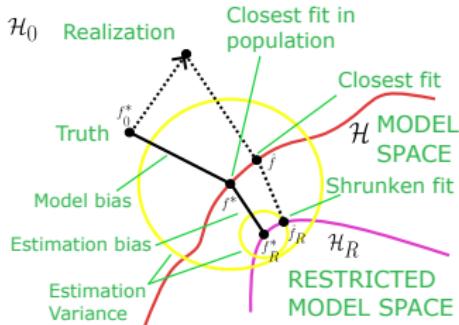


Introduction to Machine Learning

Regularization Bias-variance Tradeoff



Learning goals

- Understand the bias-variance trade-off
- Know the definition of model bias, estimation bias, and estimation variance



BIAS-VARIANCE TRADEOFF

In this slide set, we will visualize the bias-variance trade-off.

We consider a DGP \mathbb{P}_{xy} with $\mathcal{Y} \subset \mathbb{R}$ and the L2 loss L . We measure the distance between models $f : \mathcal{X} \rightarrow \mathbb{R}^g$ via

$$d(f, f') = \mathbb{E}_{\mathbf{x} \sim \mathbb{P}_{\mathbf{x}}} [L(f(\mathbf{x}), f'(\mathbf{x}))].$$

We define f_0^* as the risk minimizer such that

$$f_0^* \in \arg \min_{f \in \mathcal{H}_0} \mathbb{E}_{(\mathbf{x}, y) \sim \mathbb{P}_{xy}} [L(y, f(\mathbf{x}))]$$

where $\mathcal{H}_0 = \{f : \mathcal{X} \rightarrow \mathbb{R} \mid d(\underline{0}, f) < \infty\}$ and $\underline{0} : \mathcal{X} \rightarrow \{0\}$.

