MODEL TRAINING: BIAS VARIANCE TRADEOFF

Machine learning models depend on input data, output data, and understanding the relationship between the two.

Bias and variance affect the relationship between input and output

Bias: An error from flawed assumptions in the algorithm, can miss important relationships, under-fitting
- Fix: try new features, decrease the degree of regularization

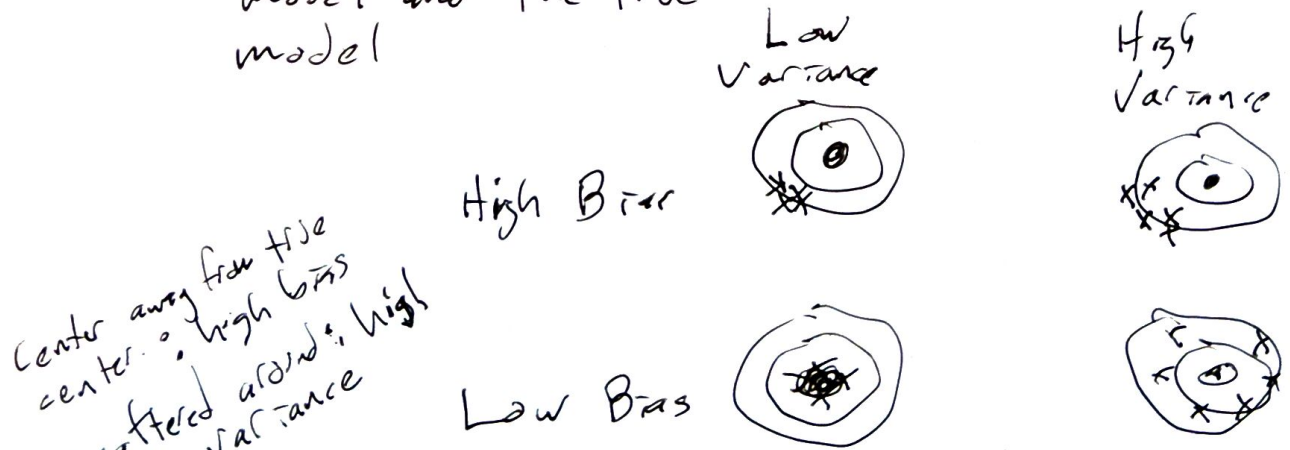
Variance: An error from sensitivity to small variations in the training data. Causes alg to model random noise in the training set, resulting in overfitting

Defining Bias

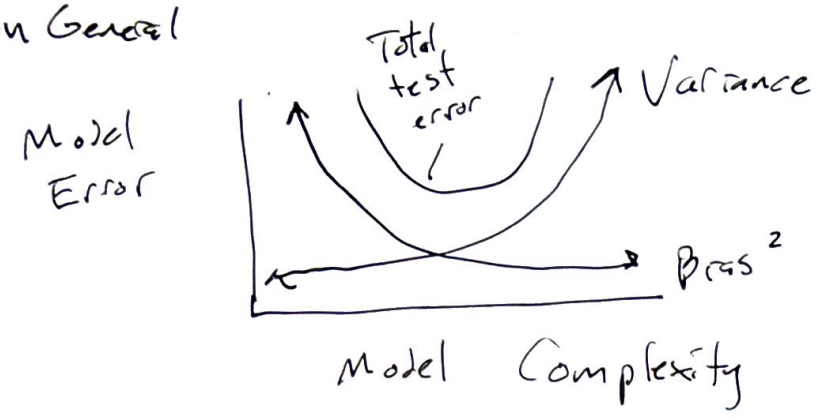
Total Error(x) = Bias^2 + Variance + Irreducible Error

$Bias = E\left[\hat{f}(x)\right] - f(x)$ $\quad Var = E\left[\left(\hat{f}(x) - E\left[\hat{f}(x)\right]\right)^2\right]$

↓
Diff between estimated model and the true model



In General



sweet spot: moderate complexity, both bias and variance at a small scale

Using Learning Curves to Evaluate the Model

- Motivation: Detect if the model is underfitting or overfitting, and impact of training data size on the error
- Learning curves: plot training dataset and validation dataset error or accuracy against training set size
- scikit-learn: sklearn.learning_curve.learning_curve
  Use stratified k-fold cross validation by default if output is binary or multiclass (preserves % of samples in each class)

High Bias

High Variance