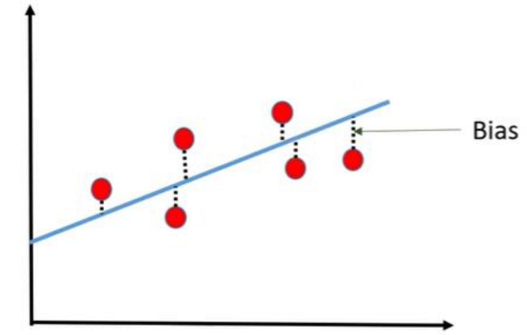
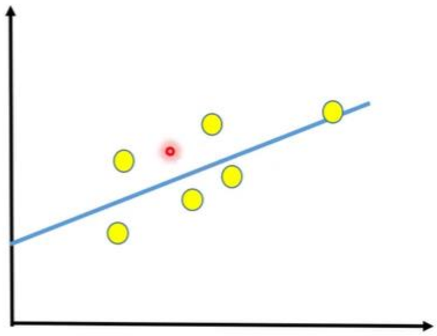
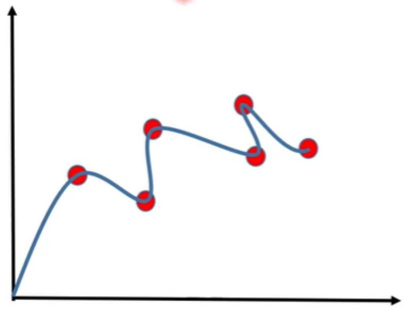
Bias – Variance Tradeoff

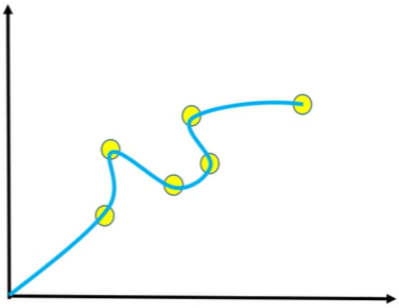
Bias – difference btw real n predicted value



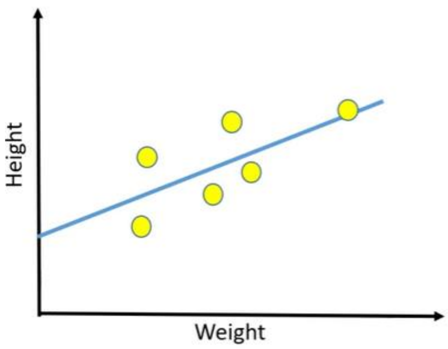


Variance – amount of estimate of target function change bw different points



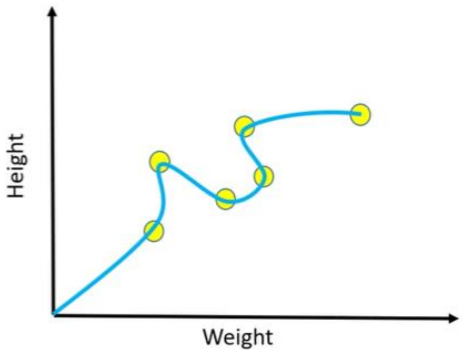


(Testing with different data)



(i) Underfitting

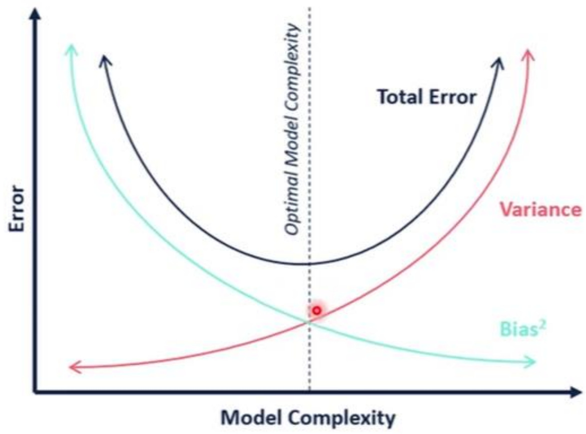
Inference: *a. High Bias*
b. Low Variance



(ii) Overfitting

Inference: *a. Low Bias*
b. High Variance

By adjusting bias and variance we can have an optimized error



- Techniques to have proper bias- variance tradeoff
    1. Good model selection: too simple- underfitting, too complex – overfitting
    2. Regularization – used when model overfits
    3. Reducing dimensionality
    4. Ensemble methods- used for underfitting

Loss Function

How far the estimated value is from true value

$$\textbf{Loss} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$$

Types:

- Cross entropy loss
- Squared error loss
- KL divergence

x	y	y_1	y_2	y_3
0.30	0.35	0.38	0.39	0.41
0.45	0.48	0.45	0.47	0.56
0.50	0.55	0.59	0.58	0.63
0.55	0.63	0.65	0.69	0.70
0.66	0.72	0.75	0.78	0.78

$$\textbf{\textit{Loss}} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$$

$Loss_1$ = [$(0.35-0.38)^2 + (0.48-0.45)^2 + (0.55-0.59)^2 + (0.63-0.65)^2 + (0.72-0.75)^2$] / 5

$Loss_1$ = 0.173

Low Loss value → High Accuracy

Model Evaluation

Mean Squared Error

Mean Squared Error measures the average of the squares of the errors, that is, the average squared difference between the estimated values and the actual value.

$$\text{MSE} = \frac{1}{n}\sum_{i=1}^{n}(Y_i - \hat{Y}_i)^2$$

Actual Value (Y_i = 140 mg/dL) Predicted Value (Y_i = 160 mg/dL)