Bias-variance Week-2, Lecture7

$Y = f(x) + \varepsilon$ → (irreducible error)

$E(\varepsilon) = 0$

$Var(\varepsilon) = \sigma^2$

$\hat{f}(x)$ → prediction

~~Predict~~ True Y

~~Prediction~~ → Unknown relationship

Expected prediction error$(x_0) = E\left[Y - \hat{f}(x_0)\right]^2$

$= E_{Y|X}\left[(Y - \hat{f}(x))^2 \mid X = x\right]$

$= \underbrace{E\left(E\left[\hat{f}(x_0)\right] - f(x)\right)}_{\text{~~bias~~ ~~bias^2~~ variance}} + \underbrace{\left[E\left[\hat{f}(x_0)\right] - f(x_0)\right]^2}_{\text{~~variance~~ bias}^2} + \sigma^2$

In case of KNN:

variance: $\frac{\sigma^2}{k} \rightarrow \downarrow$ if k ↑ {More stable, less complex}

bias → ↑

K-NN in high-dimension bias is more so more error