



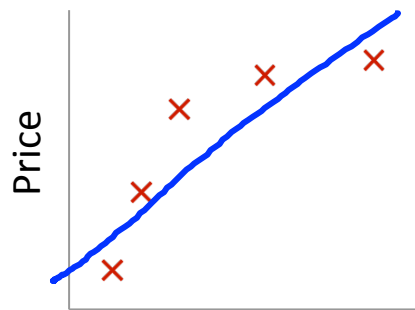
Machine Learning

Advice for applying machine learning

Diagnosing bias vs. variance

Bias/variance

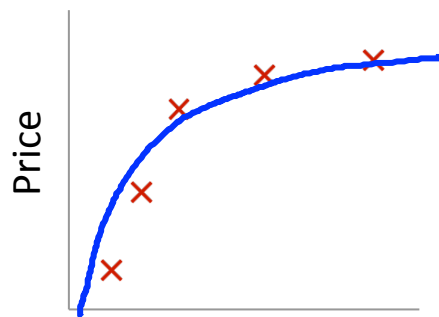
mesmo pontos
nos 3



Size
 $\theta_0 + \theta_1 x$

High bias
(underfit)

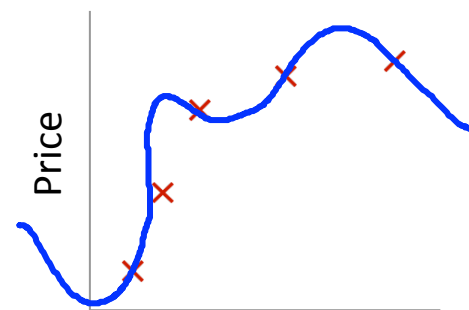
$d=1$



Size
 $\theta_0 + \theta_1 x + \theta_2 x^2$

“Just right”

$d=2$



Size
 $\theta_0 + \theta_1 x + \theta_2 x^2 + \theta_3 x^3 + \theta_4 x^4$

High variance
(overfit)

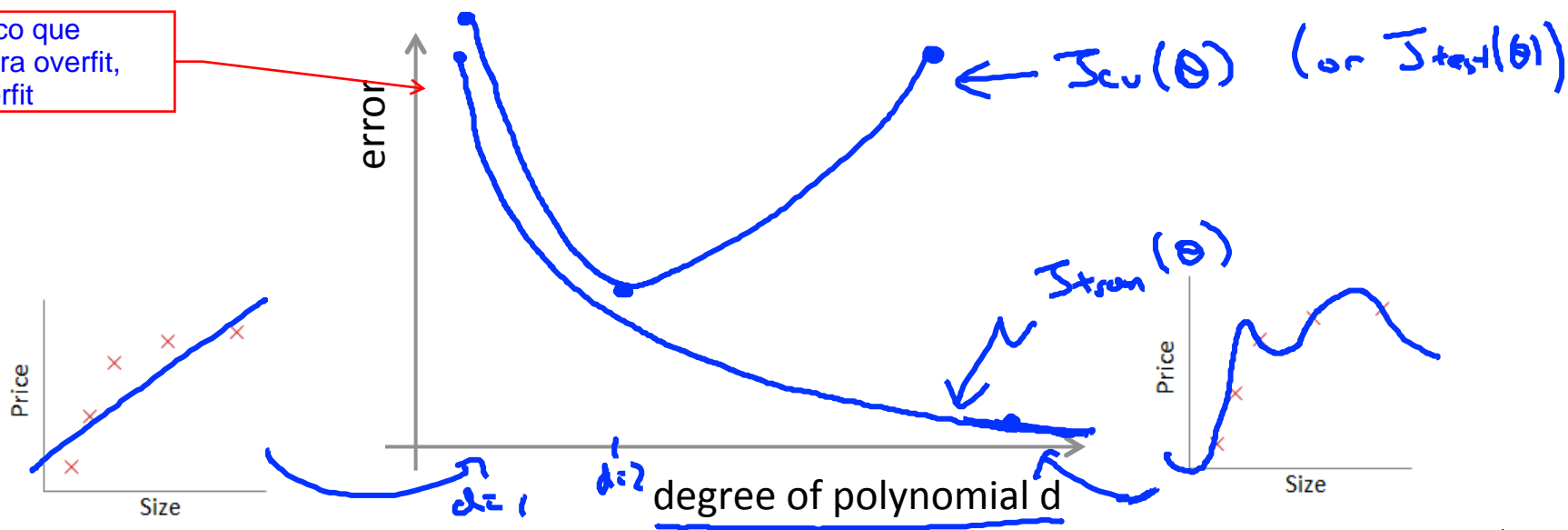
$d=4$

Bias/variance

Training error: $J_{train}(\theta) = \frac{1}{2m} \sum_{i=1}^m (h_{\theta}(x^{(i)}) - y^{(i)})^2$

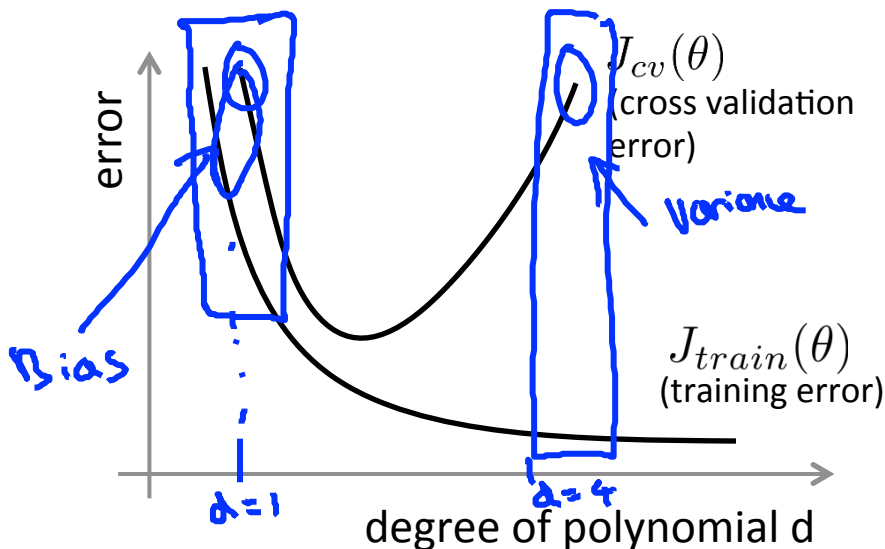
Cross validation error: $J_{cv}(\theta) = \frac{1}{2m_{cv}} \sum_{i=1}^{m_{cv}} (h_{\theta}(x_{cv}^{(i)}) - y_{cv}^{(i)})^2$ (or $J_{test}(\theta)$)

grafico que
mostra overfit,
underfit



Diagnosing bias vs. variance

Suppose your learning algorithm is performing less well than you were hoping. ($J_{cv}(\theta)$ or $J_{test}(\theta)$ is high.) Is it a bias problem or a variance problem?



Bias (underfit):

$\rightarrow J_{train}(\theta)$ will be high
 $J_{cv}(\theta) \approx J_{train}(\theta)$

Variance (overfit):

$\rightarrow J_{train}(\theta)$ will be low
 $J_{cv}(\theta) \gg J_{train}(\theta)$
muito maior

\gg