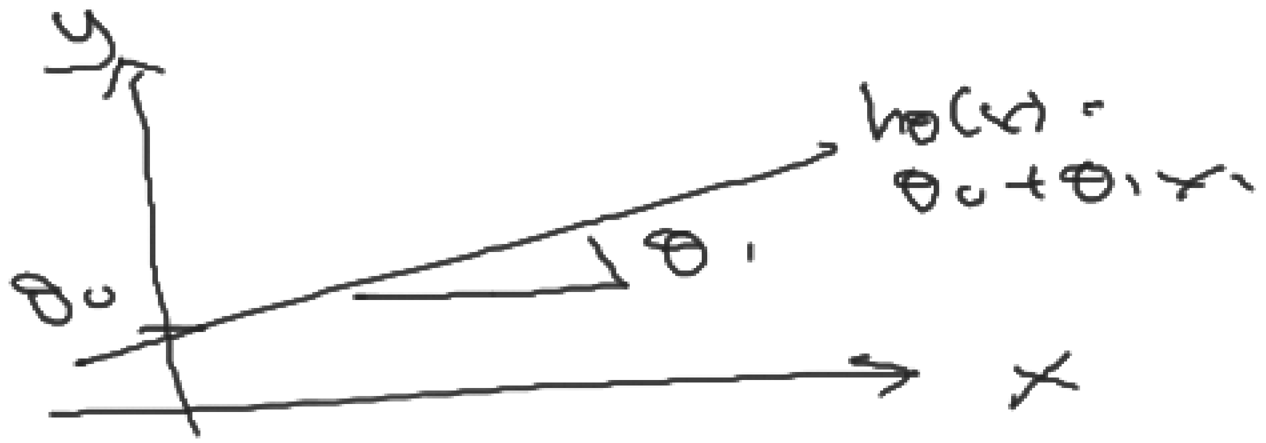
$h_\theta(x) = \underline{\theta_0} + \theta_1 x_1$



$h_\theta(x) = \underline{\theta_0} + \theta_1 x_1 + \theta_2 x_2$

bedroom

sq ft

θ_0: intercept

bias

$\boxed{m=5}$

m: number of training example

index	x	y
1	10	
2		
3		
⋮		
100		

70~80%: training data

30~20% : test data

if the number of samples $n=100$, and the training vs test ratio 0.8 : 0.2, then $\underline{m=80}$

	x_1	y	$h_\theta(x)$	$(h_\theta(x) - y)^2$	$\lvert h_\theta(x)^i - y^i \rvert$
$i=1$	3	2	3	$(3-2)^2 = 1$	1
	2	3	2	$(2-3)^2 = 1$	1
	4	5	4	$(4-5)^2 = 1$	1
	1	1	1	$(1-1)^2 = 0$	0
$m=5$	5	4	5	$(5-4)^2 = 1$	1

$= \sum (h_\theta(x)^{(1)} - y^{(1)})^2$ → i indicates the 1st sample

$\sum_{i=1}^{m} = 1+1+1+0+1 = 4$

$\sum_{i=1}^{m} = 4$

Cost function

$$J(\theta_0, \theta_1) = \frac{1}{2m} \underline{\sum_{i=1}^{M} (h_\theta(x)^i - y^i)^2}$$

$J(0,1) \rightarrow \theta_0 = 0 , \theta_1 = 1$

Hypothesis eqn:

$$h_\theta(x) = \theta_0 + \theta_1 x_1$$
$$= 0 + 1 \cdot x_1$$
$$= x_1$$

$$J(0,1) = \frac{1}{2m} \cdot 4$$
$$= \frac{1}{(\cancel{2})(5)} \cdot \cancel{4}^{2} = 0.4$$

$$MAE = \frac{1}{m} \sum_{i=1}^{M} \lvert h_\theta(x)^i - y^i \rvert$$
$$= \frac{1}{4} \cdot 4$$

$$h_\theta(x) = \theta_0 + \theta_1 x_1$$

$$= -1 + 0.5x_1$$

$$h_\theta(3) = -1 + 0.5(3)$$

$$= \underline{0.5}$$

Low changes = low variance

High robustness = high bias

Not sensitive

just nice

Sensitive

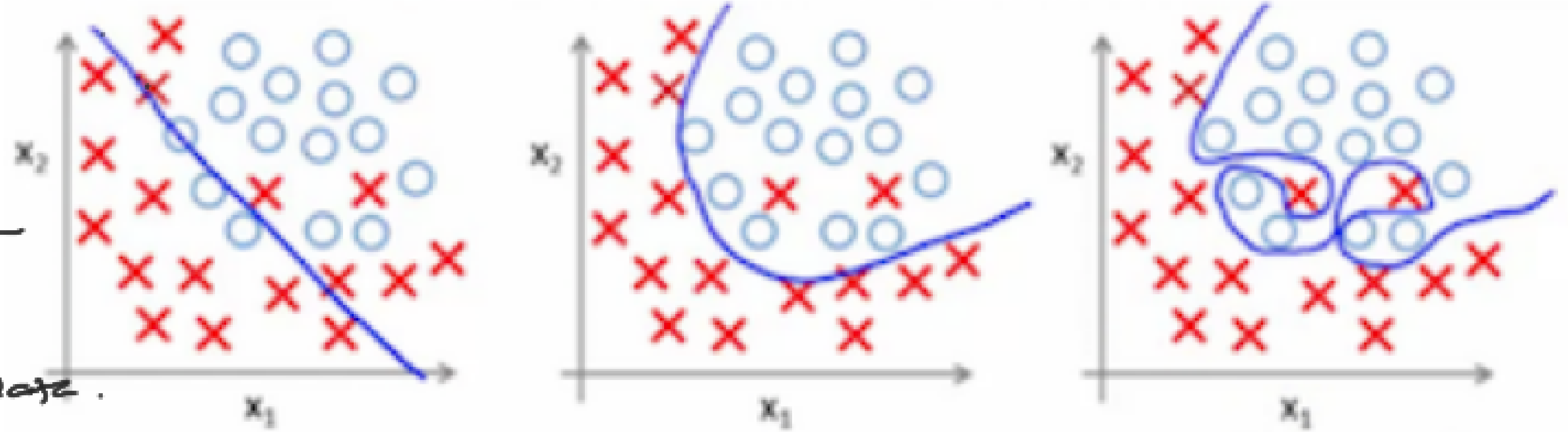
high variance = High changes

Low biase

Predictions is bad even on training data.

Train acc ↓

test acc ↓



- Train acc ?

  Test acc ?

underfitting? ? overfitting ?

Q.) How do we know if our model ?

a) underfitting

b) overfitting

What happens to the accuracy?

Check Accuracy (Classification)

R^2, RMSE (Regression)

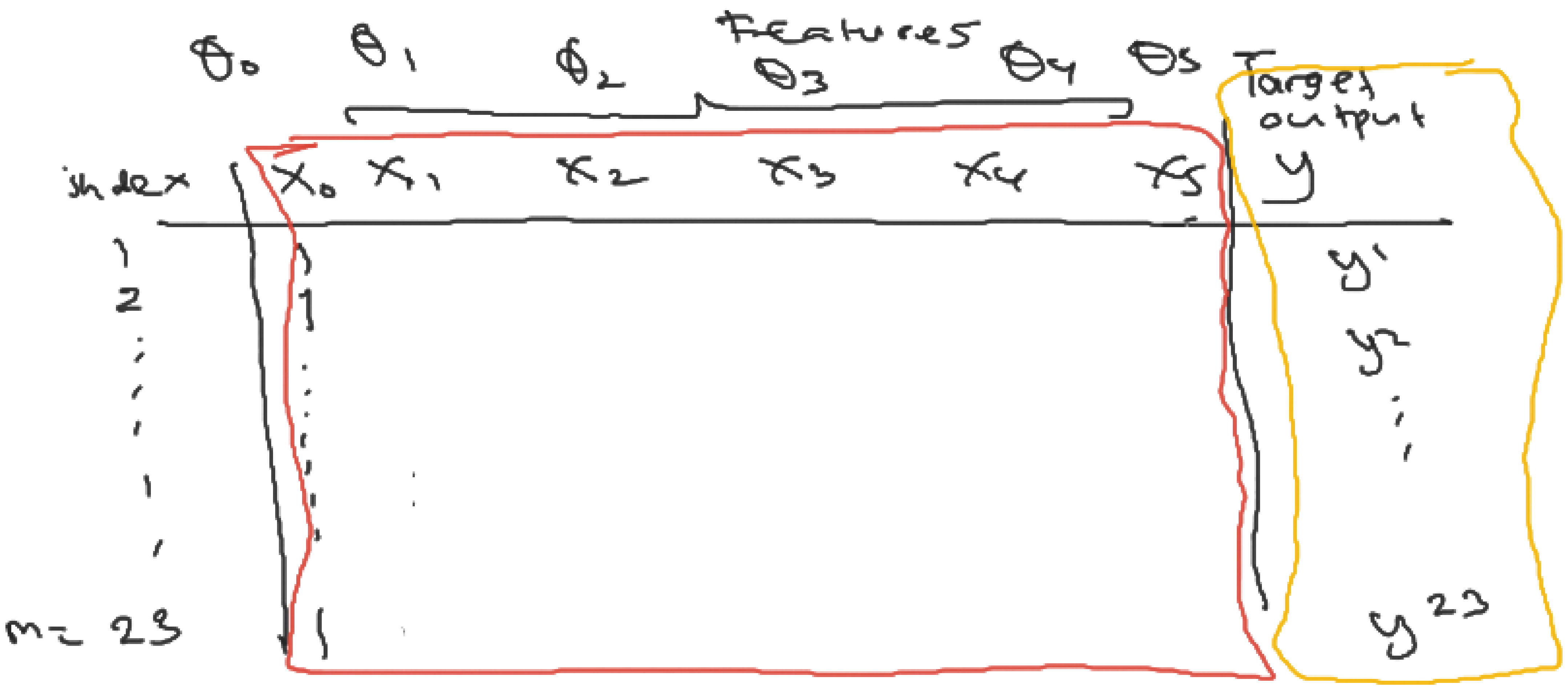
	Training	Test
model A	95%	40%
model B	90%	80%

Which is better and why?

3. Suppose you have m = 23 training examples with n = 5 features (excluding the additional all-ones feature for the intercept term, which you should add). The normal equation is $\theta=(X^TX)^{-1}X^T y$. For the given values of m and n, what are the dimensions of θ, X, and y in this equation?

1. X is 23 × 6, y is 23 × 6, θ is 6 × 6
2. X is 23 × 5, y is 23 × 1, θ is 5 × 1
3. X is 23 × 6, y is 23 × 1, θ is 6 × 1
4. X is 23 × 6, y is 23 × 1, θ is 5 × 5

Ans: 3



$$h_\theta(x) = \underline{\theta_0} x_0^{(1)} + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 + \theta_4 x_4 + \theta_5 x_5$$

$$\theta = (X^T X)^{-1} X^T y$$

$$\theta = \begin{bmatrix} \theta_0 \\ \theta_1 \\ \vdots \\ \theta_5 \end{bmatrix} \qquad y = \begin{bmatrix} y^1 \\ y^2 \\ \vdots \\ y^{23} \end{bmatrix}$$

$\underline{6 \times 1}$ $\qquad$ $\underline{23 \times 1}$

X =

$\underline{23 \times 6}$