

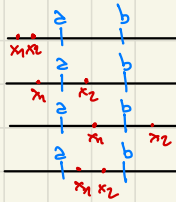
# VC-Dimension

$$h(x) = \begin{cases} 1 & \text{if } a \leq x \leq b \\ 0 & \text{otherwise} \end{cases}$$

With **Two** points  $x_1, x_2$  where  $x_1 < x_2$  we have  $2^2 = 4$  labels

$x_1 \ x_2$

0 0  
0 1  
1 0  
1 1



$x_1 < x_2 < a < b$  or  $a < b < x_1 < x_2$  OK  
 $x_1 < a < x_2 < b$  OK  
 $a < x_1 < b < x_2$  OK  
 $a < x_1 < x_2 < b$  OK

With **THREE** points  $x_1, x_2, x_3$  where  $x_1 < x_2 < x_3$  we have  $2^3 = 8$  labels

$x_1 \ x_2 \ x_3$

0 0 0  
0 0 1  
0 1 0  
0 1 1  
1 0 0  
1 0 1  
1 1 0  
1 1 1



$x_1 < x_2 < x_3 < a < b$  OK  
 $x_1 < x_2 < a < x_3 < b$  OK  
 $x_1 < a < x_2 < b < x_3$  OK  
 $x_1 < a < x_2 < x_3 < b$  OK  
 $a < x_1 < b < x_2 < x_3$  OK

$x_3??$  NO ANSWER



The classifier can not shatter  
any set of 3 points,  
so the VC dimension in  $\mathbb{R}$  is 2!