

- ① Free win now
 ② win a prize.
 ③ Hello how are you.
 ④ Let's win it
 ⑤ Free lunch today

spam.

spam

Not spam

Not spam

Not spam.

Naive Bayes classifier

word free	word win.	Label
Yes	Yes	spam
No	Yes	spam.
No	No	Not spam.
No	Yes	N.S.
Yes	No	N.S.

Free	win	label
Yes	Yes.	spam
No	Yes	spam.
No	No	Not spam.
No	Yes	N.S.
Yes	No	N.S.

$$P(Y=1 | \text{spam})$$

$$P(Y=0 | \text{Not spam})$$

$$n=5$$

$$\text{Spam} = 2$$

$$\text{No. spam} = 3$$

$$= 2/5 = 0.4$$

$$= 3/5 = 0.6$$

Prob of occ spam.

Prob of occ Not. S.

$$P(\text{Free} | \text{win})$$

$$P(\text{Free} = \text{Yes}) | \text{Spam} = 1/3$$

$$P(\text{Free} = \text{Yes}) | \text{Spam} = 1/2 = 0.5$$

$$P(\text{Win} = \text{Yes}) | \text{N.S.} = 1/3$$

$$P(\text{Win} = \text{Yes}) | \text{Spam} = 2/2 = 1$$

$$= 0.3, 0.3.$$

Compute likelihood for both for
compute this

x_1 Free = Yes $win = 4 \text{ cl. } (x_2)$

$$P(\text{spam} | x) = P(x | \text{spam}) \cdot P(\text{spam})$$

$$P(x | \text{spam}) = P(x_1, x_2 | \text{spam}) \\ = P(x_1 | \text{spam}) \cdot P(x_2 | \text{spam}) \cdot P(\text{spam})$$

$$= P(1/2) \cdot P(2/2) \cdot P(2/5)$$

$$= P(0.5) \cdot P(1) \cdot P(0.4)$$

$$= (0.5)(1)(0.4)$$

$$= 0.2$$

likelihood for Not-spam.

~~$P(\text{spam})$~~

$$P(\text{Not-spam} | x) = P(x | \text{Not-spam}) \cdot P(\text{Not-spam})$$

$$= P(x_1, x_2 | \text{Not-spam})$$

$$= P(x_1 | \text{Not-spam}) \times P(x_2 | \text{Not-spam}) \times P(\text{Not-spam})$$

$$= P(1/3) \times P(1/3) \times P(3/5)$$

$$= 0.33 \times 0.33 \times 0.6$$

$$= 0.066$$

Since $0.2 > 0.066$

so text message belongs to spam.