$P(B)$

※ 비오는 날에, 교통사고 확률?

사건 B가 발생했을 때 A 사건 발생 확률.

조건부 확률.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$P(B|A) =$

$P(B|A) = \frac{P(A \cap B)}{P(A)}$

$P(A \cap B) = P(A|B)P(B) = P(B|A)P(A)$

☆

i) 독립 : $P(서큰 \cap 맑음)$
$P(\frac{비온}{리음} \cap 서큰)$

두 사건이 영향 X

(서큰 → 맑음)

$\underline{P(A)} \cdot \underline{P(B)} = \underline{P(A \cap B)}$
$0.3 \quad \cdot \quad 0.5 = 0.15$

ii) 종속

두 사건이 영향 O.

(비 → 교통사고)

$$① \quad P(A|B) = \frac{P(A \cap B)}{P(B)}$$

Bayes

• $\underset{\sim\sim\sim}{A, B}$

영향 X

$$P(A \cap B) = P(A) \cdot P(B)$$

$\underset{==}{\overset{\text{추론}}{\text{가능}}} \circ \quad \underline{P(A|B) = P(A)}$

$$P(B|A) = P(B)$$

항상 성립
하는 !? 영향?

☞ 알았표, 헤라이스

    ·|·
    +
    +, !?

영향 O

$P(A) = $ 비가 올 확률

$P(B) = $ 우산 판매 확률

$$P(A \cap B) \neq P(A) \cdot P(B)$$

$$= P(B|A) \cdot P(A)$$

$$\Rightarrow \quad P(B|A) = \frac{P(A \cap B)}{P(A)}$$

$$\bullet \ P(B|A) = \frac{P(A \cap B)}{P(A)} \qquad\qquad \bullet \ P(A|B) = \frac{P(B \cap A)}{P(B)}$$

$$\Rightarrow P(A \cap B) = P(A) \cdot P(B|A)$$
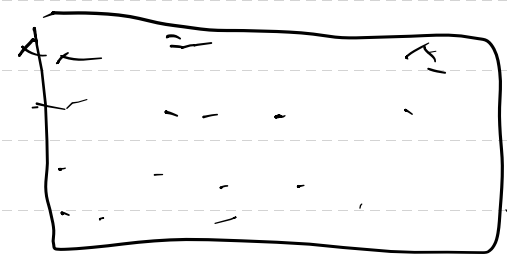
$$\Rightarrow P(B \cap A) = P(B) \cdot P(A|B)$$

$$P(A \cap B) = P(B \cap A) \quad \text{이므로} \quad P(A) \cdot P(B|A) = P(B) \cdot P(A|B)$$

베이즈정리.

$$P(B|A) = \frac{P(B) \cdot P(A|B)}{P(A)}$$

$$P(B|A) = \frac{P(A|B) \cdot P(B)}{P(A)}$$

스팸메일 중에, free가

베이즈 정리 :+×+ free ×+×

$$\frac{2}{3} \Bigg| \frac{3}{3} \Rightarrow \frac{2}{3}$$

스팸확률² $\frac{1}{5}$중 $\frac{2}{5}$

$\frac{3}{5}$의 spam $\Rightarrow \frac{3}{10}$

$$P(spam|free) = \frac{P(free|spam) \cdot P(spam)}{P(free)}$$

$$\underset{B}{} \quad | \quad \underset{A}{}$$

$$\underset{A.}{}$$

베이즈 → 'free' 받겨진일 $\Rightarrow$ spam/ham ? 내가 가진 메일 리쿨리의 free 중강 확률

베이즈 레몬기

(10중 중 free $\frac{4}{5}$ 중의 $\Rightarrow \frac{4}{10}$)

free

$$P\left(spam \Bigg| \frac{free \, 단어}{중강}\right) = ? = \frac{\text{사건확률}^2 \; P(free|spam) \cdot P(spam)}{P(free \, 중강)}$$

← 사전확률.

$$P\left(ham \Bigg| \frac{free \, 단어}{중강}\right) = \frac{P(free|ham) \cdot P(ham)}{P(free)}$$

$$P(\text{spam} \mid \text{free}) = \frac{P(\text{spam}) \cdot P(\text{free} \mid \text{spam})}{P(\text{free})}$$

$$\bullet \quad P(\text{spam}) = \frac{3}{10}, \quad P(\text{free}) = \frac{4}{10}, \quad P(\text{free} \mid \text{spam}) = \frac{2}{3}$$

$$P(\text{spam} \mid \text{free}) = ?$$

$$\underline{\underline{0.5}} \; (50\%)$$

$$\frac{\frac{\cancel{3}}{\cancel{10}} \cdot \frac{\cancel{2}}{\cancel{3}} \quad \frac{1}{5}}{\frac{\cancel{4}}{\cancel{10}} \quad \frac{2}{5}} = \frac{\frac{5}{10}}{} = \frac{1}{2}$$

free, coupon.　　　free coupon | spam　　$\dfrac{W \quad I}{R \quad H}$　P

　　　　　　　　　　　　　? Y/N.　　　　　Y/N ?

14 번의 메일, free.
　　　　　 coupon.
　　　　 free, coupon.
　　　　　　 $\times$

- $P(\text{spam}) = \dfrac{6}{14}$,　$P(\text{free} \cap \text{coupon} \mid \text{spam}) = \dfrac{1}{2}$

- $P(\text{free} \cap \text{coupon}) = \dfrac{4}{14} = \boxed{\dfrac{2}{7}}$

$P(\text{spam} \mid \text{free} \cap \text{coupon}) = ?$

$$\Rightarrow \frac{P(\text{spam}) * P(\text{free} \cap \text{coupon} \mid \text{spam})}{P(\text{free} \cap \text{coupon})}$$

$$\frac{\frac{3}{7} * \frac{1}{2}}{\frac{2}{7}} = \frac{3}{4} = 0.75 = 75\%$$

$$\bigstar \ P(\text{스팸} \mid \text{나이드}) = \frac{P(\text{나이드} \mid \text{스팸}) \cdot P(\text{스팸})}{P(\text{나이드})} = \frac{\frac{4}{20} \cdot \frac{20}{100}}{\frac{5}{100}}$$

$$= 0.8 = 80\%$$

$\bigstar$ 나이브 베이즈 → 조건부

[빈도표] $\Longrightarrow$ 우도표 $\checkmark$ e

나이드

	Y	N	합계
스팸	4	16	20
햄	1	79	80
전체합	5	95	100

나이드

	Y	N
	4/20	16/20
	1/80	79/80
	5/100	95/100

$P(\text{스팸} \mid \text{나이드}) = ?$

$P(\text{햄} \mid \text{나이드}) = ?$

$$\frac{\frac{1}{80} \cdot \frac{80}{100}}{\frac{5}{100}} = 0.2$$

$$P\left(\underline{buy} \mid \neg X_1, \neg X_2, X_3, \neg X_4, \ldots \quad X_m\right)?$$

$$P(spam \mid free \land coupon) = \frac{P(spam) \cdot P(free \land coupon \mid spam)}{P(free \land coupon)}$$

$$P(spam \mid w_1, w_2, \ldots w_m) = \frac{P(w_1 \mid spam) \cdot \ldots \cdot P(w_m \mid spam) \cdot P(spam)}{P(w_1) \cdot P(w_2) \cdot \ldots P(w_m)}$$

$$P(w_1 \mid ham) \cdot \ldots \cdot P(w_m \mid ham) \cdot P(ham)$$

dam).
maver). mail Server. → s/h $\frac{\cancel{2}}{\cancel{4}}$기

*Laplace. 추정값 fun: A
to: 홍기녹

메일 제목 숙술 → 답 → 100 번까지 답

반보기 / 우편함

mail: (W₃) W₇ W₉

0.

	W_1	W_2	W_3		$W_{1000000}$	$P(스팸)...(P△|W_3)$
	Y N	Y N Y N				
H						P = [____]
S		∅ 1000				X

$P(스팸) = 0.0003$

$P(정상) = 0.0001$

확률 $= \dfrac{0.0003}{0.0003 + 0.0001}$