$C = \{\text{red, orange, yellow, green, blue}\}$

$n = 100$ balls

n_{red}, n_{orange}, n_{yellow}, n_{green}, n_{blue}

$$p(red) = \frac{n_{red}}{n}$$

HH HT TH TT

$$p(T, T) = \frac{1}{2} \cdot \frac{1}{2} = p(T)p(T)$$

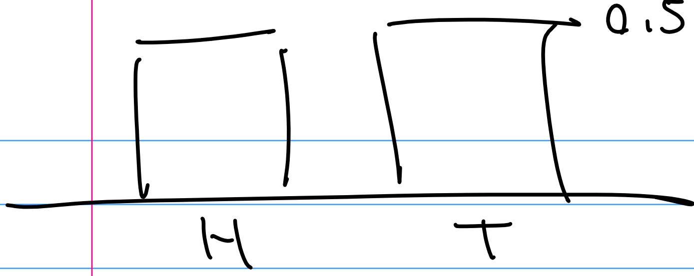
$$p(red, red) = \frac{n_{red}}{n} \cdot \frac{n_{red}}{n}$$

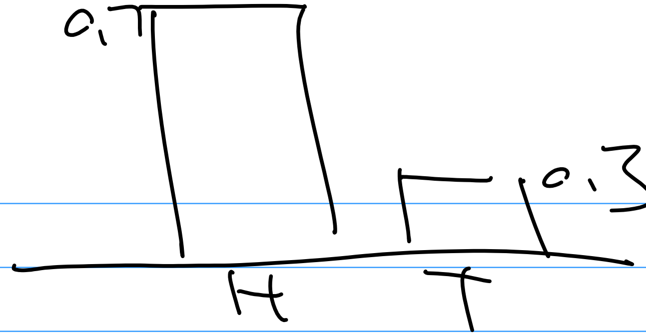
$$p(\text{different col}) = 1 - p(\text{same color})$$

$$= 1 - [p(red, red) + p(blue, blue) + \ldots]$$

$c \in C$

$$= 1 - \sum_{c \in C} \left(\frac{n_c}{n}\right)^2 = 1 - \sum_c p_c^2$$



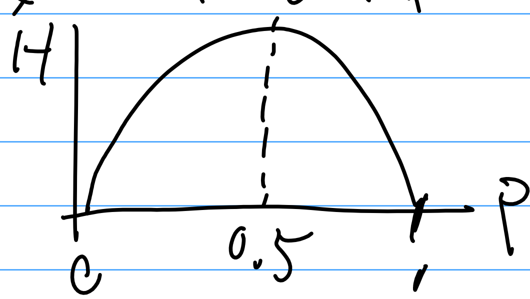


more disorder

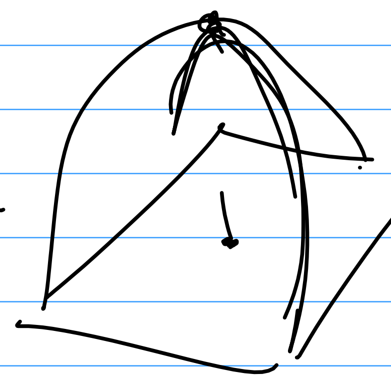
→ LOOK AT YOUR DT NOTES

entropy $H = -\{p \log p + (1-p)\log(1-p)\}$

max H wrt $p \longrightarrow p = 0.5$



$$H = -\sum_k p_k \log p_k$$



Gini index

$$G = 1 - \sum_k p_k^2$$

Print each [illegible] 20 times

$$\sigma(w_0 + w_1 x_1 + w_2 x_2 + \dots) \to [0, 1]$$

$$\underbrace{P(\underset{\text{class}}{Y} = 1 \mid \underset{\text{data}}{X})}_{\text{posterior}}$$

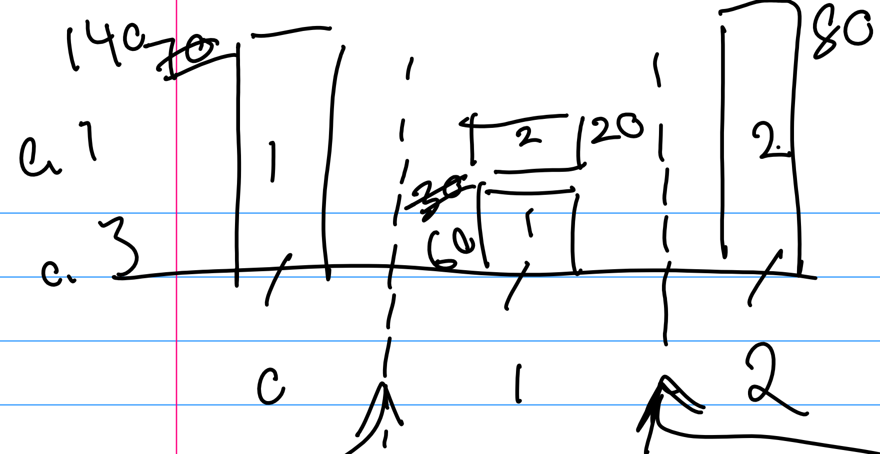
$$P(Y=1 \mid x) = \frac{P(x, Y=1)}{P(x)}$$

$$= \frac{P(x \mid Y=1)\, P(Y)}{P(x)}$$

$$\propto \underbrace{P(x \mid Y=1)}_{\text{likelihood}} \underbrace{P(Y)}_{\text{prior}}$$

$$P(\underset{Y=1}{\text{YES}}) = 0.001 \qquad P(Y=0) = 0.999$$

$$\pi_1 = \qquad\qquad \pi_0 =$$



0.8 2 cans

0.2 $C_1 \to 0, 1$

$C_2 \to 1, 2$

\$1

\$3

$\pi_1 = 0.5 = \frac{100}{200}$

$\pi_2 = 0.5 = \frac{100}{200}$

cost 20

cost 30

$\pi_1 = \frac{200}{300} = \frac{2}{3}$

$\pi_2 = \frac{100}{300} = 1/3$

FN

FP

cost $\underline{60}$ \$60

cost $\underline{20}$ \$60

not $\to P(x \mid C_1)$ vs. $P(x \mid C_2)$

✓ $\to P(C_1 \mid x)$ vs. $P(C_2 \mid x)$

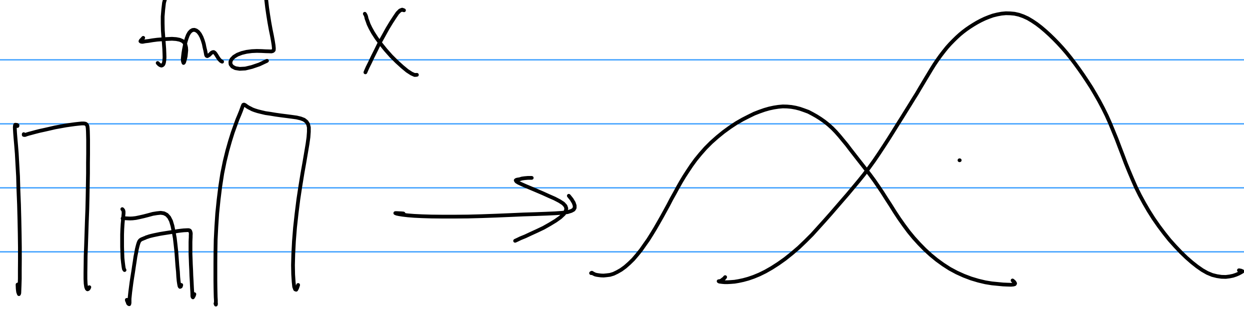
$\propto$

$P(x \mid C_1)\pi_1$ vs. $P(x \mid C_2)\pi_2 C$

$\times \frac{2}{3}$ $\times \frac{1}{3}$

$$P(x|c_1)\pi_1 = P(x|c_2)\pi_2 C$$

find x



$$\pi_0 = 2/3 \qquad \pi_1 = 1/3$$

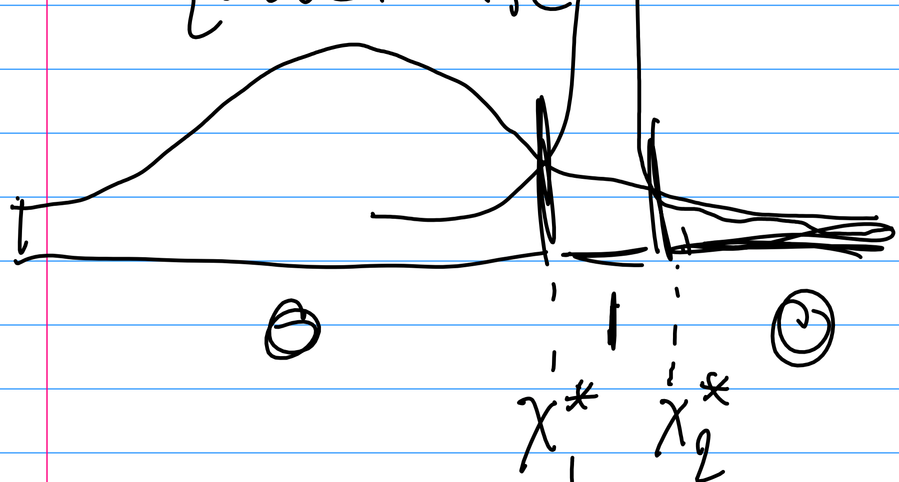
$$P(x|Y=0) = N(0,1) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2}$$

$$P(x|Y=1) = N(1, 1/4) = \frac{1}{\sqrt{2\pi(1/4)}} e^{-\frac{1}{2}\frac{(x-1)^2}{(1/4)}}$$

$$P(x|Y=0)\boxed{\pi_0} = P(x|Y=1)\boxed{\pi_1 C}$$

→ find x boundary

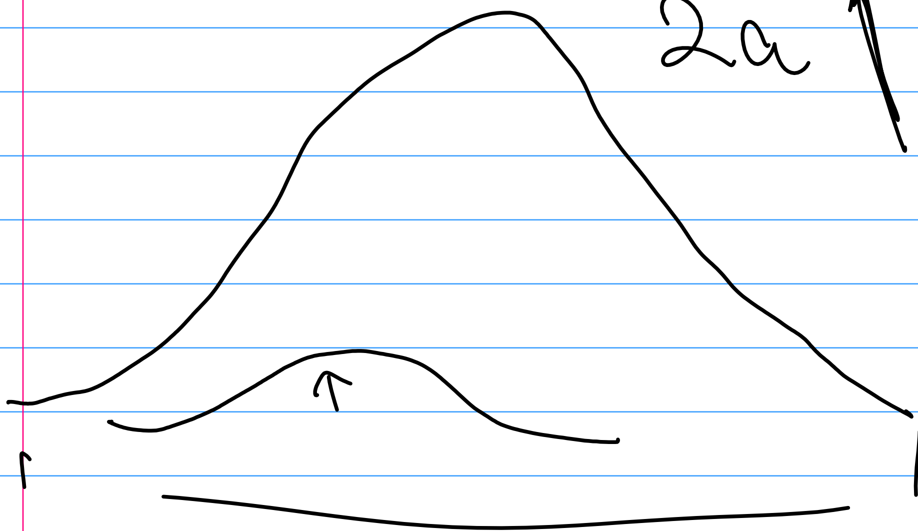
→ quadratic → 2 answers



$ax^2 + bx + c = 0$

"quadratic formula"

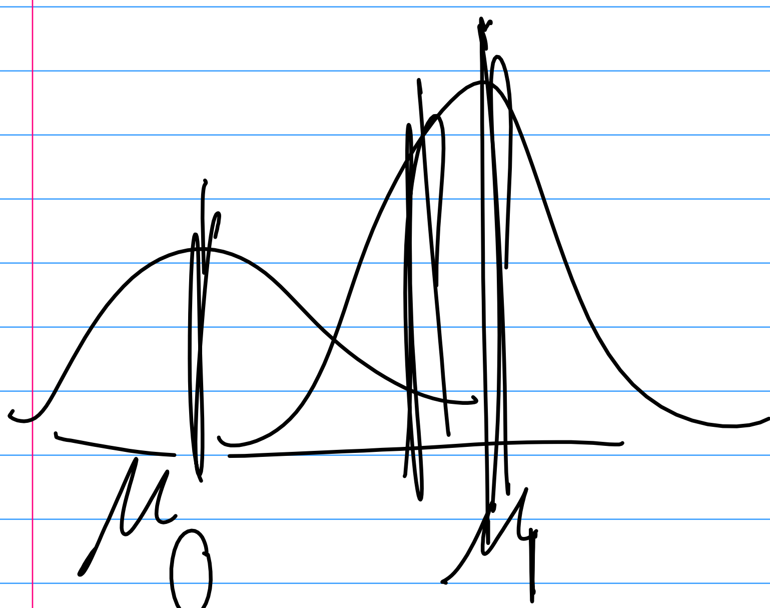
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



b_1

b_2

$$f^*(x) = \begin{cases} 0 & x < b_1 \\ 1 & b_1 < x < b_2 \\ 0 & x > b_2 \end{cases}$$



$$N\left\{\overbrace{\begin{bmatrix} \quad & \quad & \quad \\ & & \\ & & \end{bmatrix}}^{D}\right.$$

$$\begin{array}{c|ccc} & \text{"dog"} & \text{"cat"} & \text{"mouse"} \\ \hline 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 2 & 0 & 0 & 1 \end{array}$$

Vocab:
dog ← $A[0,0]$
cat
mouse

$$\begin{array}{c|cccc} & n_1 & \cdots & \cdots & n_N \\ \hline n_1 & 1 & & & 1 \\ \vdots & & & 1 & \\ \vdots & 1 & & & \\ n_N & & & & \end{array}$$

$$d = \{ (0,0) : 1, \; (0,5) : 1, \}$$

$$P(x \mid \text{class}) = \prod_{j=1}^{d} \mu_j^{x_j} (1 - \mu_j)^{x_j}$$

$$L = \log(\ldots\ldots) \rightarrow \frac{\partial L}{\mu_j} = 0$$

$$P(\text{motorcycle})\,P(\text{gas}) \cdots\cdots P(\text{mouse})$$

$$0$$

$$\frac{0}{N} \rightarrow \frac{1+0}{2+N}$$

$$= \left(\text{MLE} \mid \text{Lap} \right)$$

$$P(Y \mid X)$$

$$\text{prediction} = \underset{\text{forum}}{\operatorname{argmax}}\ \underbrace{P(Y = \text{forum} \mid X)}$$

$$\propto \underbrace{P(X \mid \text{forum})}\ \underbrace{P(\text{forum})}$$

$$\prod_{j=1}^{d} \mu_j^{x_j} (1-\mu_j)^{1-x_j} \cdot \frac{\#\text{forum}}{\text{total}}$$

P(data | μ) $\rightarrow$

P(data | μ_{forum1}) -

P(data | μ_{forum2})

likelihood = $\prod$ P(word appears)$^{\text{(word appears)}}$ P(!word appears)$^{\text{!word appears}}$

$$\underset{y}{\operatorname{argmax}} \left(\prod_{j=1}^{d} \mu_{y,j}^{x_j} (1-\mu_{y,j})^{1-x_j} \right) \pi_y$$

Linear classifier:
$$y = w_0 + \underbrace{w_1 x_1 + w_2 x_2 + \dots}$$

$$y = mx + b \qquad = w_0 + \sum_{j=1}^{d} w_j x_j$$

$$\log \left[\left(\prod_{j=1}^{d} \mu_{y,j}^{x_j} (1-\mu_{y,j})^{1-x_j} \right) \pi_y \right]$$

$$= \log \pi_y + \sum_{j=1}^{d} x_j \log \mu_{y,j} + (1-x_j) \log (1-\mu_{y,j})$$

$$= \underbrace{\log \pi_y + \sum_j \log(1-\mu_{y,j})}_{b} + \sum_j \underbrace{\left[\log \mu_{y,j} - \log(1-\mu_{y,j})\right]}_{w_j} \underbrace{x_j}_{x_j}$$

$$= b_y + \underbrace{w_{yj}}_{w_j} x_j \qquad w_{y,j}$$

forum or class

dimension or word index

$$\prod_{j=1} \mu \cdots (1-\mu) \pi_y$$

$$\underbrace{b} + \underbrace{w^T x}_{\text{dot product}}$$

params = {

label$_y$: { "bias" : b_y,

"weights" : $\vec{w}_y$ },

: