Homework 3 P1

Cole Rottenberg

MLE Rule

$P(B_0|A_0) = 0.5$, $P(B_1|A_0) = 0.25$,

$P(B_2|A_0) = 0.25$, $P(B_0|A_1) = 0.1$

$P(B_1|A_1) = 0.3$, $P(B_2|A_1) = 0.6$

$$\begin{bmatrix} 0.5 & 0.25 & 0.25 \\ 0.1 & 0.3 & 0.6 \end{bmatrix} \begin{matrix} \to 1 \\ \to 1 \end{matrix}$$

$$\begin{matrix} \downarrow & \downarrow & \downarrow \\ 0.6 & 0.55 & 0.85 \end{matrix}$$

so our MLE is $\begin{bmatrix} 0 & 1 & 1 \end{bmatrix}$

Given B_0 assume A_0
Given B_1 assume A_1
Given B_2 assume A_1

<u>MAP rule:</u> $P(A_i|B_j) = \dfrac{P(B_j|A_i)P(A_i)}{\sum_i P(B_j|A_i)P(A_i)}$

$$P(A_0|B_0) = \frac{P(B_0|A_0)P(A_0)}{P(B_0|A_0)P(A_0) + P(B_0|A_1)P(A_1)}$$

$$\frac{0.5 \cdot 0.6}{(0.5 * 0.6) + (0.1)(0.4)} = 0.882$$

so

$P(A_1|B_0) = 0.118$ Given B_0, $\hat{A}_0$

$P(A_0|B$

$=$

$P(A_1|B$

$P(A_0|$

$= \frac{}{0}$

$P(A_1|$

2). Perc

MLE

P

P

F

Homework 3 P1

Cole Rottenberg

MLE Rule

$P(B_0|A_0) = 0.5$, $P(B_1|A_0) = 0.25$,

$P(B_2|A_0) = 0.25$, $P(B_0|A_1) = 0.1$

$P(B_1|A_1) = 0.3$, $P(B_2|A_1) = 0.6$

$$\begin{bmatrix} 0.5 & 0.25 & 0.25 \\ 0.1 & 0.3 & 0.6 \end{bmatrix} \begin{matrix} \to 1 \\ \to 1 \end{matrix}$$

$$\begin{matrix} \downarrow & \downarrow & \downarrow \\ 0.6 & 0.55 & 0.85 \end{matrix}$$

so our MLE is $\begin{bmatrix} 0 & 1 & 1 \end{bmatrix}$

Given B_0 assume A_0
Given B_1 assume A_1
Given B_2 assume A_1

<u>MAP rule:</u> $P(A_i|B_j) = \dfrac{P(B_j|A_i)P(A_i)}{\sum_i P(B_j|A_i)P(A_i)}$

$$P(A_0|B_0) = \frac{P(B_0|A_0)P(A_0)}{P(B_0|A_0)P(A_0) + P(B_0|A_1)P(A_1)}$$

$$\frac{0.5 \cdot 0.6}{(0.5 * 0.6) + (0.1)(0.4)} = 0.882$$

so

$P(A_1|B_0) = 0.118$ Given B_0, $\hat{A}_0$

$$P(A_0|B_1) = \frac{P(B_1|A_0)P(A_0)}{P(B_1|A_0)P(A_0) + P(B_1|A_1)P(A_1)}$$

$$= \frac{0.25 \cdot 0.6}{0.25 \times 0.6 + 0.3 \cdot 0.4} = 0.556$$

$P(A_1|B_1) = 0.444$, so given B_1, $\hat{A}_0$ is our choi

$$P(A_0|B_2) = \frac{P(B_2|A_0)P(A_0)}{P(B_2|A_0) \cdot P(A_0) + P(B_2|A_1)P(A_1)}$$

$$= \frac{0.25 \cdot 0.6}{0.25 \times 0.6 + 0.6 \cdot 0.4} = 0.385$$

$P(A_1|B_2) = 0.615$, so given B_2, we chose $\hat{A}_1$

$[0\ 0\ 1]$ as choices

2). Perror of both?

MLE

$$P(B_j) = \sum_{i \in (0,1)} P(B_j|A_i)P(A_i)$$

$$P(B_0) = 0.5 \times 0.6 + 0.1 \times 0.4 = 0.34$$

$$P(B_1) = 0.27$$

$$P(B_2) = 0.39$$

$P(B) = [0.34, 0.27, 0.39]$

~~$P(E) = 0.34 \cdot 0.4 + 0.27 \cdot 0.6 + 0.39 \cdot 0.16$~~

$P_{error} = \sum P(A_j) \times P(B_i | A_j)$ where j is not the decision

$P(A_1) \cdot P(B_0 | A_1) = 0.04$

$P(A_0) \cdot P(B_1 | A_0) = 0.15$

$P(A_0) \cdot P(B_2 | A_0) = 0.15$

P_{error} for MLE $= 0.34 \cdot 0.04 + 0.27 \times 0.15 + 0.39 \cdot 0.15$

$= 0.113$ for MLE

for MAP

~~$P_{error} = 0$~~

$P(A_1) \cdot P(B_0 | A_1) = 0.04$

$P(A_1) \cdot P(B_1 | A_1) = 0.12$

$P(A_0) \cdot P(B_2 | A_0) = 0.15$

P_{error} for MAP $= 0.34 \times 0.04 + 0.27 \times 0.12 + 0.39 \times 0.15$

$= 0.1045, .105$

for MAP $\cdot P_{error}$

3) rule 3: $0.5 \cdot P_{\text{error for MLE}} + \ldots$

$0.5 \cdot P_{\text{error for MAP}}$

$\cong 0.109$

Scanned with CamScanner