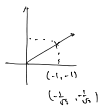
Final Exam

April 13, 2017 9:49 AM

1a)



b)

x_1	x_2	x_3	x_4	μ_1	μ_2	μ_3
1	2	2	2	1	1.666	3
1	1	2	2	1	1	2
1	2	2	2	1	2	2
1	2	2	2	1	2	2

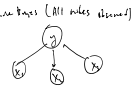
2) Naive Bayes

$P(X,y) = P(X|y)P(y)$

$P(X|y) = \frac{P(X,y)}{P(x)} = \frac{P(X,y)}{\sum_y P(X,y)}$

$= \frac{P(X,y)}{P(X,y=0)+P(X,y=1)}$

Naive Bayes (All nodes observed)



$P(X|y) = P(x_1|y)\,P(x_2|y)\ldots P(x_3|y)$

$P(X|y=0) = (2)(\frac{1}{5})(4) = 40$

$P(X|y=1) = (2)(3)(20) = 120.$

$P(y=1) = 0.4$

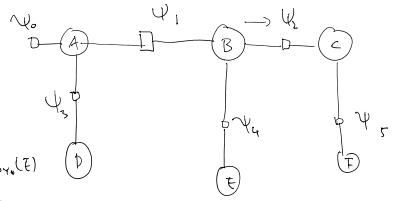
$P(y=0) = 0.6.$

$P(y=1|X) = \frac{40}{40+20} = \frac{2}{3}.$

$y=0|X) = 1 - P(y=1|X) = \frac{1}{3}$

Q4

$\mu_{B\to\psi_2}(B=0) = ?$



$\psi_{E\to\psi_4} = \begin{bmatrix}1\\1\end{bmatrix}$

$\psi_{\psi_4\to D}(B) = \sum_E \psi_4(B,E)\,\mu_{E\to\psi_4}(E)$

$= \begin{bmatrix}0.5 & 0.25\\ 0.75 & 0.75\end{bmatrix}\begin{bmatrix}1\\1\end{bmatrix} = \begin{bmatrix}1\\1\end{bmatrix}$

$\mu_{\psi_1\to D} = \sum_A \psi_1(A,B)\,\mu_{A\to\psi_1}$

$A = 0 \quad 1$

$B: 0 \quad \begin{bmatrix}0.1 & 0.9\\ 0.1 & 0.9\end{bmatrix}\begin{bmatrix}0.4\\0.6\end{bmatrix} = \begin{bmatrix}0.1\\0.9\end{bmatrix}$

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Since row sums $= 1$

$P(B|A)$

$\psi_{B\to\psi_2} = \begin{bmatrix}1\\1\end{bmatrix}\cdot\begin{bmatrix}0.1\\0.9\end{bmatrix} = \begin{pmatrix}0.1\\0.9\end{pmatrix}.$

b)

Observed $\psi_{E\to\psi_4} = \begin{bmatrix}1\\0\end{bmatrix}$

$\mu_{\psi_4\to B} = \begin{bmatrix}0.5 & 0.5\\ 0.25 & 0.25\end{bmatrix}\begin{bmatrix}1\\0\end{bmatrix} = \begin{bmatrix}1\\0\end{bmatrix}$

$\mu_{B\to\psi_2}(B=0) = 0.1.$

$\mu_{B\to\psi_2}(B=1) = 0$

c) $P(B|E=0) = \mu_{\psi_4\to B}\,\mu_{\psi_2\to B}\,/\,\mu_{\psi_1\to B}.$

$\mu_{\psi_2\to B} = \sum_C \psi_2(B,C)\,\mu_{C\to\psi_2}$

Since row sums $= 1$.

$\begin{bmatrix}P(C=0|B=0) & P(C=1|B=0)\\ P(C=0|B=0). & P(C=1|B=1)\end{bmatrix} = P(C|B)$

$\mu_{\psi_2\to B} = \begin{bmatrix}0.125 & 0.875\\ 0.5 & 0.5\end{bmatrix}\begin{bmatrix}1\\1\end{bmatrix} = \begin{bmatrix}1\\1\end{bmatrix}$

$P(B|E=0) = \begin{bmatrix}1\\0\end{bmatrix}\cdot\begin{bmatrix}1\\1\end{bmatrix}\begin{bmatrix}0.1\\0.9\end{bmatrix} = \begin{bmatrix}0.1\\0\end{bmatrix}$

$Z = 0.1 + 0 = 0.1$

$\psi_{\psi_4} = P(E|B)$

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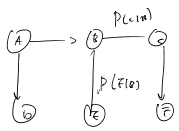
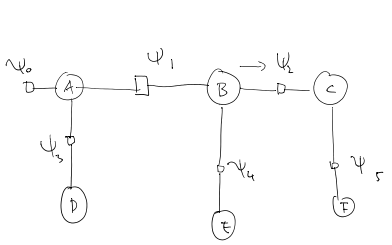
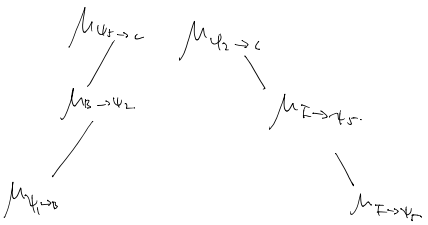


4e) $P(C) = \mu_{\psi_5\to C}\,\mu_{\psi_2\to C}$

$\mu_{\psi_5\to C}$ $\mu_{\psi_2\to C}$





Q5 (SAMPLING STRATEGIES / ITERATIVE NODE)

(22a)

$$\frac{0.2^{k-1}\,0.32}{(0.2^{k-1})(0.32) + 0.75^{k-1}\,0.15}$$

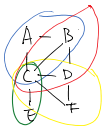
b) 61.7 %

c) 75.5 %

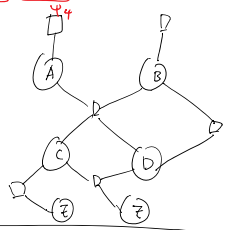
3a) $\underbrace{P(A)P(B)P(C|A,B)}_{\psi_1}\underbrace{P(D|B)}_{\psi_2}\underbrace{P(F|C,D)}_{\psi_3}\underbrace{P(E|C)}_{\psi_4}$

b) TF?T

c)



d)



4f)

$$\mu_{\psi_4\to B}(B) = \begin{bmatrix} 0.8 & 0.5 \\ 0.25 & 0.75 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.8 \\ 0.25 \end{bmatrix}$$

$$\mu_{\psi_1\to B}(B) = \begin{bmatrix} 0.1 \\ 0.9 \end{bmatrix}$$

$$\mu_{\psi_2\to B}(B) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

correction

$$P(B|E=0) \propto \begin{bmatrix} 0.08 \\ 0.225 \end{bmatrix}$$

6a) $\frac{1}{2}, \frac{1}{2}, \frac{2}{3}, \frac{1}{3}$

b) $\frac{9}{20}, \frac{11}{20}, \frac{3}{8}, \frac{2}{5}$.

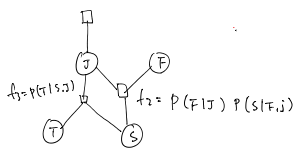
c) $\frac{2}{5}, \frac{3}{8}, \frac{4}{8}, \frac{1}{5}$.

L23)

(a) 70.8 %

2a) "in the most likely joint outcome) ☆ Question is changed

b) 79.7 %



☆ NO MESSAGING PASSING on JUNCTION TREE OR LOOPY BELIEVE