

$$P(w) = P(w|o) \times P(o)$$

$$\Rightarrow P(w=+) = P(w=+|o=+) \times P(o=+) + P(w=+|o=-) \times P(o=-) =$$

$$0.9 \times 0.5 + 0.2 \times 0.5 = 0.2 + 0.45 = 0.65$$

$$P(w=-) = 0.1 \times 0.5 + 0.8 \times 0.5 = 0.45$$

w	
+	0.65
-	0.45

$$P(+o, -w, +f, -r, +a) = P(+o) P(-w|+o) P(+f|+o, -w) P(-r)$$

$$= 0.5 \times 0.1 \times 0.6 \times 0.8 \times 0.7 = 0.0168$$

ج) به شرط داشتن پدر از جدا مستقلی شویم پس درست

2- نادرست: زیرا با داشتن فرزندان، والدین مستقلی هستند

3- نادرست: با داشتن پدر، زنان از فرزندان مستقلی هستند: نادرست

4- والدین زن و مرد را بدون ارتباط در حالت جدا از هم مستقل هستند

$$P(+o|-A) = P(+o, -A) \times P(-A)$$

$$P(+o, -A) = \sum_{f, w, r} P(-A, f, w, r, o) =$$

$$\sum_{f, w} P(o) P(r) P(w|o) P(f|+o, w) P(-A|r, f)$$

$$= \sum_{f, w} P(o) P(w|o) P(f|+o, w) \sum_r \frac{P(r) P(-A|r, f)}{P(-A|f)}$$

$$= \sum_f P(o) P(-A|f) \sum_w [P(w|o) P(f|+o, w)]$$

$$P(+o|-A) = \frac{P(+o, -A)}{\sum_o P(+o, -A)} = \frac{P(+o) \times P(-A|+o)}{P(+o) \times P(-A|+o) + P(-o) \times P(-A|-o)}$$

$$= \frac{P(+o) \times P(-A|+o)}{P(+o) \times P(-A|+o) + P(-o) \times P(-A|-o)}$$

HMM

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کتاب زبان

transition: q a h v

$$\begin{bmatrix} q & a & h & v \\ a & 0.1 & 0.1 & 0.1 \\ h & 0.1 & 0.1 & 0.1 \\ v & 0.1 & 0.1 & 0.1 \end{bmatrix}$$

Emission: B H P L

$$\begin{bmatrix} q & B & H & P & L \\ a & 0.1 & 0.1 & 0.1 & 0.1 \\ h & 0.1 & 0.1 & 0.1 & 0.1 \\ v & 0.1 & 0.1 & 0.1 & 0.1 \end{bmatrix}$$

Emission

$$\pi = \lim_{n \rightarrow \infty} \pi^n = [0.125, 0.125, 0.125, 0.125]$$

$$\alpha_1(q) = 0.125 \times 0.1 = 0.0125 \quad \alpha_1(a) = \alpha_1(h) = 0 \quad \alpha_1(v) = 0.125 \times 0.12 = 0.015$$

$$\alpha_2(q) = \sum_m \alpha_1(m) \cdot E[m, B]$$

$$\alpha_2(q) = \sum_m \alpha_1(m) \cdot E[m, B] = (0.125 \times 0.1 + 0.015 \times 0.12) \times 0.1 = 0.0125$$

$$\alpha_2(a) = (0.125 \times \dots) \times 0 = 0 = \alpha_2(h)$$

$$\alpha_3(q) = (0.125 \times 0.1 + 0.015 \times 0.12) \times 0.12 = 0.0026$$

$$\alpha_3(q) = (0.0026 \times 0.1 + 0.0026 \times 0.12) = 0.00068$$

$$\alpha_3(h) = \alpha_3(a) = 0$$

$$\alpha_3(v) = (0.0026 \times 0.1 + 0.0026 \times 0.12) \times 0.1 = 0.000312$$

$$\alpha_4(q) = \alpha_4(v) = 0$$

$$\alpha_4(a) = (0.00068 \times 0.1 + 0.000312 \times 0) \times 1 = 0.000068$$

$$\alpha_4(h) = (0 \times \dots + 0.000312 \times 0.12) \times 0.1 = 0.0000372$$

$$\text{result} = 0.0000372 + 0.000068 = 0.0001052$$

$$P_2(i) = \frac{\alpha_2(i) \beta_2(i)}{\sum_j \alpha_2(i) \beta_2(j)}$$

$$P_2(q) = P_2(a) = P_2(h) = P_2(v) = 1$$

(2)

$$\beta_3^{(9)} = \sum_{j=1}^4 a_{3j}(H) \beta_2(j) = 0/1 \times 0 + 0/1 \times 1 + 0/1 \times 0 + 0/1 \times 0 = 0/1$$

$$\beta_3(1) = 0/2 \times 0/1 = 0/02$$

$$\beta_2(5) = 0/1 \times 0 + 0/2 \times 0/1 + 0/1 \times 0/1 \times 0/02 = 0/015$$

$$\beta_2(1) = 0/2 \times 0/2 \times 0/1 + 0/1 \times 0/1 \times 0/02 = 0/0124$$

$$\Rightarrow \gamma_2(5) = \frac{0/072 \times 0/015}{0/012 \times 0/015 + 0/026 \times 0/0124} = 0/78$$

$$v_1(5) = 0/2 \quad v_1(a) = v_1(h) = 0 \quad v_1(v) = 0/05$$

$$v_2(5) = 0/64 \quad v_2(v) = 0/02$$

$$v_3(5) = \max(0/064 \times 0/1, 0/02 \times 0/2) \times 0/2 = 0/00512$$

$$v_3(1) = \max(0/064 \times 0/1, 0/02 \times 0/6) \times 0/1 = 0/0224$$

$$v_4(a) = \max(0/12 \times 10^{-3} \times 0/1, 0/0224 \times 0) = 0/12 \times 10^{-3}$$

$$v_4(h) = \max(0/12 \times 10^{-3} \times 0, 0/0224 \times 0/2) \times 0/1 = 0/000448$$

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