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 y_1, y_2, \dots, y_n x

$$\log \text{it}(E[Y_i|x_i]) = x_i^T \beta \quad ()$$

 $P \times 1 \quad \beta$

$$f(Y|X, \beta)$$

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$$f(Y, X | \Omega) = f(Y|X, \beta) f(X|\gamma) \quad ()$$

$$\Omega = (\beta, \gamma)$$

$$f(X; Y)$$

$$\beta$$

$$\beta$$

$$\beta$$

$$x$$

$$x$$

$$x$$

$$A$$

$$f(Y, X, A | \Omega^*) = f(Y | X, A, \beta^*) f(X, A | \gamma^*)$$

$$\Omega^* = (\beta^*, \gamma^*)$$

$$E(Y | X, A) = \int f(Y | X, A, \beta^*) f(X, A | \gamma^*) dP$$

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$$f(Y, X, A | \theta) = f(A | Y, X, \alpha) f(Y | X, \beta) f(X | \gamma)$$

$$\theta = (\alpha, \beta, \gamma)$$

$$\sum_i l_{a,y,x}(\theta | a_i, y_i, x_i) = \sum_i \{ l_{a|y,x}(\alpha | a_i, y_i, x_i) + l_{y|x}(\beta | y_i, x_i) + l_x(\gamma | x_i) \}$$

X_i

$$\prod f(Y_i | X_i, \beta)$$

$$\beta$$

$$\gamma$$

$$\alpha$$

$$\beta$$

$$L_{a,y,x}^0(\theta) = \sum_i \log \{ L_{a|y,x}(\alpha | a_i, y_i, x_i) \times L_{y|x}(\beta | y_i, x_i) L_x(\gamma | x_i) \}$$

$$X = (x_1, x_2, \dots, x_p)$$

$$X_{miss,i}$$

$$X_{miss,i}$$

$$\beta \quad X \quad \gamma = (\gamma_1, \gamma_2, \dots, \gamma_r)$$

$$\text{EM} \quad X \quad \gamma \quad r = 2^3 - 1 = 7$$

$$() \quad c_1, \dots, c_p$$

$$\text{E} \quad \theta^{(t)} \quad L_{a,y,x}(\theta|a,Y,X) \quad r = c_1 \times \dots \times c_p - 1$$

$$f(Y|X, \beta)$$

$$f(X|Y) \quad f(A|X, Y, \alpha)$$

$$(\beta) \quad \gamma, \alpha$$

$$X_{obs,i} \quad (y_i, x_{obs,i}, a_i) \quad X$$

$$P \quad i \quad X_i \quad r+1 \quad \gamma$$

$$X_i \quad x$$

$$Q(\theta|\theta^{(t)}) \quad f(A|X, Y, \alpha) \quad P$$

$$:()$$

$$Q(\theta|\theta^{(t)}) = \sum_{i=1}^n \sum_{j=1}^{r+1} w_{ij}^{(t)} L_{a,y,x}(\theta|a_i, y_i, x^j)$$

$$= \sum_{i=1}^n \sum_{j=1}^{r+1} w_{ij}^{(t)} \{l_{a|y,x}(\alpha|a_i, y_i, x^j) + l_{y|x}(\beta|y_i, x^j) + L_x(\gamma|x^j)\} \quad ()$$

$$i \quad j \quad x^j$$

$$L_{a,y,x}(\theta|a_i, y_i, x_i)$$

$$i \quad \theta$$

$$x^j = x_{obs,i} \quad X_i$$

$$x^j$$

$$w_{ij}^{(t)} = p(x^j|a_i, y_i, x_{obs,i}, \theta^{(t)})$$

$$i \quad j$$

$$W_{it}^{(t)} = 1 \quad t$$

$$w_{ij}$$

$$x^j \quad X_{obs,i}$$

$$x^j \quad)$$

$$X_{obs,i} \quad X_{obs,i}$$

$$x^j$$

$$.$$

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$$W_{ij}^{(t)} = P(x^j | a_i, y_i, x_i, \theta^{(t)})$$

$$= \begin{cases} 0 & \text{if } x^j \text{ is not compatible with } x_i \\ \frac{p(y_i | x_i^j) p(a_i | x_i^j, y_i) p(x_i^j)}{\sum_{k \in \text{obs}_i} p(y_i | x_i^k) p(a_i | x_i^k, y_i) p(x_i^k)} & \text{if } x^j \text{ is compatible with } x_i \end{cases} \quad ()$$

p $X_{obs,i}$ x^j

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 $f(A|X, Y, \alpha), f(X; \delta)$

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 $f(A|Y, X)$

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