Grundlagen der künstlichen Intelligenz: Hausaufgabe 6

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Aufgabe 1 - Hidden Markov-Prozess

Die Anfangsbedingung wird mit $P(X_0 = w) = 0.5$ angenommen.

(a)

$$P(X_1 = \cdots = X_k = w, X_{k+1} = f \mid X_0 = f) = P(X_{k+1} = f \mid X_k = w) \cdot \prod_{i=1}^{k} P(X_{i+1} = w \mid X_i = w) \cdot P(X_1 = w \mid X_0 = f)$$

$$= 0.2 \cdot 0.8^{k-1} \cdot 0.1$$

(b)

$$p_t = P(X_t \mid Y_{1:t})$$
$$= \alpha p(X_t, Y_t \mid Y_{1:t-1}) = \alpha p(Y_t \mid X_t, Y_{1:t-1}) p(x_t, e_{1:t-1})$$
$$= \alpha p(Y_t, X_t) p(X_t, Y_{1:t-1})$$
$$p(X_t \mid Y_{1:t-1}) = \sum_{x_t} p(X_t, X_t \mid Y_{1:t-1}) = \sum_{x_t} p(X_t \mid X_{t-1}) p(X_t \mid Y_{1:t})$$
$$p(X_t \mid Y_{1:t}) = \alpha p(Y_t \mid X_t) \sum_{x_t} p(X_t \mid X_{t-1}) p(X_t \mid Y_{1:t-1})$$
$$= \alpha p(Y_t = g \mid X_t = w) \sum_{x_t} p(X_t \mid X_{t-1}) p(X_t \mid Y_{1:t-1})$$
$$= \alpha 0.3 \cdot \sum_{x_t} p(X_t \mid X_{t-1}) p(X_t \mid Y_{1:t-1})$$

(c)

(d)

(e)

Aufgabe 2 - Hidden Markov-Modell

(a)

(b)

(c)

(d)