

(1)

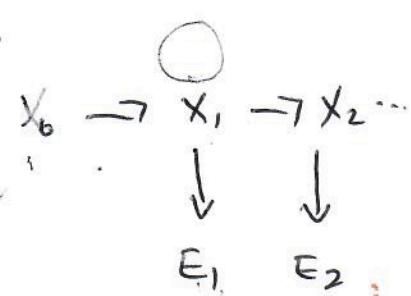
Transfer

x_{t-1}	x_t	$P(x_t x_{t-1})$
h	h	0.7
h	f	0.3
f	h	0.4
f	f	0.6

Emission

x_t	e_t	$P(e_t x_t)$
H	Dry	0.1
H	Cold	0.4
H	Normal	0.5
F	Dry	0.6
F	Cold	0.3
F	Normal	0.1

$$x_0 = [0.6, 0.4]$$



$$P(x_t) = P(x_t | e_{1:t}) = \sum_{x_{t-1}} P(x_t | x_{t-1}) P(x_{t-1})$$

$$P(x_1) = \sum P(x_1 | x_0) P(x_0)$$

$$\text{Evidence: } P(x_t | e_{1:t}) = \alpha P(e_{1:t} | x_t) P(x_t)$$

By Bayes

$$= \frac{\alpha P(e_t | x_t) \cdot P(x_t)}{P(e_{1:t})}$$

↑

unknown

$$\text{Day 1: } x_0 \rightarrow [0.6, 0.4]$$

$$P(x_1) = \sum_{x_0} P(x_1 | x_0) \cdot P(x_0)$$

health fine
 $= [h \rightarrow h, f \rightarrow h, h \rightarrow f + f \rightarrow f]$

$$= [0.7 \cdot 0.6 + 0.4 \cdot 0.4, 0.3 \cdot 0.6 + 0.6 \cdot 0.4]$$

$$= [0.58, 0.42]$$

$$\text{Evidence } P(X_1 \mid \text{normal}) = d P(\text{Normal} \mid X_1) \cdot \Phi(X_1)$$

②

$$= d[0.5, 0.1] [0.58, 0.42]$$

$$= d[0.5 * 0.58, 0.1 * 0.42]$$

$$= d[0.29, 0.042] \quad d = 0.29 + 0.42 \\ = 0.332$$

$$\text{Normalizing} \quad \frac{[0.29, 0.42]}{d \quad d}$$

$$= [0.87, 0.13]$$

$$P(X_1 = \text{health} \mid \text{normal}) = \frac{P(\text{normal} \mid \text{health}) \cdot P(\text{health})}{P(\text{normal})}$$

$$= \frac{0.5 \cdot 0.58}{0.332} = 0.87$$

$$P(X_2 \mid E_{1:t} = \text{normal, dysy})$$

$$P(X_2 \mid \text{normal}) = \sum_{X_1} P(X_2 \mid X_1) \cdot P(X_1 \mid \text{normal})$$

$$= [0.7 * 0.87 + 0.4 * 0.13, \frac{0.3 * 0.87 + 0.6 * 0.13}{\text{from}}]$$

$$= [0.661, 0.339]$$

$$\text{Evidence: } P(X_2 \mid \text{normal, dysy}) =$$

$$\begin{aligned}
 &= \alpha P(\text{days}_2 | x_2) P(x_2 | \text{normal}) \\
 &= \alpha [0.1 * 0.661, 0.6 * 0.339] \\
 &= \alpha [0.0661, 0.2034] \\
 \alpha &= 0.0661 + 0.2034 = 0.2695
 \end{aligned} \tag{3}$$

$$P(x_2 = \text{health} | n, d) = \frac{0.1 * 0.661}{0.2695} = 0.245$$

$$P(x_2 = \text{Fever} | n, d) = \frac{0.6 * 0.339}{0.2695} = 0.755$$

$$P(x_2 | n, d) = [0.245, 0.755]$$

$$\overbrace{P(x_3 | n, d, n)}$$

$$\begin{aligned}
 P(x_3 | n, d) &= \sum P(x_3 | x_2) \cdot P(x_2 | n, d) \\
 &= [0.7 * 0.245 + 0.4 * 0.755, 0.3 * 0.755 + 0.6 * 0.245] \\
 &= [0.47, 0.53]
 \end{aligned}$$

Evidence

$$\begin{aligned}
 P(x_3 | n, d, n) &= \alpha P(n | x_3) \cdot P(x_3 | n, d) \\
 &= [0.5 * 0.47, 0.1 * 0.53]
 \end{aligned}$$

(4)

$$\lambda = 0.24 + 0.053 = 0.293$$

$$= \left[\frac{0.24}{0.293}, \frac{0.053}{0.293} \right]$$

$$= [0.82, 0.18]$$



$$P(X_3=H|n,d,n) \quad P(X_3=F|n,d,n)$$

Point Equivalently incorporate evidence in $P(X_4|n,d,n,c)$

$$\begin{aligned} P(X_4|n,d,n,c) &= \alpha P(\text{cold}|x_3) \cdot P(X_4|n,d,n) \\ &= \alpha P(\text{cold}|x_3) \sum_{x_3} P(X_4|x_3) P(X_3|n,d,n) \end{aligned}$$

What is your belief in X_4 without evidence?

$$P(X_4|n,d,n) = \sum P(X_4|x_3) \cdot P(X_3|n,d,n)$$