Tutorial-7

(Bayesian network)

travel → foreign purchase

↳ fraud ↗

→ increased prob. of travel makes fraud more likely. (travel cause fraud)

→ increased prob. of foreign purchase makes fraud more likely. Foreign purchase is evidence for fraud.

→ travel & fraud can cause foreign purchase. Travel explains foreign purchase & so is evidence against fraud.

True	False
0.05	0.95

travel	True	False
True	0.01	0.99
False	0.002	0.998

Travel	Fraud	True	False
True	True	0.9	0.1
False	True	0.1	0.9
True	False	0.9	0.1
False	False	0.01	0.99

1) travel = ?, F.P. = true, fraud = ? [classify hidden variables]
(Foreign purchase)

$P(fraud = true \mid F.P. = true)$

$= \alpha [P(fraud = true, travel = true) \times P(FP = true)]$

$= \alpha [P(fraud = true \mid travel = false) \times P(FP = true \mid travel = false, fraud = true) \times P(travel = false)]$

$= \alpha [0.01 \times 0.9 \times 0.05 + 0.002 \times 0.1 \times 0.95]$

$= 0.00064\,\alpha$

similarly,

$P(fraud = false \mid FP = true)$

$= \alpha [0.99 \times 0.9 \times 0.05 + 0.998 \times 0.01 \times 0.95]$

$= 0.054051\,\alpha$

$$\alpha = \frac{1}{0.00064 + 0.05403} = 18.291$$

$P(\text{feaud} = \text{true} \mid FP = \text{true})$

$= 0.00064\,\alpha = 0.0117$

$\therefore P(\text{feaud} = \text{true} \mid FP = \text{true}) = 1.17\%$

2) $P(\text{feaud} = \text{true} \mid FP = \text{true}, \text{travel} = \text{true})$

$= \alpha \times 0.00045$

$P(\text{feaud} = \text{false} \mid FP = \text{true}, \text{travel} = \text{true})$

$= \alpha \times 0.04455$

$$\therefore \alpha = \frac{1}{0.04455 + 0.00045} = 22.222$$

$P(\text{feaud} = \text{true} \mid FP = \text{true}, \text{travel} = \text{true})$

$= \alpha \times 0.00045$

$= 22.222 \times 0.00045$

$= 0.01$

$= 1\%$ //