Tutorial 7

Bayesian Network

Travel → Foreign Purchase.

↘ ↗

Fraud

1) Increased Probability of travel makes fraud more likely.
2) Increased probability of foreign purchase makes fraud more likely.
3) Travel and fraud can cause foreign purchase. Travel explains foreign purchase and so is evidence against fraud.

4)

True	False
0.05	0.95

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

Travel	True	False
True	0.01	0.99
False	0.002	0.998

5) Travel = ?, F.P. = True, Fraud = ? {Classify Hidden variables}

$$P(fraud = true / F.P = true) = \alpha [P(fraud = true) \times P(travel = true) \times P(FP = true)]$$

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$= \alpha [P(fraud = true | travel = false) \times P(FP = true)$

$travel = false, fraud = true) \times P(travel = false)$

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

$= 0.00064\alpha$

Similarly, $P(fraud = false / FP = true)$

$= \alpha [0.99 \times 0.9 \times 0.5 + 0.998 \times 0.01 \times 0.95)$

$= 0.05405\alpha$

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

$P(fraud = true / FP = true) = 0.00064 \times \alpha = 0.0117$

$\therefore P(fraud = true / FP = true) = 1.17\%$

2) $P(fraud = true / FP = true), travel = true)$

$= \alpha \times 0.00045$

$P(fraud = true / (FP = true, travel = true))$

$= \alpha \times 6.00045$

$= 22.222 \times 0.00045 = 0.01 = 1\%$

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