COMP 4190 Assignment 2: Bayesian Networks

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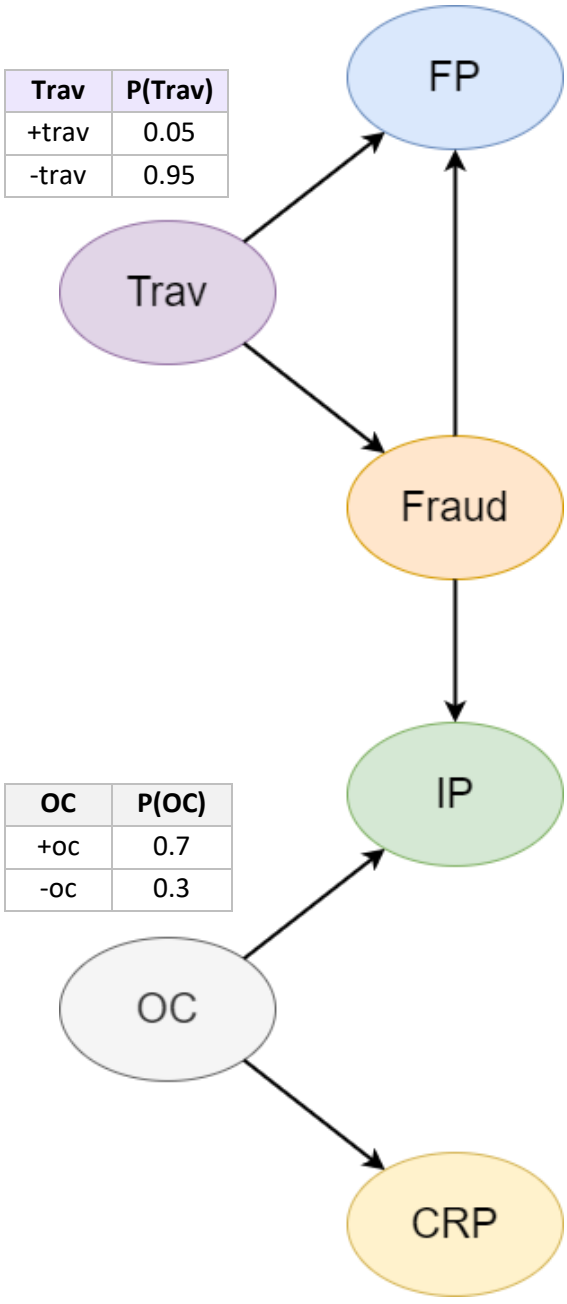
2-a: Bayes Network to identify fraudulent transactions



Trav	P(Trav)
+trav	0.05
-trav	0.95

Trav	Fraud	FP	P(FP | Trav, Fraud)
+trav	+fraud	+fp	0.9
+trav	+fraud	-fp	0.1
+trav	-fraud	+fp	0.9
+trav	-fraud	-fp	0.1
-trav	+fraud	+fp	0.1
-trav	+fraud	-fp	0.9
-trav	-fraud	+fp	0.01
-trav	-fraud	-fp	0.99

Trav	Fraud	P(Fraud | Trav)
+trav	+fraud	0.01
+trav	-fraud	0.99
-trav	+fraud	0.004
-trav	-fraud	0.996

OC	P(OC)
+oc	0.7
-oc	0.3

OC	Fraud	IP	P(IP | OC, Fraud)
+oc	+fraud	+ip	0.02
+oc	+fraud	-ip	0.98
+oc	-fraud	+ip	0.01
+oc	-fraud	-ip	0.99
-oc	+fraud	+ip	0.011
-oc	+fraud	-ip	0.989
-oc	-fraud	+ip	0.001
-oc	-fraud	-ip	0.999

OC	CRP	P(CRP | OC)
+oc	+crp	0.1
+oc	-crp	0.9
-oc	+crp	0.001
-oc	-crp	0.999

2-b: Answering queries by using the variable elimination code

- Prior Probability that the current transaction is Fraud

  Query: P(Fraud)

  Output generated by the code:

```
Initial factors:
P(Trav)
P(Fraud|Trav)
P(OC)
P(CRP|OC)
P(FP|Trav,Fraud)
P(IP|OC,Fraud)

After eliminating Trav:
P(OC)
P(CRP|OC)
P(IP|OC,Fraud)
f(Fraud,FP)

After eliminating FP:
P(OC)
P(CRP|OC)
P(IP|OC,Fraud)
f(Fraud)

After eliminating IP:
P(OC)
P(CRP|OC)
f(Fraud)

After eliminating OC:
f(Fraud)
f(CRP)

After eliminating CRP:
f(Fraud)

Solution:
P(Fraud)
  +fraud  | 0.00430  |
  -fraud  | 0.99570  |
```

  So, the probability that the current transaction is Fraud = P(+fraud) = 0.00430

- Probability that the current transaction is fraud once we verify that it is a foreign transaction, but not an internet purchase and that the card holder purchased computer related accessories in the past week

  Query: P(Fraud | +fp, -ip, +crp)

  Output generated by the code

```
Initial factors:
P(Trav)
P(Fraud|Trav)
P(OC)
P(+crp|OC)
P(+fp|Trav,Fraud)
P(-ip|OC,Fraud)

After eliminating Trav:
P(OC)
P(+crp|OC)
P(-ip|OC,Fraud)
f(+fp,Fraud)

After eliminating OC:
f(+fp,Fraud)

Solution:
P(Fraud|+fp,-ip,+crp)
  +fraud  | 0.01513  |
  -fraud  | 0.98487  |
```

  So, probability that the current transaction is fraud with given evidence

  = P(+fraud | +fp, -ip, +crp) = 0.01513