

Prediction using Bayesian Networks

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- Will I be moving to a new apartment?
- Considering a 2 year span
- Some more probable events and some less probable

Creating the network

- What causes me to move?
 - Change in income
 - lower
 - higher
 - House gets unlivable
 - Noisy neighbours
 - etc.
- And what causes these things?

- How to represent money gain, money loss or money income that stays the same?
 - Creating multiple boolean nodes that are dependent of eachother
 - Creating a node with multiple values(not boolean)
- Can noisy OR be implemented?
 - Probably not all the time!

Models compared

Con: we now have 2^3 probabilities in regards to moving, from which some aren't even possible combinations.

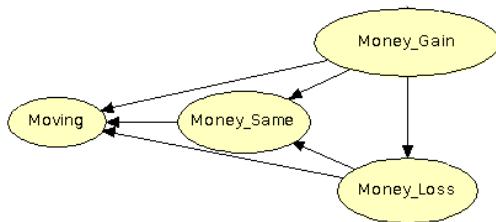


Figure: Using booleans to represent money.

Models compared (2)

Now only 3 probabilities to consider

Con: How can Noisy OR be used?

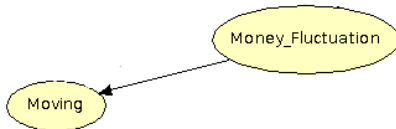


Figure: Money fluctuation represented as 3 nodes.

The final network: Moneygain

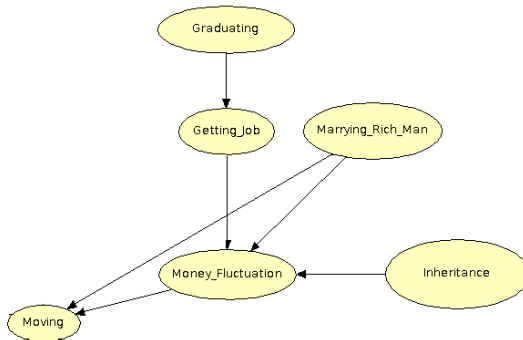


Figure: Money dependencies

The tables(1)

	$\mu(\textit{Graduating})$
1	0.8
0	0.2

Table: Chance of graduating

	$\mu(\textit{Marrying_rich_man})$
1	0.01
0	0.99

Table: Chance of marrying rich man

The tables(2)

	$\mu(Inheritance)$
1	0.1
0	0.9

Table: Chance of inheritance

Graduating	$\mu(Job)$	$\mu(\neg Job)$
1	0.8	0.2
0	0.2	0.8

Table: Chance of graduating

The tables(3)

M	I	G	$\mu(\text{more})$	$\mu(\text{same})$	$\mu(\text{less})$
0	0	0	0.1	0.6	0.3
0	0	1	0.8	0.2	0
0	1	0	0.3	0.4	0.3
1	0	0	0.9	0.1	0
0	1	1	0.8	0.1	0.1
1	0	1	1	0	0
1	1	0	0.9	0.1	0
1	1	1	0.99	0.01	0

Table: Probability of money fluctuation

The final network: Noisiness

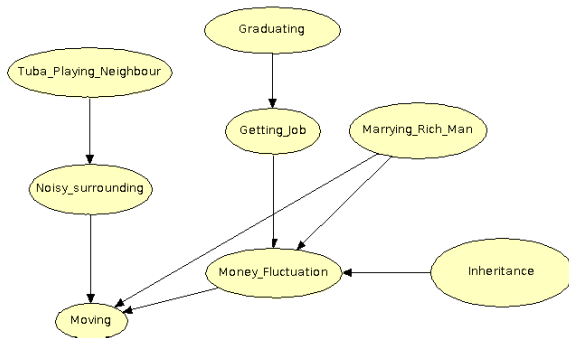


Figure: Noisiness dependencies

The tables

	$\mu(Tuba_neighbour)$
1	0.02
0	0.98

Table: Chance of tuba playing neighbour

Tuba	$\mu(Noise)$	$\mu(\neg Noise)$
1	0.98	0.02
0	0.5	0.5

Table: Chance of noise

The final network: Unlivability

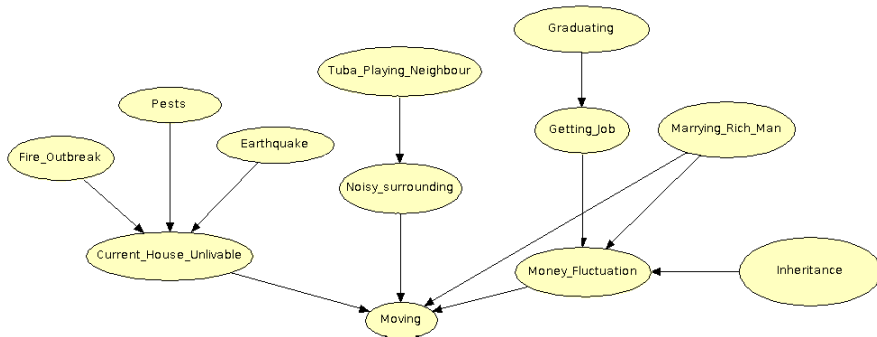


Figure: Unlivable dependencies

The tables

	$\mu(\textit{Fire})$
1	0.01
0	0.99

Table: Chance of fire

	$\mu(\textit{pest})$
1	0.2
0	0.8

Table: Chance of pests

	$\mu(\textit{Earthquake})$
1	0.3
0	0.7

Table: Chance of Earthquake

- Not all elements are considered (More variables possible when considering money gain)
- How to implement noisy OR in case of 3 possible values instead of boolean?
- Using noisy OR to indicate house livability seems to work very well

noisy OR implemented

E = Earthquake, P = Pest, F = Fire, U = Unlivable conditions

E	P	F	$\mu(U)$	$\mu(\neg U)$
0	0	0	0	1
0	0	1	0.6	0.4
0	1	0	0.8	0.2
1	0	0	0.001	0.999
0	1	1	0.92	$0.4 * 0.2 = 0.08$
1	0	1	0.6004	$0.999 * 0.4 = 0.3996$
1	1	0	0.8002	$0.999 * 0.2 = 0.1998$
1	1	1	0.92008	$0.4 * 0.2 * 0.999 = 0.07992$

Table: Probability of Unlivable conditions arising

Probability of moving

- probability of moving is dependent of money fluctuation, noisiness of surroundings, livability of house and if I will be getting married
- 24 different combinations of events
- Problematic pairs like Marrying rich man and Low income occur

The table

Marrying	Unlivable	Noisy	Money	$\mu(Moving)$	$\mu(\neg Moving)$
0	0	0	L	0.7	0.3
0	0	0	S	0	1
0	0	0	H	0.7	0.3
0	0	1	L	0.5	0.5
0	0	1	S	0.1	0.9
0	0	1	H	0.7	0.3
0	1	0	L	0.8	0.2
0	1	0	S	0.85	0.15
0	1	0	H	0.9	0.1
...
1	0	1	H	0.9	0.1
1	1	0	L	0.9	0.1
1	1	0	S	0.95	0.05
1	1	0	H	0.95	0.05
1	1	1	L	0.9	0.1
1	1	1	S	0.99	0.01
1	1	1	H	1	0

Chance of moving

- Chance of moving: 54.6
- Seems somewhat low given the probability distribution
 - Only 57 percent chance of earning more
 - Most of the nodes are biased towards reasons to move
 - But are very small chances of happening
- More nodes (that are more relevant) could give a more accurate result of moving probability

- Chance of moving given tuba playing neighbours and earning more: 73.61
- Chance of moving given pests and earning the same: 56.63
- Chance of getting a job given moving and earning the same: 40.82
 - Seems a bit much...
- Chance of graduating when not getting a job: 50