TDT4171 Artificial Intelligence Methods

Exercise 1

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Contents

I 5-card Poker Hands

a Atomic events

The number of different poker hands available, is the combination of 52 cards, choosen 5 at a time. [1]

$\binom{52}{5} = 2598960$

b The probability of an atomic event

The probability of each atomic event is equal, given the dealer is fear. This means the probability of each event is $1/2598960 = 0.0000038477$

c The probability of special hands

c.1 The probability of a Royal Straight Flush

There are four possible different Royal Straight Flush-hands in poker. Since their probability each are equal to all other possible hands, the probability of one of them, are $0.0000038477 \cdot 4 = 0.00015391$

c.2 The probability of a Three of a Kind

In order to get Three of a kind, you need to get 3 cards of the same value, and 2 of any other value. First, we need to be given one card of value and color. Then we need to be delt 2 more of this color, that is $\binom{13}{1}\binom{4}{3} = 13 \cdot 4 = 52$. This is the number of ways we can choose 3 cards of same value from a normal deck of cards. We need to multiply this with the number of ways we can choose the rest of the other cards, wich is to choose 2 cards with a different value, both with any color. $\binom{12}{2}\binom{4}{1}\binom{4}{1} = 66 \cdot 4 \cdot 4 = 1056$

The mathematical formula for how many different Three of a Kind will then be: $\binom{13}{1}\binom{4}{3} \cdot \binom{12}{2}\binom{4}{1}^2 = 52 * 1056 = 54912$

Since there are 54912 Three of a Kind hands, and 2598960 poker hands total, the probability for one of these are $54912/2598960 = 0.021128$.

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[1] If we take the order into account, the number would be $52 \cdot 51 \cdot 50 \cdot 49 \cdot 48 = 311875200$.

II Bayesian Network Construction

bay-net-const.png

The conditional independence properties of this Bayesian Network are:

- Household income, given Working Parents

- Number of children, given Household income and Religion
- Drinking habits given Working parents and Religion
- History of illness given Drinking habits, Fish-eating habits and Fiber-eating habits
- Illness at the moment given Number of children and History of illness

I have chosen Working parents, Fish-eating habits and Fiber-eating habits as the "independent" nodes that has no parents.

I would say that in an isolated world, using my knowledge and understanding of the properties, this assumptions may be perfectly sound. Of course, in the real world, there are a lot more variables to add to this model. Also, there are a lot of special cases not well represented in this network. Eg. if your religion requires you to eat a lot of fiber, there is no doubt that Fiber-eating habits should have Religion as parent, but in the general case, not so.

III Bayesian Network Application

I have constructed the Bayesian Network in GeNIe 2.0, and will explain with screenshots from the analysis of the network I made. The network-file is attached with the delivery of this exercise and is named *Bay-net-application.xdsl*.

`BNA-1.png`	`BNA-2.png`	`BNA-3.png`
(a) Initial	(b) Choise made	(c) Official opened door

Figure 1: Flow of events and their effects

(a) We see that before we have made any choise, the chance of selecting any of the doors is 1/3 each.

(b) After we have made a choise of wich door we want to open, there no change in the probability of selecting the right door, still 1/3.

(c) After the official has opened the door, we see that the door we chose, stil has a probability of 1/3 for containing the prize, while the door left closed by the official has a probability of 2/3 for containing the prize.

We see here that if we are asked if we want to alter our choise, we should always answer “Yes!”. It is easy to think that the probaility is 1/2 for each of the remaining doors, but we have just seen that this is not the case.