TDT4171: Methods in AI

Assignment 3

Anders Kjelsrud

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1 Introduction

In this assignment I have made my own decision support system. The scenario I chose to model considers travelling home for Easter. It models whether I should stay in Trondheim, travel home by airplane or travel home by train depending on a multitude of variables.

2 Variables and decisions

The entire decision support system is modelled in `GeNIe` and is depicted in Figure 1.

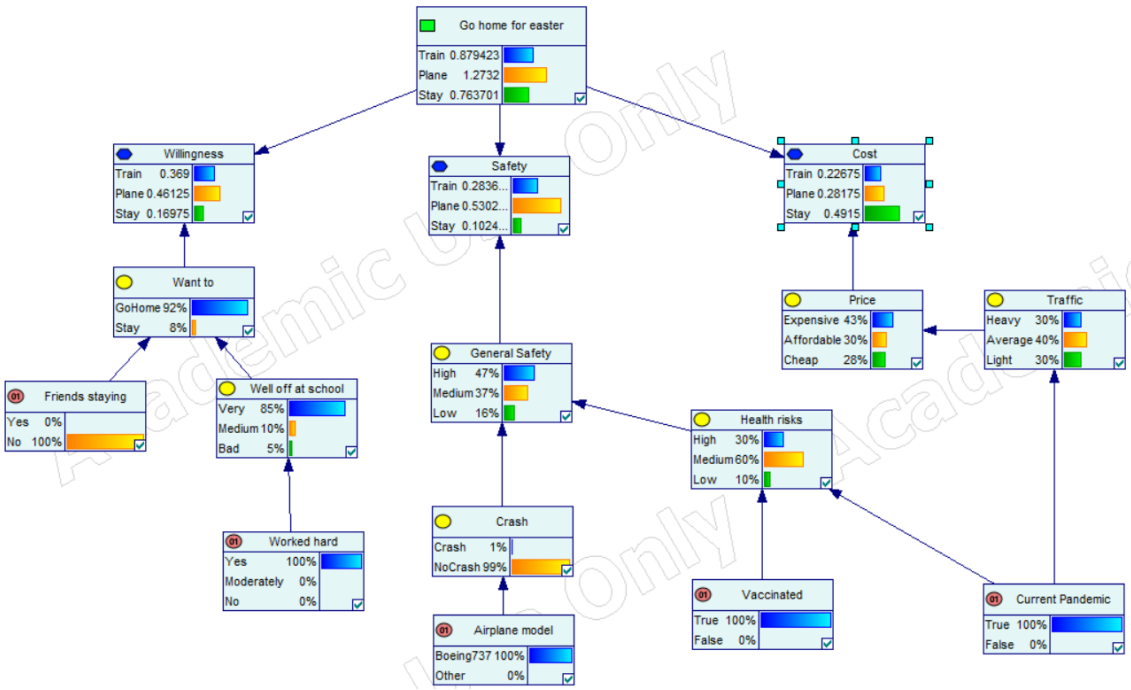

Figure 1: `DSS`

The model has 7 uncertain variables, namely:

1. Want to travel
2. Well of at school
3. General safety
4. Crash
5. Health risks
6. Price
7. Traffic

It also has 5 certain variables:

1. Friends staying
2. Worked hard

3. Airplane model
4. Vaccinated
5. Current pandemic

Together with the utility and chance nodes they constitute the entire support system. The uncertain variables need to have their probabilities quantified and I will justify my quantification on some of them in the following.

The variable `Well of at school` aims to describe if I should catch up on school work or if I'm well off. It depends on the certain variable `Worked hard` which is set to be True. Therefore, with an 85% probability, I'm well off. This will positively impact my want to go home. The conditional probability table is shown in Figure 2.

Worked hard	Yes	Moderately	No
Very	0.85	0.1	0
Medium	0.1	0.7	0.3
Bad	0.05	0.2	0.7

Figure 2: CPT for `Well off at school`

Crash	Crash			NoCrash		
Health risks	High	Medium	Low	High	Medium	Low
High	0	0	0	0.3	0.5	0.8
Medium	0.01	0.02	0.03	0.4	0.4	0.15
Low	0.99	0.98	0.97	0.3	0.1	0.05

Figure 3: CPT for `General safety`

In order to quantify the variable `General safety`, I assume the conditional probabilities in Figure 3, namely that If I crash, my general safety is very low, but if I don't, then my general safety is heavily impacted by my `health risks`.

The variable `Price` depends only on the traffic, which is a gross oversimplification and is probably not very accurate, as there are numerous factors that actually contribute to determining the price on tickets. Also the fact that the `Traffic`-variable in turn only depends on the observed `Current pandemic` is not very accurate, as the traffic e.g. heavily relies on the time of travel. There would be a heavy rise in traffic around Easter, which is not modelled here.

3 Utility

The model has 3 utility nodes, `Willingness` to travel, `Safety` and `Cost`. They describe my happiness in the different scenarios. Looking at my `Willingness` in Figure 5, we can see that if I want to go home, I'm happy with both travelling home by train and plane, with a slight preference on plane, and not very happy about staying. On the other hand, if I want to stay, I'm very happy if I do. I chose these numbers because I slightly prefer flying as that takes less time.

The utility table for `Cost` is shown in Figure 4. It shows that if the tickets are expensive, I'm happy with staying and equally unhappy about travelling by train/plane. If they are cheap however, I'm slightly happier about travelling by plane as opposed to train, while staying gives me 0 utility.

Crash	Crash			NoCrash		
Health risks	High	Medium	Low	High	Medium	Low
High	0	0	0	0.3	0.5	0.8
Medium	0.01	0.02	0.03	0.4	0.4	0.15
Low	0.99	0.98	0.97	0.3	0.1	0.05

Figure 4: `Cost`

Want to	GoHome			Stay		
Go home for ea...	Train	Plane	Stay	Train	Plane	Stay
Value	0.4	0.5	0.1	0	0	1

Figure 5: `Utility for Willingness`

4 Model verification

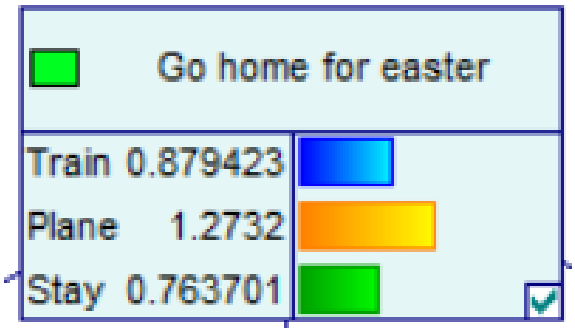

Figure 6: `Choice`

Figure 6 shows that the model advises me to travel by plane. This is in line with my own preference. I would choose to travel home for Easter and I would prefer if it was by plane. While it gives advice that harmonizes with my own choice, it has several weaknesses. The model does not consider the environmental differences between train and plane, which is significant and should be implemented. In addition, it does not use the fact that tickets generally are more expensive around Easter time. The model has an innate bias making it prefer plane over train if it were to advise travelling home. This is because I have subsequently given higher utility to this method of travel.

To verify the model, I try setting the ticket prices to `expensive` and general safety to `low`. This results in the model advising me to stay in Trondheim, as shown in Figure 7. This would also be my choice.

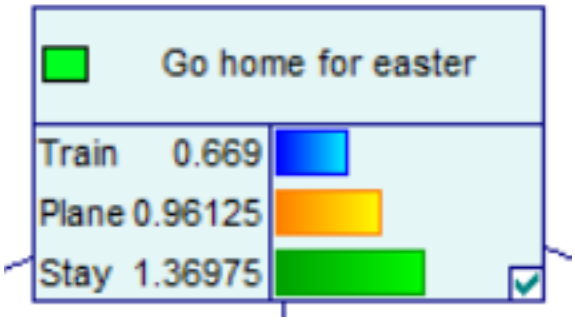

Figure 7: `Stay with low general safety and expensive tickets`