TDT4171 — Artificial Intelligence Methods
Assignment 5 - Making complex decisions

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Exercise 1 - Decision Support System

In this exercise, I have developed a decision support system to assist in choosing the most suitable cross-country skiing technique for a session. This is a choice I often face when going on a ski session. The choice is between whether I should choose to go classical technique or skating technique. The least desirable outcome is that there will be no session.

Modeling the system

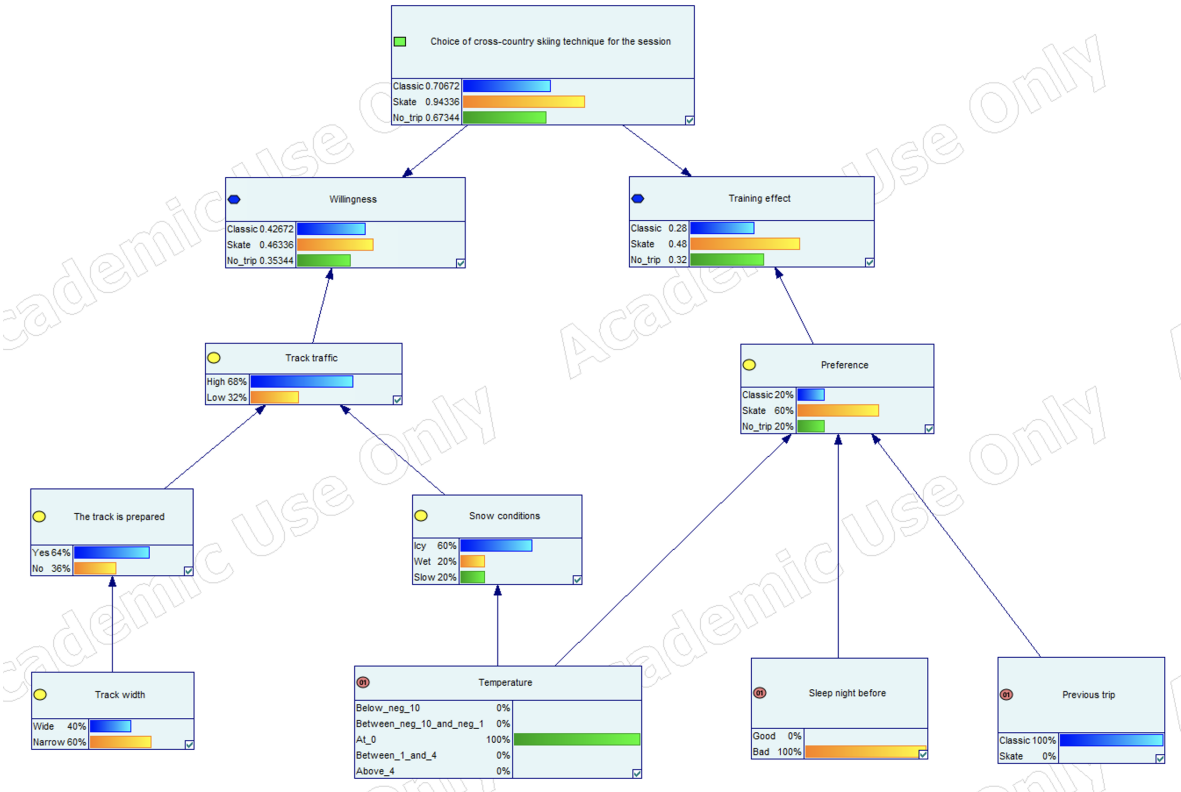

Figure 1: DSS

Decision problem: Choice of cross-country skiing technique for the session.

- Classic
- Skating
- No session (No trip)

Uncertan variables:

- Track traffic
- The track is prepared
- Snow conditions
- Track width
- Preference

Certain variables:

- Temperature
- Sleep night before
- Previous session (trip)

Utility functions:

- Willingness
- Training effect

Probability tables

Preference

Previous trip	Classic										Skate									
Sleep night bef...	Good					Bad					Good					Bad				
Temperature	Below_neg...	Between_n...	At_0	Between_1...	Above_4	Below_neg...	Between_n...	At_0	Between_1...	Above_4	Below_neg...	Between_n...	At_0	Between_1...	Above_4	Below_neg...	Between_n...	At_0	Between_1...	Above_4
Classic	0.6	0.6	0.1	0.6	0.2	0.4	0.5	0.2	0.3	0.1	0.9	0.8	0.4	0.8	0.5	0.6	0.6	0.4	0.6	0.3
Skate	0.1	0.4	0.9	0.4	0.8	0.1	0.1	0.6	0.5	0.7	0	0.2	0.6	0.2	0.5	0	0.2	0.5	0.2	0.6
No_trip	0.3	0	0	0	0	0.5	0.4	0.2	0.2	0.2	0.1	0	0	0	0	0.4	0.2	0.1	0.2	0.1

Figure 2: Probability table for preference

Snow conditions

Temperature	Below_neg...	Between_n...	At_0	Between_1...	Above_4
Icy	0.1	0.7	0.6	0.3	0
Wet	0	0	0.2	0.5	0.8
Slow	0.9	0.3	0.2	0.2	0.2

Figure 3: Probability table for snow conditions

Track traffic

Snow conditions	Icy		Wet		Slow	
The track is prepared	Yes	No	Yes	No	Yes	No
High	0.9	0.6	0.7	0.2	0.7	0.2
Low	0.1	0.4	0.3	0.8	0.3	0.8

Figure 4: Probability table for track traffic

Willingness

Choice of cross...	Classic		Skate		No_trip	
Track traffic	High	Low	High	Low	High	Low
Value	0.3	0.7	0.4	0.6	0.1	0.9

Figure 5: Probability table for willingness utility

Training effect

Choice of cross...	Classic			Skate			No_trip		
Preference	Classic	Skate	No_trip	Classic	Skate	No_trip	Classic	Skate	No_trip
Value	0.8	0.2	0	0.3	0.7	0	0.1	0.3	0.6

Figure 6: Probability table for training effect utility

Assumptions made in the model

- Both the willingness and training effect utility functions are dependant on the temperature.
- The willingness utility function is dependant on the track traffic, snow conditions and track width.
- The temperature is assumed to be constant for the entire session.
- The training effect utility function is dependant on the previous session, sleep the night before and temperature.
- The track width is conditionaly independant of snow conditions.

Results

The system recommends skating, based on the following factors: good snow conditions, wide track width, high track traffic, most likely prepared track, previous session was classic, poor sleep the night before, and a temperature of 0 degrees.

This result is reasonable given previous experiences.