Delft University of Technology

IN4010 Practical Assignment 2

Automated Negotiation

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10 A4 pages may be enough, 15 A4 pages maximum

Introduction to assignment

As part of the TU Delft course IN4010 Artificial Intelligence Techniques completion of a practical assignment on automated negotiation is required. This is the assignment report of group 11, of which the group members are Hidde Coehoorn, Ralf Nieuwenhuizen and Jan-Willem van Velzen.

The subject of the assignment is multilateral negotiation taking place in a multi-issue negotiation domain with discrete issues. The challenge is to design and implement a negotiating agent in GENIUS which can guide the negotiation process and help the parties involved with reaching a satisfying agreement. Various scenarios are created to test the agent, ranging in the degree of conflict between parties.

Domain
Each group had to define their own negotiation domain, complete with multiple issues. Our group chose to create the 'Purchasing a Car' domain. This domain has a total of five issues, each with a number of issue values ranging from two to four (see Table 1).

Power (hp)	Capacity	Mileage (km)	Fuel consumption (km/l)	Wheels
less than 200	2	Below 10.000	5	3
200 or more	5	Between 10.000 and 20.000	10	4
	7	Above 20.000	15	6
			20	

Table 1: The domain issues and issue values.

In this domain nine preference profiles are created in three sets of three each. Profiles 1, 2 and 3 will negotiate with one another, as will 4,5 and 6 and so on. The first three profiles are negotiating in a collaborative scenario, the second set is a moderate scenario and the last three profiles clash in a competitive scenario.

	Profile	1	2	3	4	5	6	7	8	9
	Issue weight	0.10	0.15	0.20	0.40	0.15	0.40	0.10	0.35	0.50
Power (hp)	less than 200	2	1	2	2	1	2	2	6	1
	200 or more	1	1	5	1	1	5	1	1	4

Table 2: preference profiles 1-9 for issue 1

	Profile	1	2	3	4	5	6	7	8	9
	Issue weight	0.20	0.20	0.20	0.15	0.20	0.15	0.10	0.05	0.10
Capacity	2	3	2	3	3	2	3	6	2	5
	5	2	2	3	2	1	3	4	3	1
	7	1	1	1	1	1	1	2	4	3

Table 3: preference profiles 1-9 for issue 2

	Profile	1	2	3	4	5	6	7	8	9
	Issue weight	0.30	0.35	0.20	0.20	0.35	0.15	0.10	0.05	0.15
Mileage (km)	Below 10.000	3	2	3	2	4	6	6	4	1
	10.000-20.000	2	2	1	5	1	4	3	3	10
	Above 20.000	1	1	1	4	3	1	1	1	25

Table 4: preference profiles 1-9 for issue 3

	Profile	1	2	3	4	5	6	7	8	9
	Issue weight	0.15	0.10	0.20	0.10	0.10	0.15	0.10	0.05	0.05
Fuel consumption	5	2	13	4	2	13	4	5	13	1
(km/l)	10	3	12	3	3	12	3	2	10	20
	15	1	1	1	1	1	1	3	1	18
	20	1	10	2	1	10	2	3	10	17

Table 5: preference profiles 1-9 for issue 4

	Profile	1	2	3	4	5	6	7	8	9
	Issue weight	0.25	0.20	0.20	0.15	0.20	0.15	0.60	0.50	0.20
Wheels	3	3	3	3	4	4	2	8	1	12
	4	2	3	2	3	1	3	7	6	2
	6	1	1	1	1	2	6	1	7	8

Table 6: preference profiles 1-9 for issue 5

Agent

Besides that our agent is one awesome badass, this might not be obvious by the look of his humble output. There are a couple of ingenious details that are worth pointing out.

Tactics
Our agent has a number of Tactics at its disposal to use at any given moment during the negotiation. These Tactics take the current negotiation state into account, and return an Action based on their nature.

The following Tactics are defined:

1. RANDOM: Returns a random bid above the reservation value.
2. BESTNASH: Offers the best Nash bid according to the OpponentModels.
3. NOSTALGIAN: Offers the bid from the negotiation history with the highest utility.
4. ASOCIAL: Offers the bid that has the highest utility.
5. HARDTOGET: Offers a bid with 0.99 times the utility of the previous bid.
6. EDGEPUSHER: Offers a bid slightly beter than the previous bid.
7. GIVEIN: Offers a bid with a slightly decreased utility compared to the previous bid.
8. THEFINGER: Leaves the negotiation.

Opponent Model
Something Something

Opponent Strategies
Something Something

Our own strategies
Something Something

- an explanation and motivation of all of the choices made in the design of negotiating agent.
- should help the reader to understand the organization of the source code (important details should be commented on in the source code itself).This means that the main Java methods used by your agent should be explained in the report itself.
- a high-level description of the agent and its structure, including the main Java methods (mention these explicitly!) used in the negotiating agent that have been implemented in the source code.
- an explanation of the negotiation strategy, decision function for accepting offers, any important preparatory steps, and heuristics that the agent uses to decide what to do next, including the factors that have been selected and their combination into these functions.

Tests we performed

a section documenting the tests you performed to improve the negotiation strength of your agent. You must include scores of various tests over multiple sessions that you performed while testing your agent. Describe how you set up the testing situation and how you used the results to modify your agent

Conclusions

A conclusion in which you summarize your experience as a team with regards to building the negotiating agent and discuss what extensions are required to use your agent in real-life negotiations to support (or even take over) negotiations performed by humans.

Report requirements and checklist

The report should include:

- ~~the group number~~
- an introduction to the assignment
- a high-level description of the agent and its structure, including the main Java methods (mention these explicitly!) used in the negotiating agent that have been implemented in the source code
- an explanation of the negotiation strategy, decision function for accepting offers, any important preparatory steps, and heuristics that the agent uses to decide what to do next, including the factors that have been selected and their combination into these functions
- a section documenting the tests you performed to improve the negotiation strength of your agent. You must include scores of various tests over multiple sessions that you performed while testing your agent. Describe how you set up the testing situation and how you used the results to modify your agent
- a conclusion in which you summarize your experience as a team with regards to building the negotiating agent and discuss what extensions are required to use your agent in real-life negotiations to support (or even take over) negotiations performed by humans.

The final analysis report should involve an elaborate analysis of your agent's performance from different perspectives (e.g. individual utility gained, social welfare - the sum of utilities of all agents, optimality of the outcome, fairness etc.). NU NOG NIET NODIG