Miguel Coelho ist187687

1. INTRODUCTION

Deception mechanisms can occur not only in human interactions and negotiations but also with self-interested and even cooperative agents to increase the utility gained by them.

By exploring specific deception mechanisms like **hidden utilities (**not sharing beliefs on the personal relevance of pursuing specific actions), **hidden actions (**pretending not being able to perform certain actions) and **decoy actions (**pretending to be able to realize certain actions when we are not) in game encounters and negotiation settings, we can make some high-level, abstract assumptions for strategies a deceiving agent can use.

2. SINGLE-ENCOUNTER DILEMMA

Below are one-shot game encounters with pure strategies to explore and demonstrate strategies for each deception mechanism.

2.1 Hidden Utilities

Intuition: If an agent does not share its utility associated with each action, the other agent will pick actions guided solely by its own utility. This can be used to the deceiving agent advantage.

Abstract: A1 should find the action, s2, such that A2 will choose s2 when he is guided only by his utilities, then choose a pair (s1, s2) that gains A1 (and potentially A2) more utility.

Example: For **F1**, if A1 hides all of his utilities, A2 will be purely guided by his actions he would choose C (with an average utility of 2.5) and A1 can now choose (B, C) and both agents will now receive a utility of 2 instead of 1.

Optimality: This strategy does not guarantee a pareto optimal result. For example, in **F1**, (C, C) improves both agents' utility.

2.2 Hidden Actions

Intuition: The main consequence of hiding certain actions from another agent is the manipulation of what he thinks the deceiving agent will do, thus affecting the deceived agent choice.

Abstract: A1 should find a pair (s1, s2) that will benefit him more (and potentially his adversary) than the current NE and hide all actions where the maximum for A2 is not in s2.

Example: For **F1**, agent A1 can choose (B, C) and hide all actions that don't maximize A2's utility in C, in this case, action A.

Agent A2 will expect the new payoff matrix **F2** and will choose C, agent A1 can now choose his selected action (B, C) and both agents will now receive a utility of 2 instead of 1.

Optimality: This strategy does not guarantee a pareto optimal result. For example, in **F1**, (C, C) improves both agents' utility.

2.3 Decoy Actions

Intuition: An agent can use decoy actions to force new situations, like Nash Equilibria, that were previously impossible to achieve.

Abstract: A1 should find a pair (s1, s2) that will benefit him (and potentially A2) more than the current NE such that an action, s3, that he can't execute exists and the utility of A2 in s2 is a maximum when fixing s3 for A1. If A1 discloses that his utility for (s3, s2) is higher than any of his utilities when fixing s3 for A2, then A2 will now perceive (s3, s2) as a NE and play s2, and A1 can play s1. The final play will be (s1, s2).

Example: For **F3**, assuming A1 cannot execute C, A1 can choose (B, C) and action C to decoy since fixing C for A1 yields a maximum utility for A2. A1 can now disclose his utility for (C, C) to be 5, which is bigger than his maximum utility, 4, in (A, C).

A2 will now perceive (C, C) to be a NE, and will choose C and A1 will choose planned move, B. The final play is (B, C) and both agents will now receive a utility of 2 instead of 1.

Optimality: This strategy does not guarantee a pareto optimal result. For example, in **F3**, (C, C) improves both agents' utility.

3. ZEUTHEN STRATEGY

With a monotonic concession between two rational agents, several strategies are explored for each deception mechanism.

3.1 Hidden Utilities

Hiding the utility of a task that is being negotiated does not make much sense since both agents need to agree on a deal that depends on the willingness to risk which depends on both agents' utilities.

3.2 Hidden Actions

We can define hidden tasks in negotiation as having the utility of a task that the agent can perform become apparently 0.

Intuition: Hiding tasks that one agent values but the other doesn't, will make the other agent more open to reach an agreement where he thinks it's fair, when in fact, the first agent will receive more than what the other agent perceives.

Abstract: Given a set of tasks, A1 should hide all tasks that A2 does not value but he does.

Example: For **F4**, if no deceptions are used, A1 ends up with {D, E} with a utility of 3 and A2 ends up with {A, B, C} with a utility of 4.

A1 can hide the utility of D and E, thus making them become 0 in A2's eyes. With this new deal, A1 ends up with {A, B, D, E} with a utility of 5 and A2 ends up with {C} with a utility of 2. A2 believes that both him and A1 received 2 after the deal.

Optimality: This strategy guarantees a pareto optimal result since, by definition of the monotonic concession, we cannot increase the utility of one agent without hampering the other.

3.3 Decoy Actions

Conversely, we can define decoy tasks as setting an arbitrary utility to a task the agent cannot perform (that he has 0 utility).

If we set the utility for the deceiving agent of a task that he cannot perform with a value bigger than 0, if an agreement is made between both agents, part of the deceiving agents tasks will actually have 0 utility, thus making the deal unfair for the deceiving agent, this is not a good deceiving strategy.

We can also create a completely new action and set an arbitrary utility to it, but assuming the deceived agent always knows his own utilities, when the deceiving agent creates a task that didn't exist, the deceived agent will perceive the utility of that task as 0. This will not result in any gains for the deceiving agent since, in reality, neither agents value this task.

4. REFERENCES

[1] Zlotkin, Gilad & Rosenschein, Jeffrey. (1993). The Case of the Lying Postman: Decoys and Deception in Negotiation.

		A2		
		A	B	C
A1	A	**1, 1**	1, 0	4, 0
	B	0, 1	1, 1	2, 2
	C	0, 1	1, 1	3, 3

Figure 1 - Single-encounter dilemma

		A2		
		A	B	C
A1	B	0, 1	1, 1	2, 2
	C	0, 1	1, 1	**3, 3**

Figure 2 - Perspective of deceived agent

		A2		
		A	B	C
A1	A	**1, 1**	1, 0	4, 0
	B	0, 1	1, 1	2, 2
	C	?, 1	?, 1	**5, 3**

Figure 3 - Another single-encounter dilemma

	A	B	C	D	E
A1	1	1	1	**2**	**1**
A2	1	1	2	0	0

Figure 4 - Utility distribution for negotiation