INTELLIGENT ROBOTS AND DICISION- MAKING IN CHALLENGING SITUATIONS

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Abstract:

Undoubtedly, artificial intelligence is one of the great achievements for humans, which will have many applications in their lives. Artificial intelligence is the knowledge of knowing and designing intelligent agents, although the topic of artificial intelligence is very attractive, its challenges are equally important .One of the big challenges of humans is the decisions that artificial intelligence will make based on the results of its analysis. In this article, we have stated one of these challenges and using the HMT (Hyper Move Theory) method, we have stated a solution for it.

Keywords: *Theory of moves, Rationality, Robot, Decision Making, Hyper Move Theory (HMT)*

INTRODUCTION:

Game theory tries to model a strategic situation based on the mathematical behavior that governs it. When a person's success depends on the strategies that others choose, this situation arises. The ultimate goal of this knowledge is to find the best way for players. [see 20,22,23,8]

The theory of moves adds a dynamic dimension to the classical theory of games, which its founders (Neumann and Morgenstern) considered completely static. This dimension not only distinguishes the theory of moves from game theory but also distinguishes it from modern approaches that use the past to predict the future to study the dynamics of games. Compared to the majority of other dynamic theories and by assuming that players not only think about the immediate consequences of their moves but also about the consequences of moves made in opposition to their moves, the theory of moves extends strategic thinking to a more distant future. By explaining the logical flow of moves over time, this theory facilitates the analysis of the conflict dynamics in which thoughtful and intelligent players who possess at least some level of foresight may engage. This theory is based on three basic concepts:

- Non-myopic equilibria, in other words, stable outcomes that occur when players think ahead.
- Results are created when a player has a move power, command power, or threat power.
- Incomplete information about the preferences of the players or the power holders in the game.

Brams (in his book) has focused on two-player games with two strategies to keep the analysis logical. [see 6,7,19]

The cognitive (mental) processes that lead to choosing an action from among different actions are called decision-making. Where we can trust our intuition has to do with how we think and how we can take advantage of the benefits of thinking. [see16]

In game theory, a rational player is a player who can evaluate the results (in the sense of ranking them) and calculate the ways to achieve the results. Also, he can choose actions from a set of options that have the most suitable results based on the actions of other players. [see 5,24]

In the concept of hyper-rationality, in addition to individual preferences (individual gain, individual loss, indifference between individual gain and loss), preferences for other players (others' gain, others' loss, and indifference between others' gain and loss) are also considered. [see 3,4,10,11,12,13]

If we use the concept of hyper-rationality instead of rationality in the Theory of Moves introduced by Brams and bring the intentions of the players into the game, we can use a new method called Hyper Move Theory (HMT). [9]

Our working definition of a robot is a task-oriented device that has sensors and other information input interfaces, which can physically alter its environment meant, move, and have both the energy and ability to make decisions about how to accomplish its tasks. A key feature in a robot is whether its ability to make decisions is autonomous, i.e., whether it can operate without external intervention. From the point of view of ethical decisions, autonomy is important because it is a necessary condition for the ethical agency. While some argue that an autonomous robot cannot be considered truly autonomous unless it makes all its decisions without any human intervention, we prefer to say that such robots are not only autonomous but also independent.
One key characteristic of an autonomous robot is whether it can respond appropriately to a wide variety of situations. A machine that requires no external input to make a decision but is only ever able to make one decision and could not be said to have a meaningful degree of autonomy. For example, a collaborative robot like Baxter, which is used to repeatedly perform only very specific tasks, exhibits some degree of autonomy but cannot make complex decisions that depend on highly variable environmental conditions and are unable to handle unpredictable situations [1].
What would happen if, in the future, autonomous robots were given full responsibility for their actions and outcomes [18,21]? Some researchers including Deborah Johnson believe that it is dangerous to give robots full responsibility for
Their actions might go beyond the programmers' control [15]. They might be autonomous because they perform tasks without human control, but, according to this view, it is the humans-including the manufacturers, designers, programmers, and users who must take responsibility if anything goes wrong.
In this case, the mistake that caused the harm is human, and the robots cannot be held responsible for their actions.
According to Kuflik, responsibility does not rest with robots, because they are just machines running programs that are manifestations of (human) intentions [17]. Responsibility for any action performed by a robot may be divided amongst different people, such as the robot manufacturer and the user, and each group will shoulder part of this responsibility [see 2,25]. Hew claims that, in the foreseeable future of technology, "robots will carry zero responsibility" for their actions, and that this responsibility should remain with humans. This is because "its rules for behavior and the mechanisms for supplying those rules must not be supplied entirely by external humans" [14].

But also, abrogating responsibility by the robots' users and creators could encourage some people to create dangerous autonomous robots that may harm people or perform dangerous or unwanted tasks. Therefore, as Wallach argues, people and corporations should be held responsible for all harm that is caused by technology [26]. Kuflik agrees, concluding that the responsibility of robots' outcomes rest with the people who design them and who program their systems [17].
So robot builders need to plan correctly in challenging situations. Many scientists and prominent people such as Elon Musk and Stephen Hawking have warned about human-robot conflict in the future; one of the essential things is the decisions that artificial intelligence will make in robots in challenging situations and dilemmas. In this article, we are trying to provide a solution for this basic issue using the Hyper Move Theory (HMT) method and in the form of an example.

Application:

In the encounter between a policeman and a criminal, the important issue is the arrest of the criminal, but conditions prevail in different situations that the performance of a policeman who has a human spirit is different. One of those conditions is the policeman's encounter with a child criminal. Now, a question can be raised, if robots are used in the police force, what decisions will they make in such situations?

Based on game theory, we can consider the following game for the encounter between the police and the criminal during the commission of a crime and introduce the game components as follows:

	P2		
P1		C	NC
	C	(4,3)	(2,4)
	NC	(1,1)	(3,2)

Actions of player P1 (police):

C: Calm treatment with respect for human rights.

NC: Harsh treatment of the criminal.

Actions of player P2 (the criminal):

C: Surrender without resistance to the law.

NC: Resistance and attempts to escape from the law.

C-C: If a criminal surrenders without resistance after facing the police, it will be one of the useful options for him in that situation because it affects not increase his crime and may even help in reducing his crime. And for the police, this situation is the best possible situation because it reached its goal with a calm and non-conflict approach.

C-NC: If the police have a calm approach and the criminal abuses this situation and can escape using the police's calm approach, it will bring the highest payoff for him and the police will suffer here.

But because he has humanly treated the criminal, it cannot be said that it will be the worst case for the police.

NC-C: If the criminal surrenders without resistance, but despite this behavior, the police still treat him harshly and violently, this will be the worst situation for the criminal and of course, it is also the worst situation for the police. In a situation where there was no need for violence and the criminal surrendered without resistance, the police still used harsh and strict behavior and this is not considered a success for the police.

NC-NC: If the criminal does not intend to surrender and wants to run away, and the police use severe treatment, in this case, considering that the police will probably be more successful, the criminal will not get a good payoff, and the police will also achieve the desired result. But the best result of the police, which was the arrest of the criminal with less tension and with humane ethics, has not been realized.

This game shows the general situation of the police with a criminal, but if the criminal is an adult or a child, there will be a difference in the behavior of a policeman. But the question is, if we want to replace a policeman with a robot, how will it behave in such a situation, and in general, how can a robot policeman perform a proper analysis for himself in such situations?

In such situations, the type of police's perspective and intention can make it clearer for her to deal with a criminal.

In the HMT (Hyper Move Theory) method, we use intentions to get better results. It seems that this method can have the best effect in this situation.

Now we present this game with the HMT method with the two intentions mentioned above and analyze the obtained results.

The first mode is the mode in which the police adopt a benevolent and friendly intention with the criminal because the criminal is a child (or any other reason that can be categorized for the robot), the results of which will be as follows.

In this case, if we start from the strategy of profile (2,4), taking into account the benevolent intention of the police and also the intention of the criminal who looks at the police as an enemy, we use the HMT method and the following result is obtained:

I: Profit Goal – Loss of intent									
Clockwise	State 1		State 2		State 3		State 4		State 1
	R	→	C	→	R	→	C	→	
R Start	(2,4)		(3,2)		(1,1)		(4,3)		(2,4)
Supervivor	(2,4)		(2,4)		(2,4)		(2,4)		
Counter Clockwise	State 1		State 2		State 3		State 4		State 1
	C	→	R	→	C	→	R	→	
C Start	(2,4)		(4,3)		(1,1)		(3,2)		(2,4)
Supervivor	(2,4)		(4,3)		(2,4)		(2,4)		
Outcome: (2,4)									

And we do the same for the rest of the profile strategy, the final table of which is as follows using the HMT method:

Starting from (4,3)	
I	(4,3)

Starting from (2,4)	
I	(2,4)

Starting from (3,2)	
I	(2,4)

Starting from (1,1)	
I	(2,4)

The second mode is the mode in which the police try to deal harshly with the criminal (in this case, both players will have the intention of harming each other), the results of which are as follows:

Starting from (4,3)	
II	(4,3)

Starting from (2,4)	
II	(1,1)

Starting from (3,2)	
II	(4,3)

Starting from (1,1)	
II	(1,1)

According to the obtained results, this method can help the robot police in making decisions in different situations. According to this method, the robot police will not use harsh treatment at all in the face of the child criminal, even if it leads to running away. However, in dealing with an adult criminal, he will have two solutions in front of him, if the criminal intends to surrender, which can be recognized by his behavior, do not use violent behavior, and if he resists the police or intends to escape, in such case situations, the robot police can use more intense and violent treatment.

Results:

This method has two noteworthy advantages, firstly, due to the addition of hyper-rationality instead of rationality in the game, it prevents the use of different games in the same situation, and this itself will make planning easier in the robot police.

Second, because the theory of moves is used in the HMT method and due to the addition of a dynamic dimension to static games in this method, the robot can predict the future according to the position and strategy of the profile in which it is located, and make decisions based on that, and there will be no need to program the game results as a unique action for the robot.

For example, in the mentioned game, if the child criminal wanted to resist, according to the approach of the robot police and the prediction of the future situation, he can use kind words to entertain the child criminal and at the same time request an auxiliary force specializing in child affairs. In this case, there will be no need to deal harshly with the criminal child, and on the other hand, the robot police have done their duty completely and the child's further delinquency has been prevented in the right way.

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