

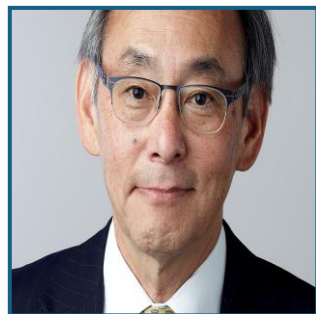
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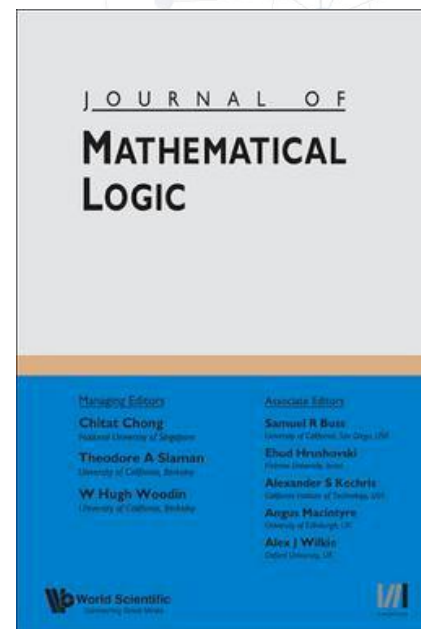
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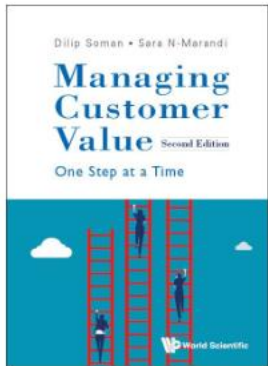


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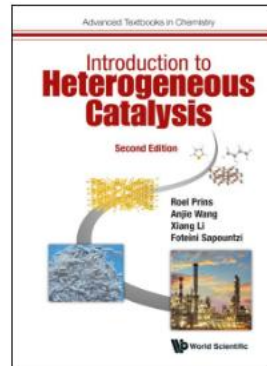
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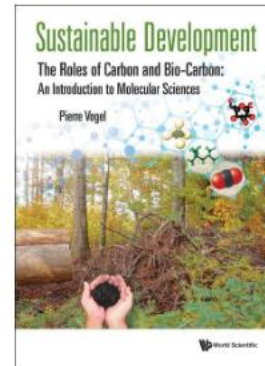
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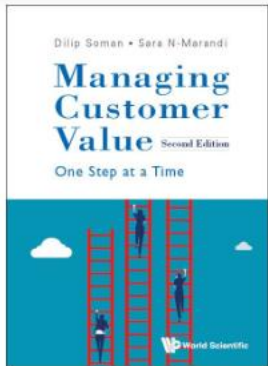
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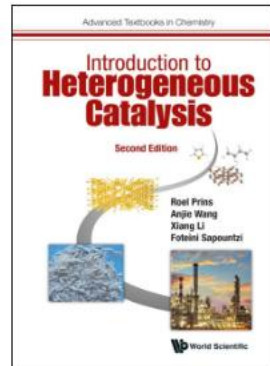
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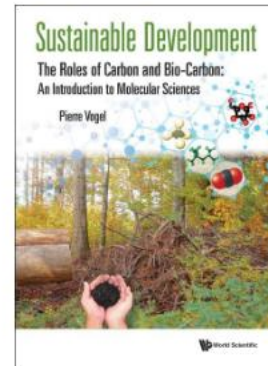
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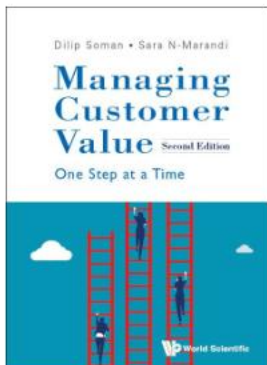
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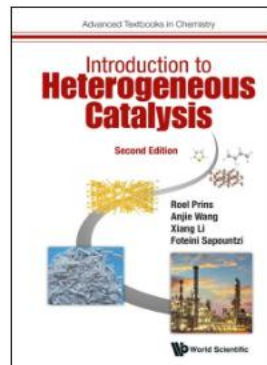
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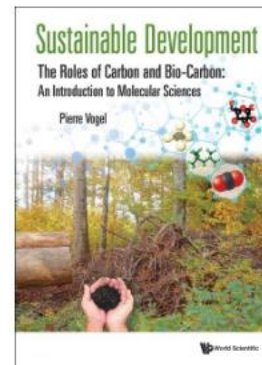
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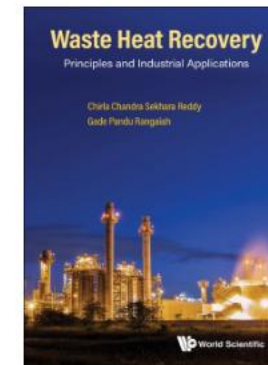
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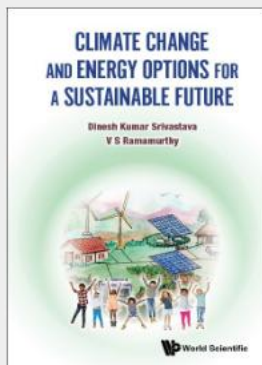


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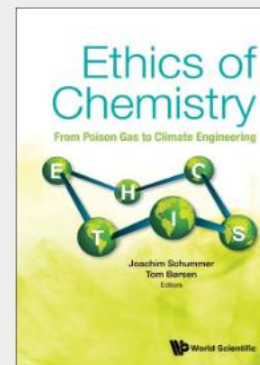
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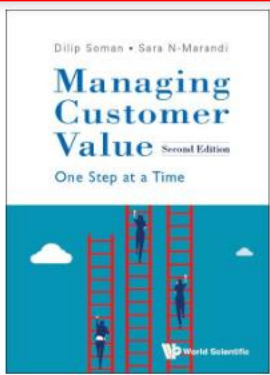
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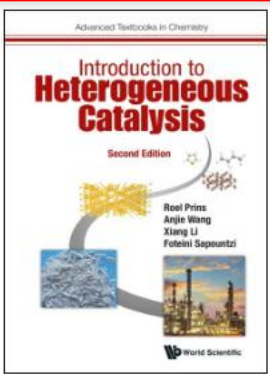


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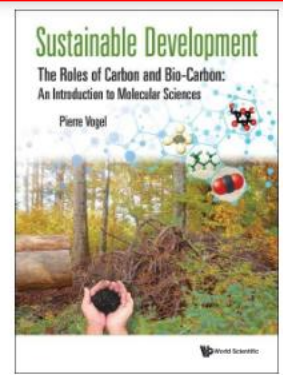
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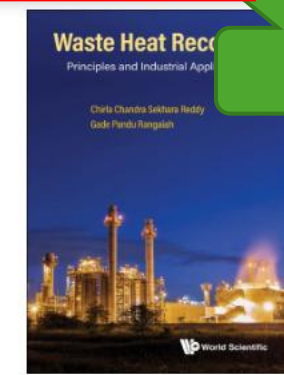
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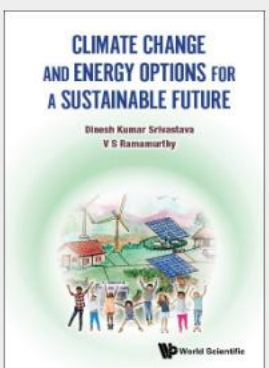


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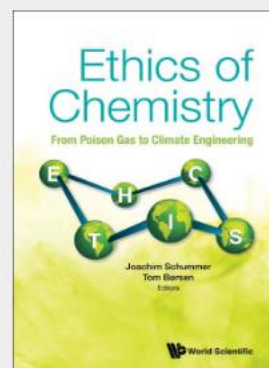
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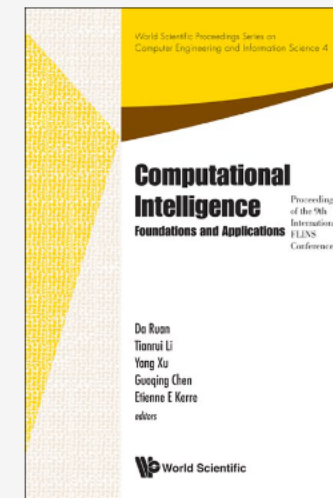
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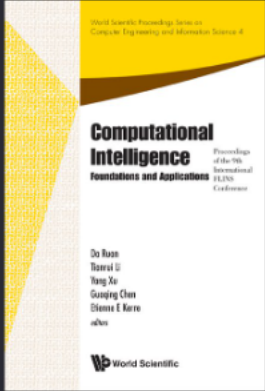
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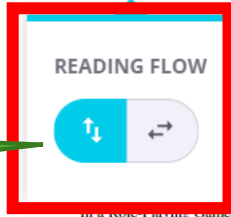
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REINFORCEMENT LEARNING vs. A* IN A ROLE PLAYING GAME BENCHMARK SCENARIO¹

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1. Introduction

Among all the decisions involved in computer-game, the most common is probably path-finding, i.e., looking for a good route for moving an entity from *here* to *there*. The entity can be a single person, a vehicle, or a combat unit; the genre can be an action game, a simulator, a role-playing game, or a strategy game. The main focus of the research is to compute collision-free and short paths as quickly as possible.

Although path-finding is not trivial, there are some well-established, solid algorithms that have been applied, some of them more efficient than others.

In this paper we work on Role Playing Games (RPG), where the player selects a target point from its current position and the entity is automatically taken to that point without interacting with the system, avoiding obstacles and optimizing the trajectory. This automatic process can be carried out by different approaches [1]. In this article, two algorithms, A* Algorithm and Q-Learning

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(Reinforcement Learning) are used to solve this problem. They are included in the wide area of machine learning [2].

A benchmark has been designed to analyze their characteristics and to compare them regarding computational time. It is possible to show how Q-Learning is a primitive form of learning but, as such, it can operate as the base of far more sophisticated devices and even more efficiently [3].

Many other applications of these learning strategies can be found in the literature. Without being exhaustive, some paradigmatic examples can be cited.



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2. Search Algorithm A* and Reinforcement Learning

The two algorithms that are going to be compared are briefly described in this section. We focus on solving planning problems for homogeneous agents in homogeneous environments.

2.1. The A* search algorithm

In the game development community, the most popular way to plan a path is to divide the environment into a grid that can be searched using A* based algorithms. This approach works very well in computer games as it always retrieves the shortest path, if one exists. This heuristic search ranks each node by an estimate of the best route that goes through that node.

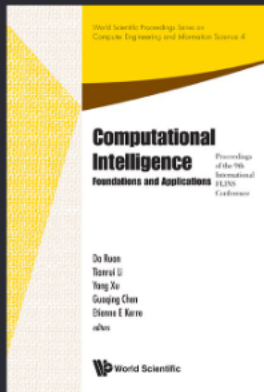
It combines the tracking of the previous path length of Dijkstra's algorithm, with the heuristic estimate of the remaining path from best-first search. Since some nodes may be processed more than once, for finding better paths to them later, it is necessary to keep track of them in a list.

A* has a couple interesting properties. It is guaranteed to find the shortest path, as long as the heuristic estimate is admissible. That is, it is never greater than the true remaining distance to the goal. It makes the most efficient use of the heuristic function: no search that uses the same heuristic function and finds optimal paths will expand fewer nodes than A*, not counting tie-breaking among nodes of equal cost. A* turns out to be very flexible in practice.

However, the resulting variation is not very natural. Also, the returned paths may not belong to the same homotopic class. In addition, grid-based methods are computationally expensive, especially for very large environments, and A* based algorithms usually produce aesthetically unpleasant paths [1].



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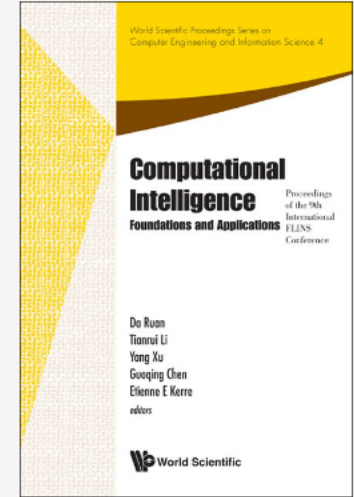
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In a Role-Playing Game (RPG), finding the optimum trajectory of a character is an important objective. In fact, it becomes a vital point of the game, due to how the path is established (reality of the game) (execution time). When classical search algorithms such as A* can be used, they are very useful for computing paths. However, grid-based methods can be computationally expensive, especially for very large environments. But they produce aesthetically unpleasant paths and the execution time is higher than evaluating results of the previous learning of the Q-learning algorithm. In this article we evaluate and compare the performance of these classic algorithms, A* and Q-Learning (Reinforcement Learning), on static searching. Simulation results of different simulation scenarios prove that reinforcement learning provides the most optimal path regarding computational cost compared with the A* algorithm depending on the configuration.

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This work is partially supported by Spanish Project DPI2009-14552-C02-01.

C. M. ALVAREZ-RAMOS, M. SANTOS and V. LÓPEZ

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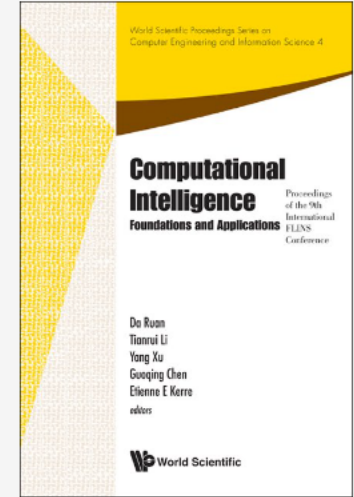
Abstract:

In a Role-Playing Game (RPG), finding the optimum trajectory of an agent is usually a vital point of the game, due to how the path is established (reality or fiction) and algorithms such as A* can be used, they are very useful for computing optimal solutions computationally expensive, especially for very large environments. Besides, A* and the execution time is higher than evaluating results of the previous learning of the Q-learning algorithm. In this article we evaluate and compare the performance of these classic algorithms, A* and Q-Learning (Reinforcement Learning), on static searching. Simulation results of different simulation scenarios prove that reinforcement learning provides the most optimal path regarding computational cost compared with the A* algorithm depending on the configuration.

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Abstract:

In a Role-Playing Game (RPG), finding the optimum trajectory of an agent is usually one of the most important objectives. In fact, it becomes a vital point of the game, due to how the path is established (reality or fiction) and the consumed resources (execution time). When classical search algorithms such as A* can be used, they are very useful for computing optimal solutions. Nevertheless, grid-based methods can be computationally expensive, especially for very large environments. Besides, A* based algorithms usually produce aesthetically unpleasant paths and the execution time is higher than evaluating results of the previous learning of the Q-learning algorithm. In this article we evaluate and compare the performance of these classic algorithms, A* and Q-Learning (Reinforcement Learning), on static searching. Simulation results of different simulation scenarios prove that reinforcement learning provides the most optimal path regarding computational cost compared with the A* algorithm depending on the configuration.

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