

Feasible Path finding for different transport modality using A-Star algorithm

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Abstract:

Several applications are available to search a feasible path from one place to various destinations on a specific transportation media. They give solutions or recommendations only based on ideal conditions. Most of those methods do not calculate the overhead of traffic, current weather conditions and many other obstacles. Sometimes we may need different possible paths between two locations. Here we propose a method that uses information from all available locations and we calculate the optimal path from that location to desired location(s) and different possible paths between two locations. These methods use heuristics that are changing time to time.

Keywords — Path finding, Heuristics, A-Star algorithm, Machine learning, Fuzzy

I. INTRODUCTION

Shortest Path:

Shortest path from one location to another location doesn't mean physically shortest path. Shortest path is a path from one location to another location which, if we follow that path, that path leads to better performance of our system than any other path from that location to the other location.

A-Star algorithm:

A-Star algorithm uses Heuristics in path finding problems. We have several path finding algorithms like BFS, DFS, Uniform Cost Search and more. But A-Star algorithm reduces the search space so that the time required to search for a feasible path is less. A-Star algorithm uses advantages of greedy path finding method and uniform cost search (Dijkstra's) method to converge to the goal node swiftly.

Heuristics:

Heuristics are common sense methods that we apply to search, learn or similar problem solving algorithms for which it is impossible or not easy to find optimal solutions. Heuristics allow us to include simple methods in complex tasks to get feasible solutions easily. Applications of Heuristics include Game theory, path finding and so on.

Heuristics in any algorithm including A-Star algorithm should not over estimate the cost to reach to the destination. That is heuristic value to reach from one place to another place should be less than the actual cost to reach from that place to destination. Such a heuristic function is called admissible heuristic function. For example from point A it needs a cost of $a(n)$ to reach point N and $h(n)$ be the cost incurs going from N to goal point, the new cost function will be

$$F(n) = a(n) + h(n)$$

Example: Heuristics for N-Puzzle, $h(n)$ are Manhattan distance or Number of misplaced numbers

II. PROBLEM

To travel from one location to another location we may choose different transport modality like train, bus, car etc. Suppose, sometimes we can't use a specific path or road for transportation. For example there may be repair on a particular road, some places are affected with high traffic, some roads might have blocked because of heavy rain and so on. So it is important to obtain information from all those sources or places about the current status of the transportation network to make decisions to choose a transportation method.

III. SOLUTION

Before continuing further, admit the fact that decisions or recommendations that are provided by the application are fuzzy, because current situation can be represented precisely but we can't predict the future possibilities with exact probability, so we need to concentrate on fuzzy representation of data and we should try to reduce the fuzziness in the result. So as a result we can present event possibilities with two values that represent the minimum and maximum likeliness of event happening.

We may also need to learn from history before making decisions. For example consider a road way in which daily 11AM to 4PM there will be less traffic in week days and there will be more traffic in the morning and in the evenings. So we can apply learning mechanisms to predict the heuristic values to set at a particular location. We then update network information dynamically for feasible path finding.

Obtained results from all sources are mapped to graphs as nodes representing places and corresponding node weights represent heuristic values. So we can compute edge weights from those heuristics. Then we can apply A-Star algorithm. We can choose to use other implementation methods.

What is more important is getting information from all points. All locations should communicate themselves and should work in coordinating

manner. We can use different types of sensors to identify particular location's current situation.

We can also think about a situation where there are dependencies. For example, situations in a place may affect the situations in another place after some time. Examples are traffic in one place can affect traffic in another place after some time. Weather conditions at a place may affect weather conditions in another place after some time. This example shows why the entire system should run in interactive, distributed and intelligent manner.

If specific transportation media can't be used in a situation we simply set heuristic values to infinity or to the values which represent that it is impossible to use that type of transportation modality.

Security plays an important role in this application development. User needs secure connection with the application and application needs to be secured from intruders.

Coming to hardware and software implementations, artificially intelligent information processor is required. Efficient Machine learning methods are required. Highly scalable, fast and efficient implementation should be developed.

Applications like this need to handle very large amounts of data. We somehow should handle these large amounts of data. Databases that handle such large data should be used. We should represent this large amount of data such that is easy to understand even to common people. Here analytics play important role in representing data.

Simpler version includes finding the path from one source to all available destinations. We can simply extend this approach to all nodes so that feasible paths among those nodes can be found easily.

IV. CONCLUSIONS

We proposed a possible model of implementation of a solution to a problem that deals about the problems in transportation and path finding. The

different possible approaches and sample problems suggested in this paper are limited. We tried to cover all the topics related to the development of this application broadly.

After implementing the basic model, we definitely get more problems to rectify and more performance optimization requirements. Better heuristic identification is generally a good exercise to think off, because heuristics change the exactness of the results developed by our application.

ACKNOWLEDGMENT

The authors express their deepest gratitude to Dr. A. Govardhan, Director, School of IT, Jawaharlal Nehru Technological University, Hyderabad for his continuous support and encouragement.

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