CSCI 4511W Writing Assignment 2
Paper Analysis

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In *Reusing Previously Found A* Paths for Fast Goal-Directed Navigation in Dynamic Terrain*, the authors talk about a shortest path search algorithm they developed based on the GAA* algorithm. The authors named their algorithm *Multipath Generalized Adaptive A** (MPGAA*) as it works mostly similarly to the GAA* but with additional functions added. The implementation principle of the MPGAA* is similar to the D* and the D*Lite, it saves computation time in the new path calculation stage by reusing some of the data generated from path data calculated from the previous calculation. The MPGAA* algorithm is designed to deal with dynamic terrain problems including start point change, goal point change, and routing terrain change. Compared to the GAA*, the advantage of MPGAA* is that it has a linear algorithm to determine whether the optimal route has been found, and once the optimal route is found, the search stops. This mechanism could save a lot of search time in certain situations.

In order to prove the superiority of the MPGAA* algorithm compared to other algorithms in specific situations, the author designed a controlled test. The author applied A*, GAA*, D*Lite and MPGAA* separately on random maps, room maps, and warcraft 3 maps to test the performance of each. Based on the provided test result, in most situations, the performance of MPGAA* outperforms the other three. However, when k is a small value and the change rate is above 20%, the performance of D*Lite could be better compared to MPGAA*. It can be said although MPGAA* is a good search algorithm in dynamic terrain problems, it does not outperform the “state-of-the-art” in all situations.

To evaluate in what real-world example the MPGAA* can be useful, we can start by considering the advantages and disadvantages of MPGAA*. In Figure 1 of the paper, how MPGAA* deals with changing terrain are demonstrated. It shows this algorithm can be a good pick when there is terrain changing while the agent is going from one point to another. It does not recalculate the unnecessary heuristic values. On another hand, if the terrain does not change while the agent moves, the advantage of MPGAA* is not so obvious. In this case, a regular A* algorithm can also be used. Back to the “real-world”, mapping software and self-driving cars could use MPGAA* during rainy and snow days as the road situation could be changed very quickly by standing water, large areas of ice and car accidents, etc. For low terrain variation situations, like vacuum robot cleaners at home and automatic food delivery robots in restaurants, the MPGAA* might not be so useful. The location of furniture and dining table etc. usually do not change, only chairs, shoes, and other human and robot could change their location. In this case, some other searching algorithms mentioned in the paper like the D*Lite and A* can perform better.

The novel contribution this paper provides is a new way of approaching the dynamic terrain searching problems. As the authors of this article did incremental work on the GAA* algorithm, some other people might do some more incremental work based on the MPGAA* or get some inspiration from their algorithm and eventually develop an algorithm that performs better in other situations. With more algorithms available to deal with different situations is not a bad thing.