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Introduction to AI
Lab 1
2/23/2020

Design Choice

For this lab, I have considered diagonals in account for the neighbors for each pixel, for the orienteer when traveling on the terrain, and for changing the terrain to any season other than summer.

I determine the speed for each terrain by considering the average speed of a human being and analyzing the provided pictures of the terrain in the writeup for this lab. The following pairs of terrains and speeds are ordered from the least time an orienteer would take to travel to the most time:

1. Paved Road; 3.8 m/s
   Paved road is given the highest speed since there is no obstacles or grass preventing the orienteer. Therefore, this is given the highest speed.
2. Open Land; 3.7 m/s
   This is given its second highest speed due to the grass being a bit soggy than the paved road, thus having a lower speed than the paved road.
3. Foot Path; 3.6 m/s
   Foot path has more debris than Open Land, thus giving this a lower speed than Open Land.
4. Easy Move Forest; 3.5 m/s
   Easy Move Forest has more debris than Foot Path such as fallen trees, sharper leaves, etc. Thus, this would have the fourth fastest speed.
5. Slow Run Forest; 3 m/s
   Slow Run Forest is similar to Easy Move Forest, but denser.
6. Walk Forest; 2.5 m/s
   This forest is similar to Slow Run Forest but contains more vegetation on the ground that can slow the orienteer.
7. Rough Meadow; 2.0 m/s
   The rough meadow contains vegetation that goes about knee level of an orienteer, more rough than walk forest.
8. Lake, Swamp, and Marsh; 1 m/s
   Rather than running through vegetation, the orienteer is running through water, which is more difficult than the Rough Meadow.
9. Impassible Vegetation; 0.01 m/s
   From the picture given in the documentation, an orienteer would not be able to run through the vegetation; therefore, this terrain would be given a lower speed.
10. Out of Bounds; 0.001 m/s
    Out of bounds is prohibited for the orienteer to travel through; thus, I give it the lowest speed.

In addition, the seasons also have their own pairs of terrains and speeds:

1. (Winter) Frozen Water; 3.75 m/s
   The orienteer can glide on ice without any injury. Thus, I give it a speed the second fastest if winter comes along.
2. (Fall) Fall Foot Path; 3.25 m/s
   Crunchy leaves slows the orienteer and gives the Open Path more debris; thus the speed to traverse this terrain is slower than Easy Move Forest
3. (Spring) Mud; 1.5 m/s
   The orienteer can run through mud. The speed to traverse this terrain is faster than any water pixel but slower than the rough meadow.

In regards to the spring season, my algorithm checks for adjacent non-water pixel next to water pixels, and, noting the water pixel’s initial elevation, disperse among 15 pixels to see if the neighbors have an elevation that is within one meter of elevation or less. If the elevation of a non-water pixel is higher, than that pixel is not considered muddy. The other seasons are implemented as written in the document.

Search Algorithm

The cost function, g(n), for an orienteer to travel from one pixel of land to another depends on the speed to traverse that pixel and the elevation. The result of this function is the least time taken for the orienteer to move to the next pixel. Following is the simple formula for solving time by taking the distance in three dimensions divided by the speed to take to get onto the pixel:

$$g(n) = \frac{\sqrt{10.29(\Delta x^2) + 7.55(\Delta y^2) + \Delta z^2}}{V(p)}$$

where ‘x’ represents the longitude, ‘y’ represents the latitude, ‘z’ represents the elevation from one pixel to another, and V(p) is the function to retrieve the speed of the terrain when going onto terrain ‘p’.

The heuristic function, h(n) in this case is simply calculating the distance between the orienteer’s point on the terrain to a given goal point.