A.I. Assignment 3

Pathfinding and exploring in a simple environment (2) - optimisation with constraints

Consider a similar setup with the previous task. The drone is placed in a known environment. We want to explore as much as possible this environment until the drone depletes its battery.

Task

Using an Evolutionary Algorithm, write and complete the application that will be used in order to drive the drone in its exploration with the sensors on a known map of a rectangular area of size *n x n* units *u* starting from an empty given square. The area is known to the drone. From each position the drone can move in one adjacent empty square.

Example:

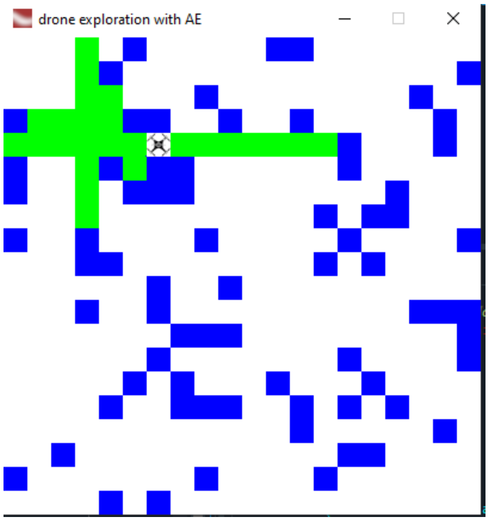

Figure 1. The drone sensors explored the green area while the drone moved on

path = [[3, 3], [3, 4], [4, 4], [4, 5], [4, 6]] The drone can make a maximum given number of *m* steps until the battery depletes. When the battery is empty the drone stops (goes down on the ground).

The application must have a layered architecture. Use the structure from the given sketch.

Consider a proper representation for the candidates to the solution, a proper fitness function, a selection mechanism, and also variation operators.

Compute and display the execution time.

Compute the average fitness of the population on an iteration and make a graphic with its variation while running the algorithm (use the library **matplotlib** - for references consider the official site: matplotlib.org).

In order to validate your algorithm you have to make at least 30 different runs with different seeds for the random numbers generator and compute the average and standard deviation of the fitnesses for the detected solutions on these runs.

Example:

No. run	Seed for random	Fitness
1	2	f[1] = 10
2	0	f[2] = 17
3	15	f[3] = 34
...	...	...

Average = numpy.average(f)

Stdev = numpy.std(f)

A good algorithm will have a standard deviation very small.

For this assignment one can get a maximum **150** points.

Extra **50** points can be earned for a solver that returns a solution where the exploration will bring the drone to the initial position (not retrace, but to have a loop while searching)

Due time:

1 week to present an almost finished version of the code

2 weeks for the final solution

IF nothing is done in the first week you will have a penalty of 10 points.

The solution can not be turned in after the 2 weeks.