AAE1001 Introduction to Artificial Intelligence and Data Analytics in Aerospace and Aviation Engineering

Week 10 (Project Additional Tasks)

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Necessary Information

- Course Repository (project download) link:
- https://github.com/IPNL-POLYU/PolyU_AAE1001_Github_Project

- TA Information & Contact:

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Additional Tasks (optional as bonus)

1. **Adding Checkpoints**
2. **Changing Environment**
3. **Compare Different Algorithms**

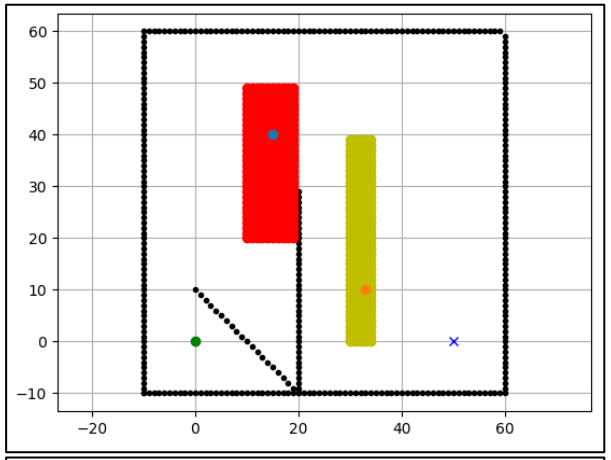
*Start working on the following Tasks after you finish the previous ones
(Create separate .py files so these tasks don't affect each other)

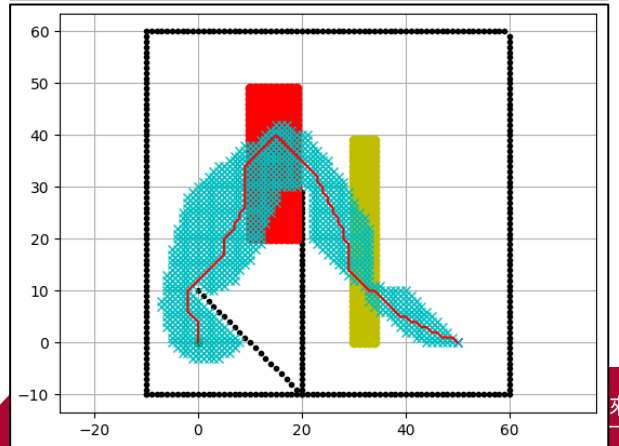
Try to incorporate GenAI to help you!

Task A1 - Adding a Checkpoint

Assume the aircraft is a supply craft that must reach 2 drop-off points to drop supplies before heading to base.

- Add one checkpoint for each cost intensive area (2 in total)
- Reach all checkpoints before arriving at the destination





Requirements:

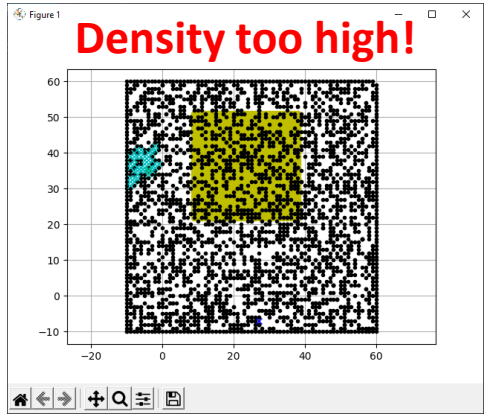
1. This is an add-on for the code you are currently working on
2. Checkpoints should be generated inside the cost intensive areas
3. Plot the checkpoints together with your planned path with appropriate visualization

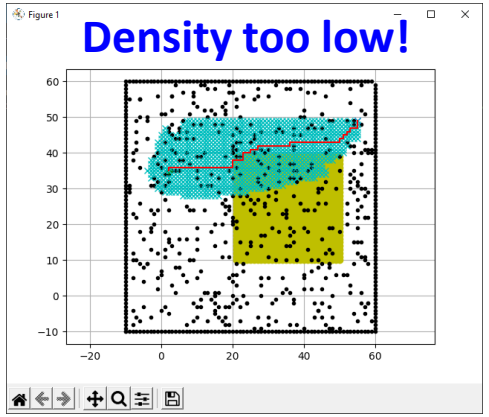
Task A2 - Changing Environment

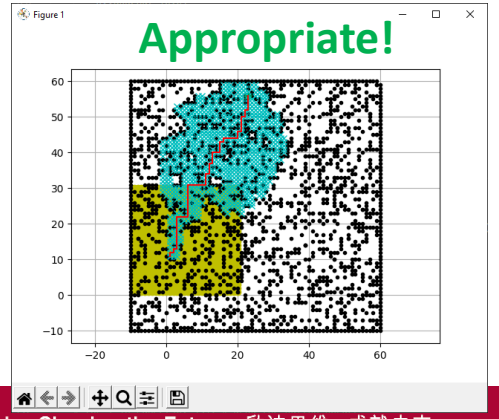
Assume the mission and the environment keep changing for each operation.

Modify the code so that:

1. Only the fuel-consuming area remains and generate it randomly **with a fixed area (40x40)**
2. Diagonal movement is **disabled**, change parameter(s) so that the object could travel **within one grid size**
3. Obstacles are generated randomly with **reasonable density**
4. Destination and starting points are generated randomly with **at least a 40-unit distance in-between**
5. Plotting of the fuel-consuming area would not cover the obstacles, and obstacles **should not generate** at/near the start and end point







Task A3 - Comparing Algorithms

A-star is one of the many path planning algorithms

Different Algorithms:

- Different theories
- Different performance
- Difference limitations and strengths

Requirements:

1. Choose 2 more algorithms from GitHub repositories
2. Modify the code so all 3 algorithms are working with the same obstacle set
3. Try and compare the algorithms and conduct a discussion

AStar	fix unittest animation bugs (#429)
BSplinePath	mypy fix test
BatchInformedRRTStar	fix scanning error (#339)
BezierPath	Replaced sqrt(x**2+y**2) with hypot in PathPlanning/BezierPath/bezier...
BidirectionalAStar	fix scanning error (#339)
BidirectionalBreadthFirstSearch	fix scanning error (#339)
BreadthFirstSearch	Update breadth_first_search.py (#374)
BugPlanning	fix docstring error
ClosedLoopRRTStar	Fix No module error in GridBasedSweepCPP and ClosedLoopRRTStart (#516)
CubicSpline	improve test coverage (#352)
DStar	change DStar animation
DStarLite	Add D* Lite. (#511)
DepthFirstSearch	Update breadth_first_search.py (#374)
Dijkstra	Update breadth_first_search.py (#374)
DubinsPath	fix dubins path length bug and clean up codes. (#527)
DynamicWindowApproach	dwa pr (#390)
Eta3SplinePath	use pytest for test runner (#452)
Eta3SplineTrajectory	use pytest for test runner (#452)
FlowField	fix unittest animation bugs (#429)
FrenetOptimalTrajectory	mypy fix test
GreedyBestFirstSearch	Update greedy_best_first_search - calc_final_path method (#477)
GridBasedSweepCPP	Fix No module error in GridBasedSweepCPP and ClosedLoopRRTStart (#516)
HybridAStar	Test code clean up (#456)
InformedRRTStar	Using scipy.spatial.rotation matrix (#335)
LQRPlanner	add comment for stopping the simulation
LQRRRTStar	add comment for stopping the simulation
ModelPredictiveTrajectoryGenerator	Merge pull request #222 from zhkmxx9302013/master
PotentialFieldPlanning	Potential field - potential range and ocillations (#345)