

Meeting

04/21/2020

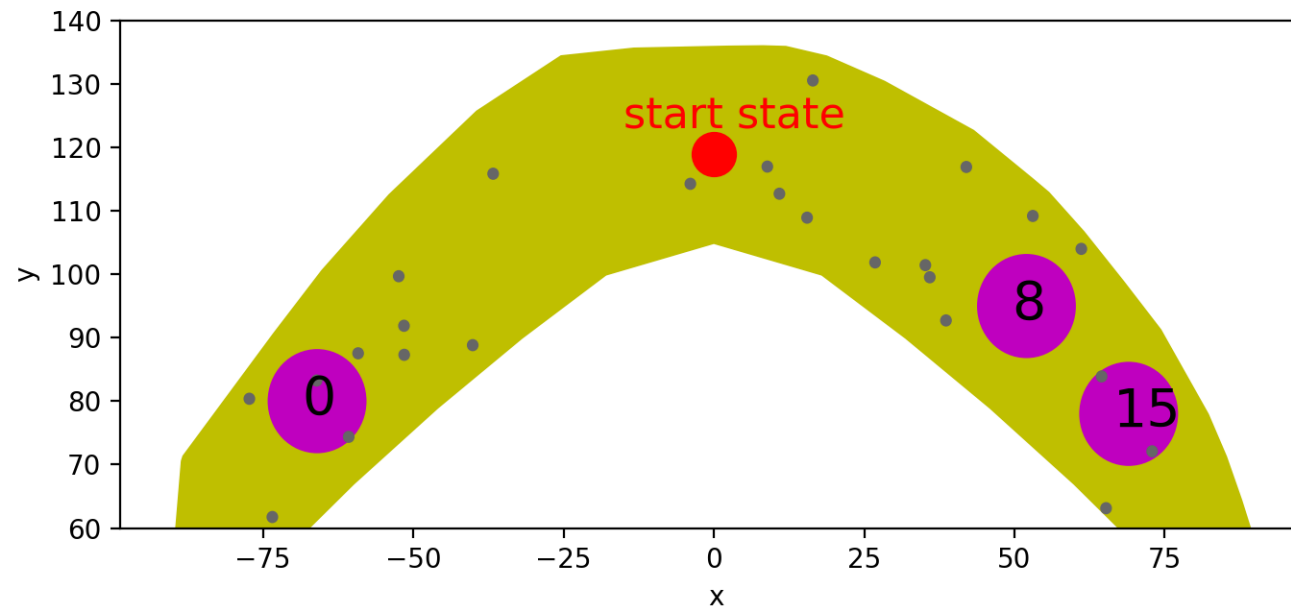
Shuo Zhang

Progress So far

- Rolled out planned paths for 3 different goals and 4 different size of obstacles.
- Each experiment has 10 rollout paths.
- 10 Evaluation metrics used are: success rate, goal reach rate, plan path length, success path length, failure path length, plan path steps, failure path steps, success path last distance to goal, failure path last distance to goal, success path RMSE relative to plan path
- Results are not satisfactory, generally.

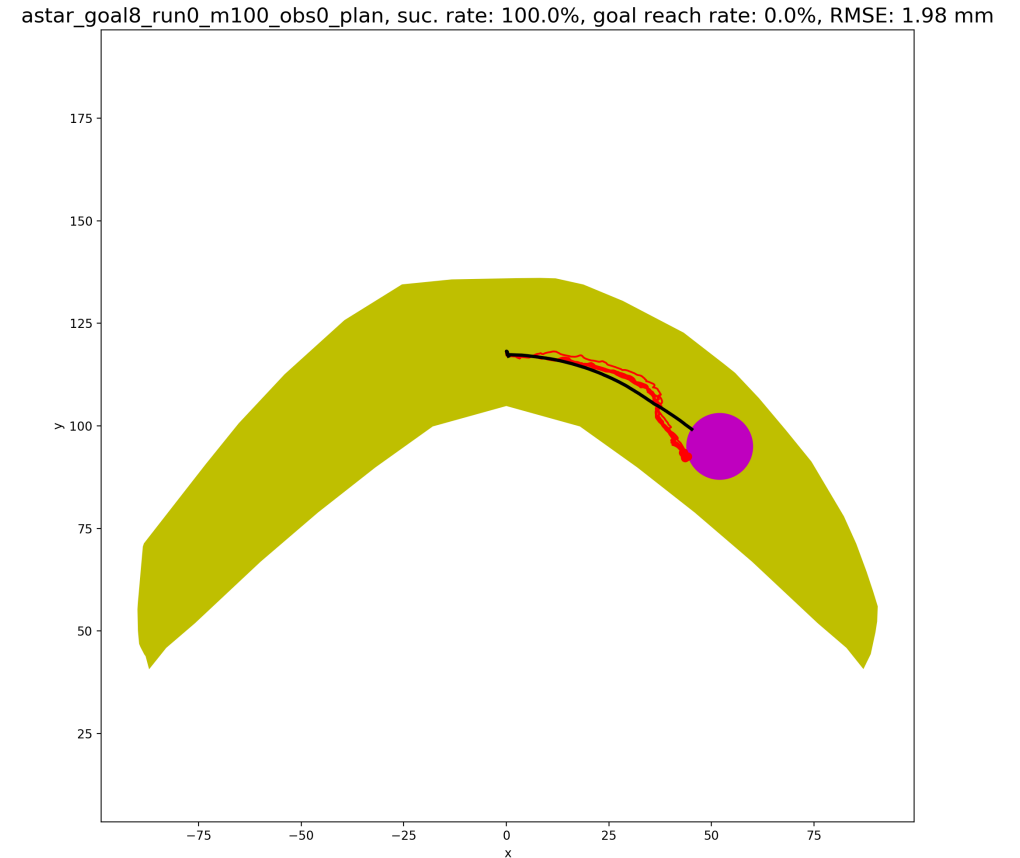
Details of Experiment

- 1) Goal Index: 0, 8, 15.
- 2) Obstacle Size: 0mm, 0.75mm, 1.5mm, 3mm.
- 3) All Avishai's experiments in paper were done with 0.75mm.
- 4) Not able to plan a path for goal 15 with 3mm obstacle within one day(24 h).



Goal 8 Obstacle 0mm

success rate	100%
Goal reach rate	0%
plan path length	53.56
success path length	57.46
failure path length	-
plan path steps	567
failure path steps	-
success path last distance to goal	0.793
failure path last distance to goal	-
success path RMSE relative to plan path	1.98

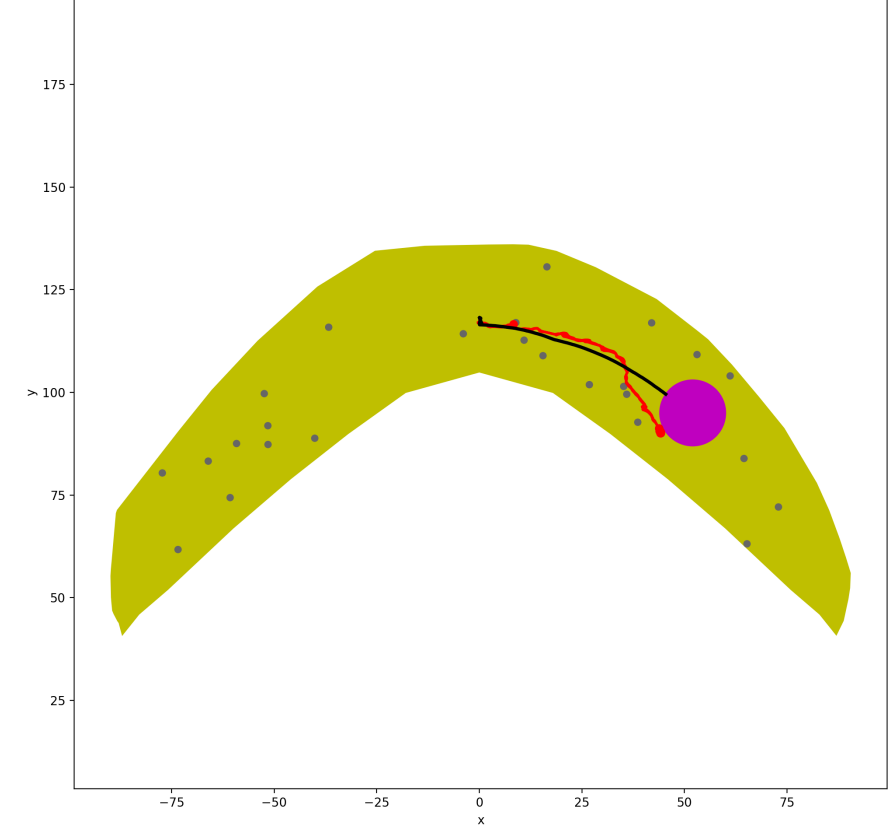


- All actions were successfully rolled out (100% success rate), but goal reach rate is 0%.
- Goal range is a circle of radius of 8mm for both planning and rollout.
- Average last distance to goal range is 0.793 mm, which is close. So, if we assume 10mm is the range of goal reach when rolling out, it would be 100% goal reach rate.

Goal 8 Obstacle 0.75mm

success rate	90%
Goal reach rate	0%
plan path length	54.73
success path length	61.9
failure path length	12.1
plan path steps	675
failure path steps	449
success path last distance to goal	1.14
failure path last distance to goal	40.78
success path RMSE relative to plan path	10.76

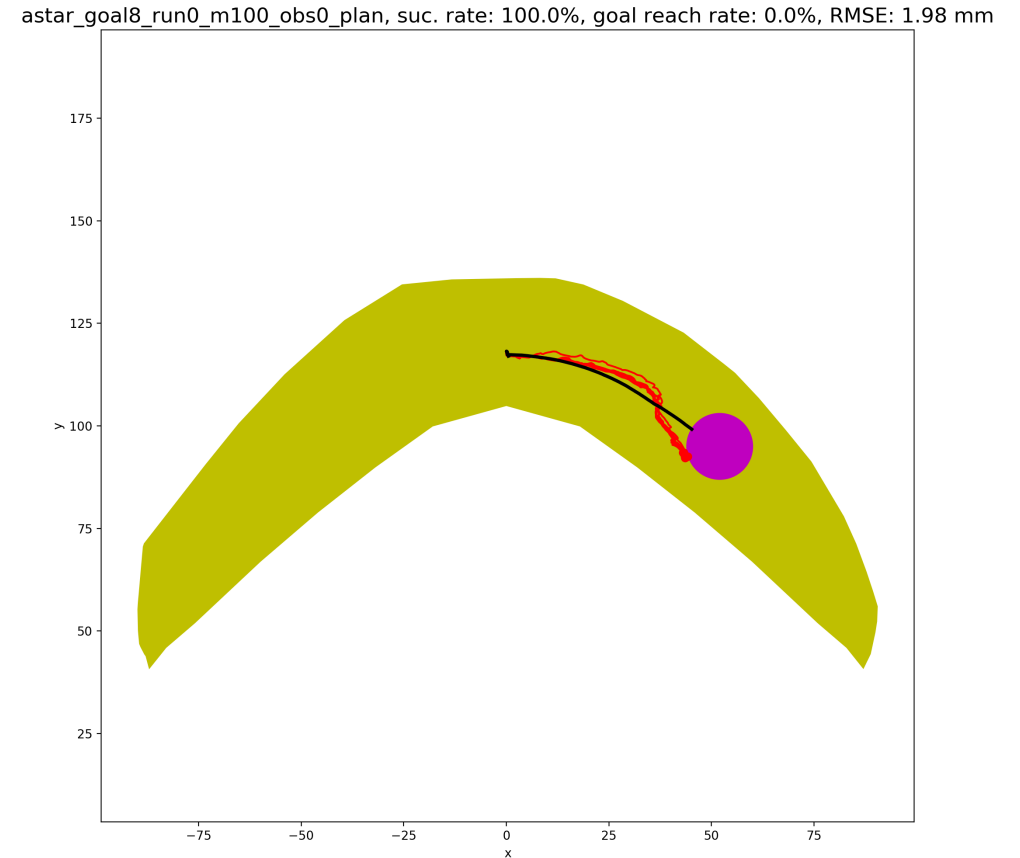
astar_goal8_run0_m100_obs0.75_plan, suc. rate: 90.0%, goal reach rate: 0.0%, RMSE: 2.79 mm



- **90% success rate (one rollout paths collided with obstacles) and 0% goal reach rate.**
- **Already considered 20% bigger obstacle size when planning.**
- **Average last distance to goal range is 1.14 mm, which is close. So, if we assume 10mm is the range of goal reach when rolling out, all success rollout paths would reach goal.**

Goal 8 Obstacle 0mm

success rate	100%
Goal reach rate	0%
plan path length	53.6
success path length	57.5
failure path length	-
plan path steps	567
failure path steps	-
success path last distance to goal	0.8
failure path last distance to goal	-
success path RMSE relative to plan path	1.98



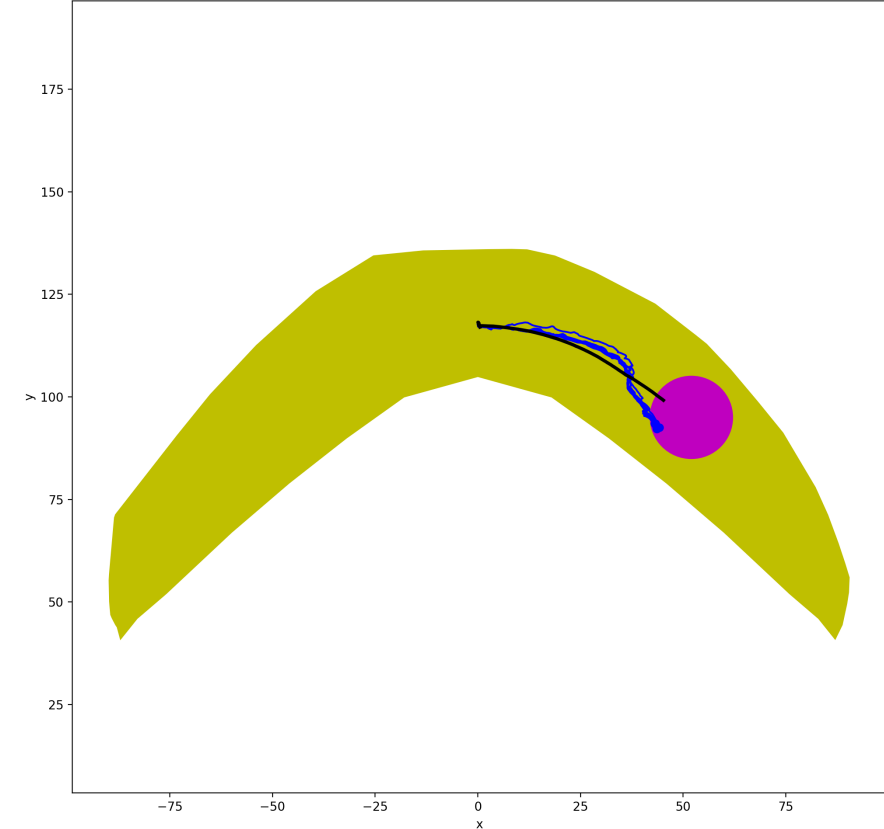
- All actions were successfully rolled out (100% success rate), but goal reach rate is 0%.
- Goal range is a circle of radius of 8mm for both planning and rollout.
- Average last distance to goal range is 0.8 mm, which is close. So, if we assume 10mm is the range of goal reach when rolling out, it would be 100% goal reach rate.

Goal 8 Obstacle 0mm

(After setting the goal range of rollout as 10mm while 8mm for planning)

success rate	100%
Goal reach rate	100%
plan path length	53.6
success path length	57.5
failure path length	-
plan path steps	567
failure path steps	-
success path last distance to goal	-1.2
failure path last distance to goal	-
success path RMSE relative to plan path	1.98

astar_goal8_run0_m100_obs0_plan, suc. rate: 100.0%, goal reach rate: 100.0%, RMSE: 1.98 mm

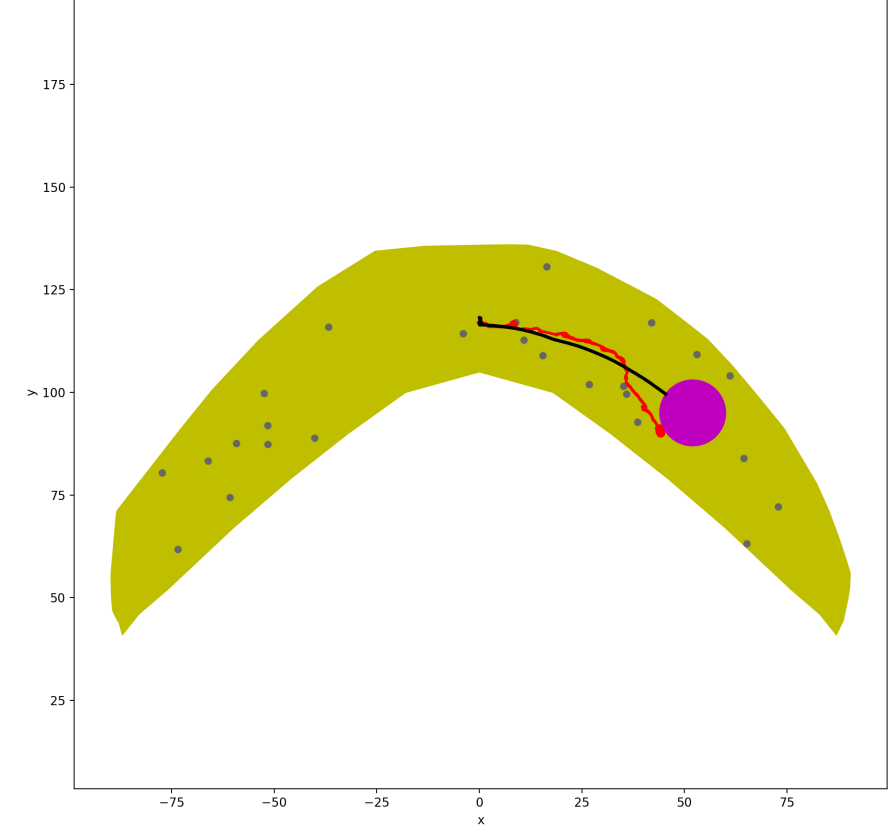


- Goal reach rate is now 100%.
- Goal range is a circle of radius of 10mm for rollout and 8mm for planning.

Goal 8 Obstacle 0.75mm

success rate	90%
Goal reach rate	0%
plan path length	54.7
success path length	61.9
failure path length	12.1
plan path steps	675
failure path steps	449
success path last distance to goal	1.1
failure path last distance to goal	40.8
success path RMSE relative to plan path	2.79

astar_goal8_run0_m100_obs0.75_plan, suc. rate: 90.0%, goal reach rate: 0.0%, RMSE: 2.79 mm

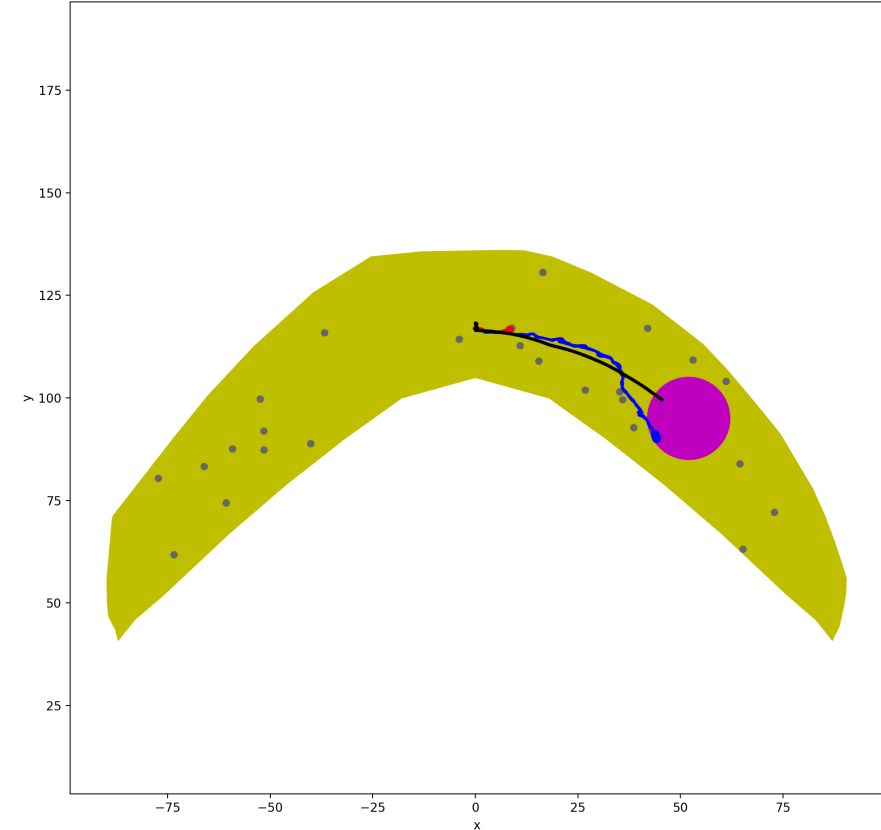


- **90% success rate (one rollout paths collided with obstacles) and 0% goal reach rate.**
- **Already considered 20% bigger obstacle size when planning.**
- **Average last distance to goal range is 1.14 mm, which is close. So, if we assume 10mm is the range of goal reach when rolling out, all success rollout paths would reach goal.**
- **Consider a bigger goal reach range for rollout and a smaller goal reach range for planning?**

Goal 8 Obstacle 0.75mm

success rate	90%
Goal reach rate	90%
plan path length	54.7
success path length	61.9
failure path length	12.1
plan path steps	675
failure path steps	449
success path last distance to goal	-0.9
failure path last distance to goal	38.8
success path RMSE relative to plan path	2.79

astar_goal8_run0_m100_obs0.75_plan, suc. rate: 90.0%, goal reach rate: 90.0%, RMSE: 2.79 mm

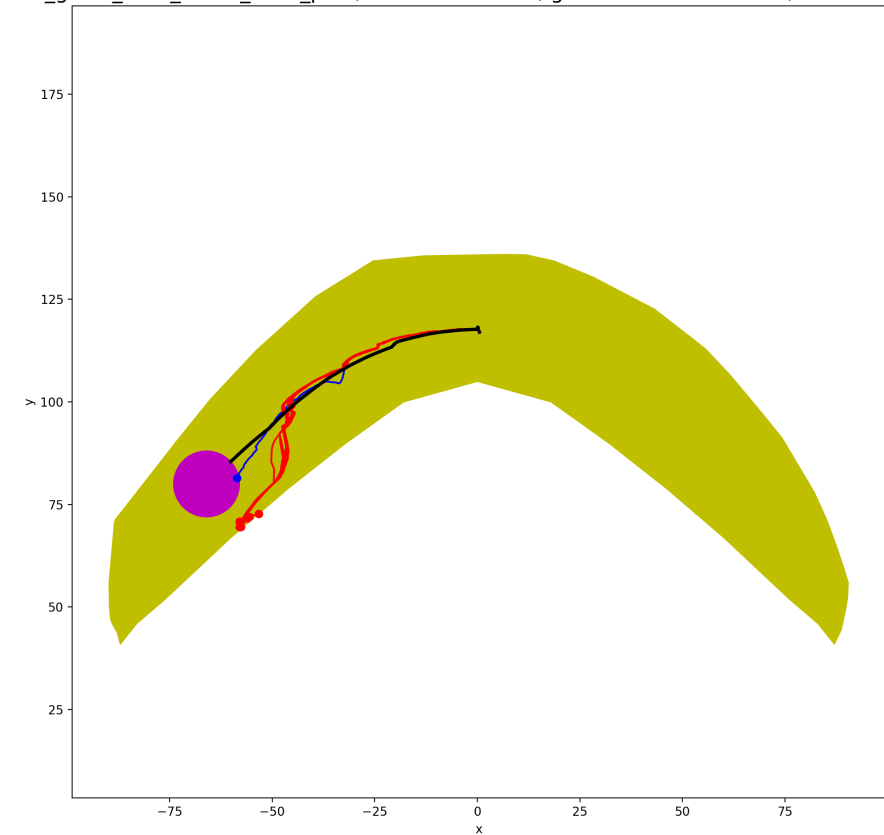


- **Goal reach rate is now 100%.**
- **Goal range is a circle of radius of 10mm for rollout and 8mm for planning.**

Goal 0 Obstacle 0mm

success rate	70%
Goal reach rate	10%
plan path length	73.7
success path length	84.5
failure path length	91.1
plan path steps	685
failure path steps	594
success path last distance to goal	4.0
failure path last distance to goal	5.6
success path RMSE relative to plan path	7.37

astar_goal0_run0_m100_obs0_plan, suc. rate: 70.0%, goal reach rate: 10.0%, RMSE: 7.37 mm

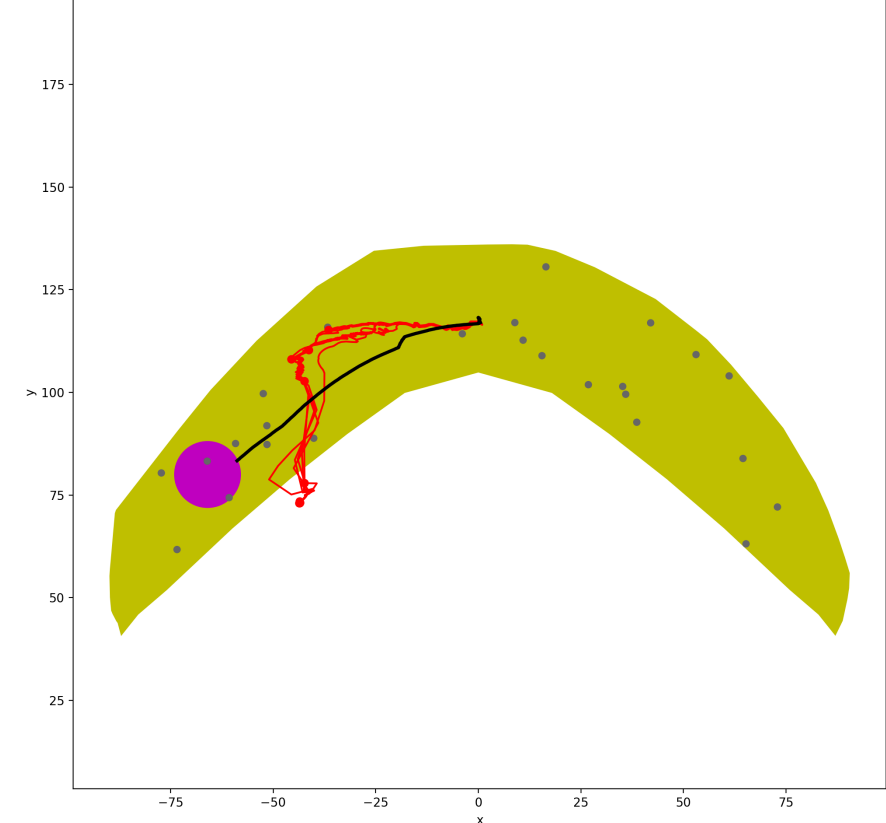


- **70% success rate (three rollout paths failed due to cylinder drop) and 10% goal reach rate.**
- **Average last distance to goal range for success path is 4.0 mm, and for failure path is 5.6mm. So even if we set the goal range as 10mm, the goal reach rate would not increase.**
- **The rollout path began to look quite different from the planned path from some point. NN model seemed not to be precise enough.**

Goal 0 Obstacle 0.75mm

success rate	40%
Goal reach rate	0%
plan path length	75.1
success path length	101.8
failure path length	76.7
plan path steps	894
failure path steps	701
success path last distance to goal	15.4
failure path last distance to goal	25.3
success path RMSE relative to plan path	10.76

astar_goal0_run0_m100_obs0.75_plan, suc. rate: 40.0%, goal reach rate: 0.0%, RMSE: 10.76 mm

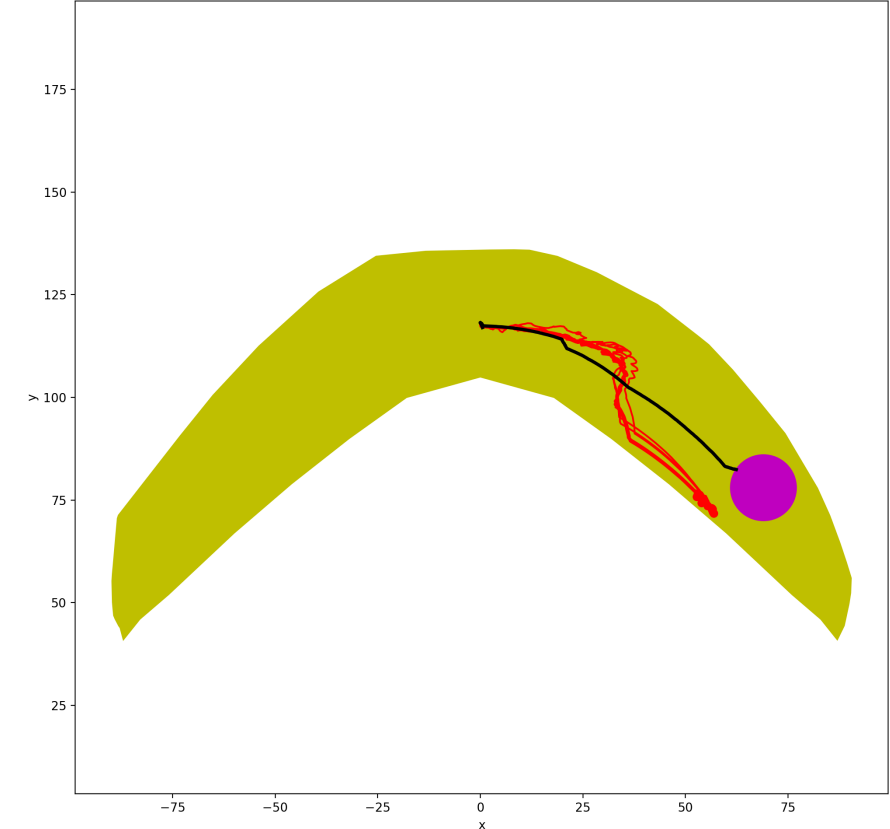


- **40% success rate (failure due to drop and collision) and 0% goal reach rate.**
- **Average last distance to goal range for success path is 15.4 mm, and for failure path is 25.3mm. So even if we set the goal range as 10mm, the goal reach rate would not increase**
- **The rollout path began to look quite different from the planned path from some point. NN model is not precise enough for a long(many steps) and complicated path.**

Goal 15 Obstacle 0mm

success rate	0%
Goal reach rate	0%
plan path length	77.9
success path length	-
failure path length	97.6
plan path steps	788
failure path steps	680
success path last distance to goal	-
failure path last distance to goal	6.6
success path RMSE relative to plan path	-

astar_goal15_run0_m100_obs0_plan, suc. rate: 0.0%, goal reach rate: 0.0%, RMSE: -1 mm

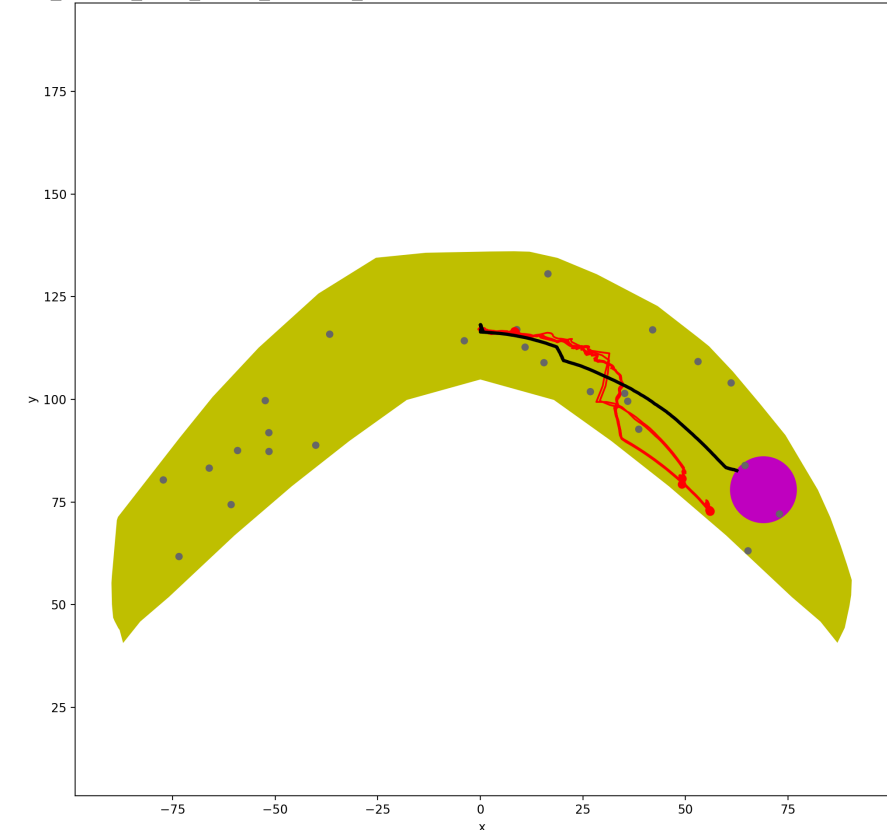


- **0% success rate (All 10 rollout paths failed due to cylinder drop) and 0% goal reach rate.**
- **Average last distance to goal range for failure path is 6.6 mm. Because of 0% success rate, there is no need to check the result if we set goal range to be 10mm.**
- **The rollout path began to look quite different from the planned path from some point. NN model seemed not to be precise enough.**

Goal 15 Obstacle 0.75mm

success rate	0%
Goal reach rate	0%
plan path length	79.3
success path length	-
failure path length	70.9
plan path steps	891
failure path steps	640
success path last distance to goal	-
failure path last distance to goal	24.5
success path RMSE relative to plan path	-

astar_goal15_run0_m100_obs0.75_plan, suc. rate: 0.0%, goal reach rate: 0.0%, RMSE: -1 mm



- **0% success rate (All rollout paths failed due to drop or collision) and 0% goal reach rate.**
- **Average last distance to goal range for failure path is 24.5mm. Because of 0% success rate, there is no need to check the result if we set goal range to be 10mm.**
- **The rollout path began to look quite different from the planned path from some point. NN model seemed not to be precise enough.**

Summary of Results

	A	B	C	D	E	F	G	H	I	J	K	L
1	Goal #	Obstacle Size	astar	astar	astar	astar	astar	astar	astar	astar	astar	astar
2			success rate	goal reach rate	plan path length	success path length	failure path length	plan path steps	failure path steps	success path last distance to goal	failure path last distance to goal	success path RMSE relative to plan path
3	0	0	70	10	73.73	84.47	91.09	685	593.6666667	3.995493704	5.58882537	7.37
4	0	0.75	40	0	75.1	101.77	76.65	894	701	15.40246093	25.30461693	10.76
5	8	0	100	0	53.56	57.46	-	567	-	0.793331421	-	1.98
6	8	0.75	90	0	54.73	61.9	12.07	675	449	1.139094054	40.77772709	2.79
7	15	0	0	0	77.89	-	97.58	788	680.1	-	6.579506062	-
8	15	0.75	0	0	79.29	-	70.92	891	639.7	-	24.54017441	-

For obstacle size of 1.5mm and 3mm, all rollout paths are failure, mainly because of the collision.

But since Avishai also only considered the obstacle size of 0.75mm, it is not the biggest issue for the moment.

Discussion

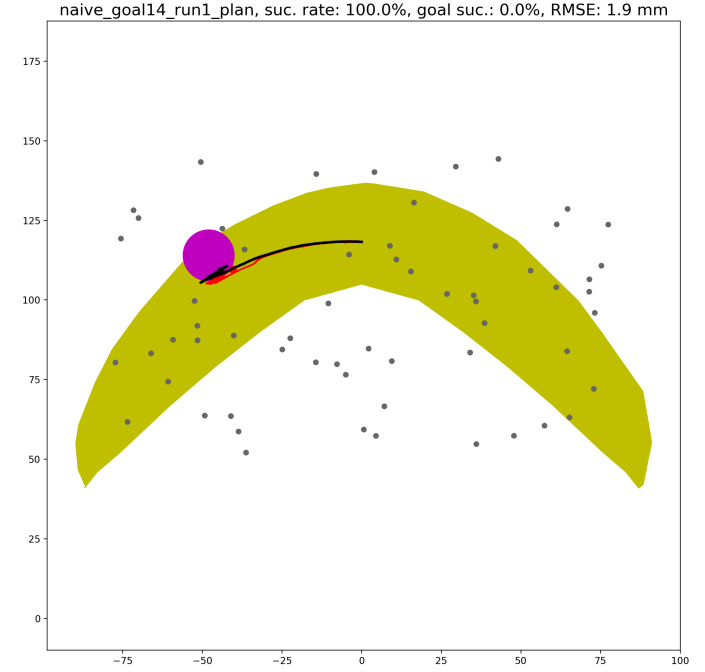
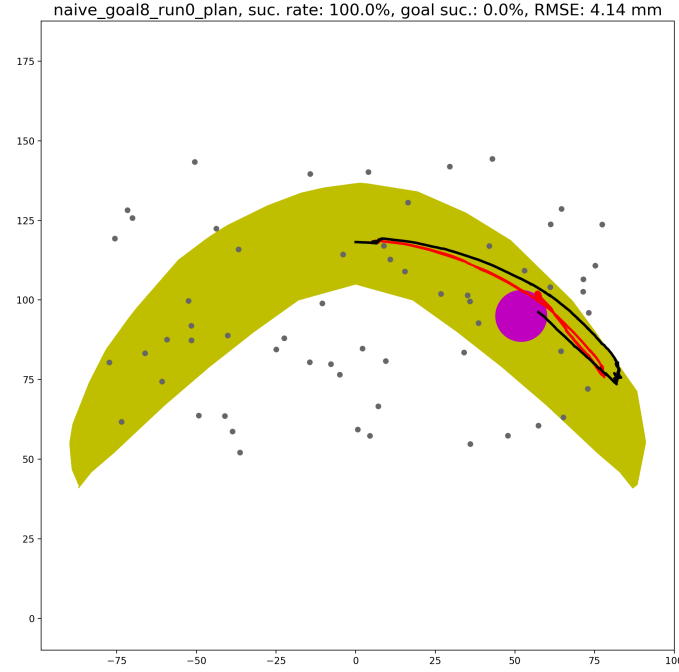
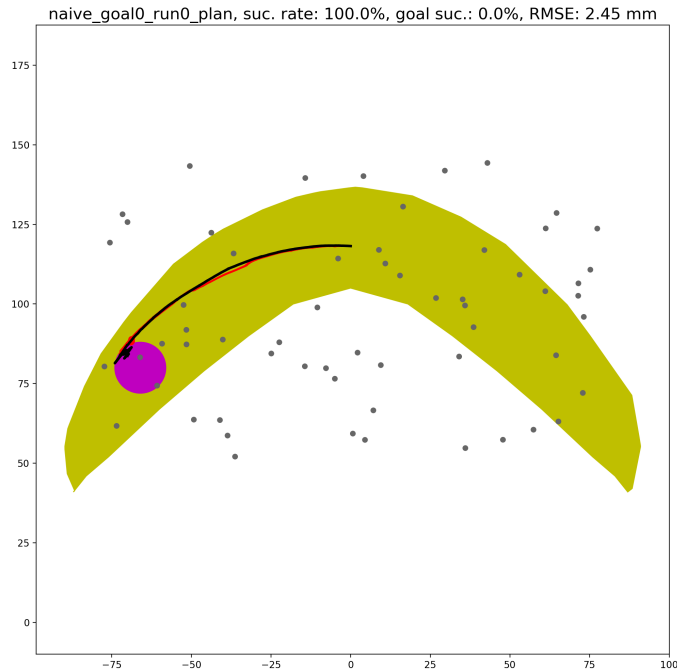
- ~~• Consider a bigger goal reach range for rollout and a smaller goal reach range for planning?~~
YES!
- NN model is not precise enough for a relatively long path or many steps of actions. Thus, Astar should not consider too many same actions (100 actions in our case) for one big step when planning? But if not do so, the planning process would take too much time.
- Difference from the planner in Avishai's paper:
 - The planner is not Astar. (the code is not available in Andrew's repo)
 - I don't know which NN model Avishai used in his paper. (There are 3 or 4 learned NN models in Andrew's repo, and I asked Avishai which model file he used in paper, he told me he forgot. The exact model file name should also be in the code of his planner)
 - Avishai's planner can plan a continuous action, such as $[0.5241234, -0.3451234]$. (I had to discretize to 8 discrete actions for my Astar)
 - Avishai's planner used 10 same actions as one big step when planning.
 - Avishai's planner did not give us a shortest path. (Please see figures on next page)
 - Avishai seemed to have also used svm classifier for checking if the state is a drop state when planning
 - Avishai also had a version of planner taking critic model into account when planning

Avishai's Naïve Planner (without critic model)

Goal #	naive_goal fail rate	naive_goal reached goal	n t
0	100	0	
1	0	0	
2	0	100	
3	0	0	
4	0	100	
5	100	0	
6	0	0	
7	0	0	
8	0	100	
9	0	0	
10	0	0	
11	0	0	
12	0	0	
13	0	0	
14	0	0	
15	0	0	

- In fact, Avishai's naïve planner also did not work very well.
- Goal indices I used this time are [0,8,15].

Avishai's Naïve Planner (without critic model)



In conclusion, it would be nice if I can get access to the code of his planner. Then, I can look deeper into his planner details.