Understanding of ANA* algorithm: a comparison with original A*

RBE550 Motion planning Siyu Li

1. For the maze given by TA

   A* performance

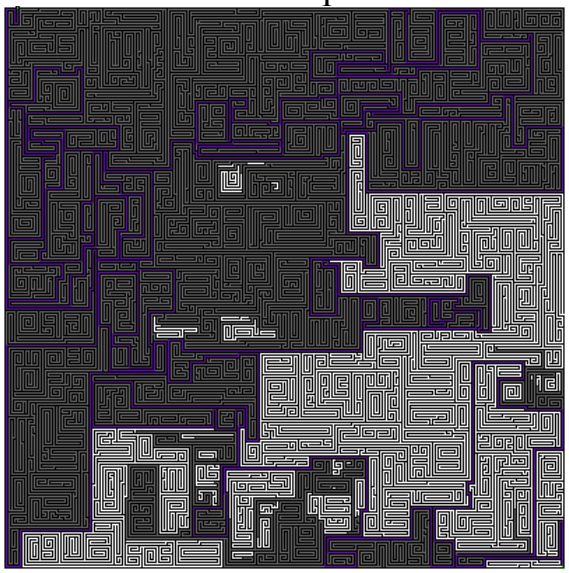
	trivial	medium	hard	Very_hard
Cost	146	3226	7981	18062
Time taken	0.0015211	0.1564419	0.45484018	3.8913040

ANA* performance

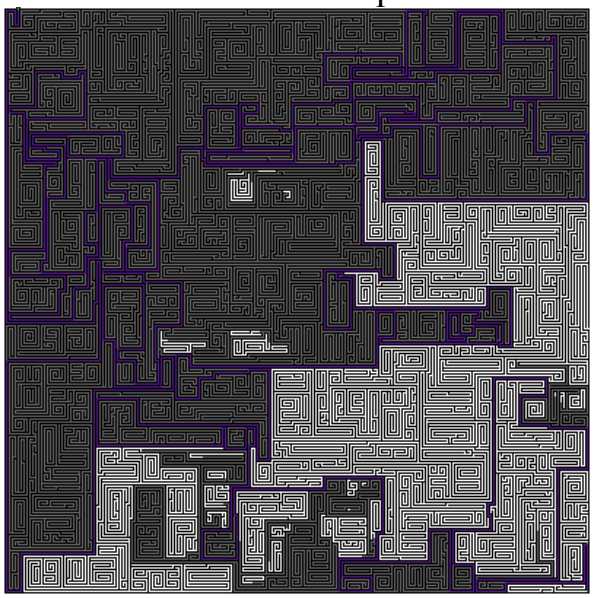
Improve		trivial	medium	hard	Very_hard
1	Cost	146	3226	7981	18062
	Time taken	0.001711	0.1863031	0.2388861	5.002968
	Sub-optimal E	3820803599 5042.24	44166147564 12.61	177665020 3986.24	90506632 8120.94
2	Cost	146	3226	7981	18062
	Time taken	0.00183796	0.1866400	0.5289270	5.289934
	Sub-optimal E	1.58823529 4	4.491071201	1.0002718 1710231	3.966170 733

From the data, we can compare ANA*'s performance with A*. Both generate the same path with the same cost, but A* is faster generation an initial optimal solution.

Figure example (more examples attached to the folder):
For hard maze A* implementation:



For hard maze ANA* implementation:



2. For other motion planning maps found online

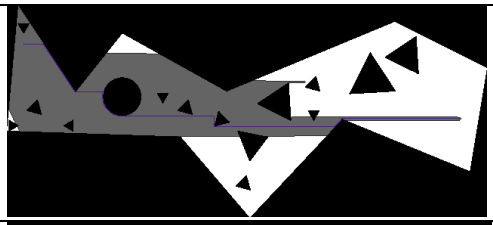
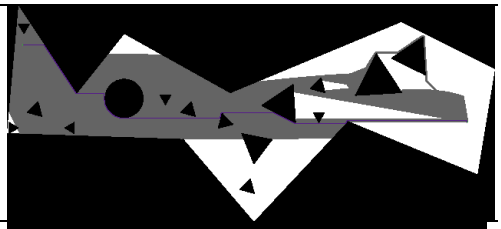
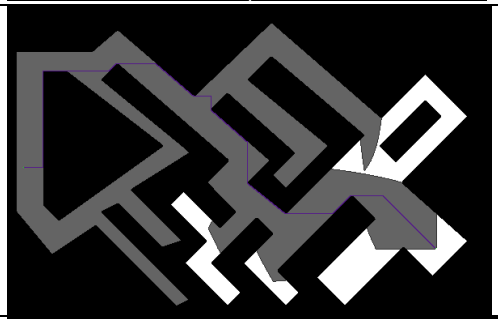
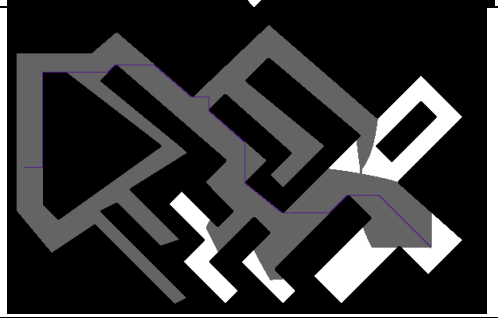
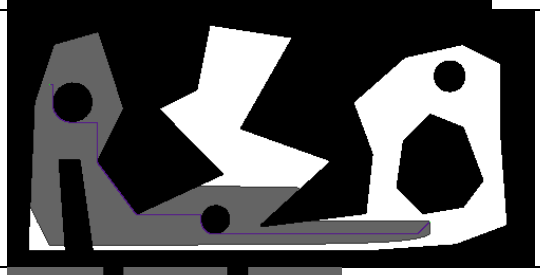
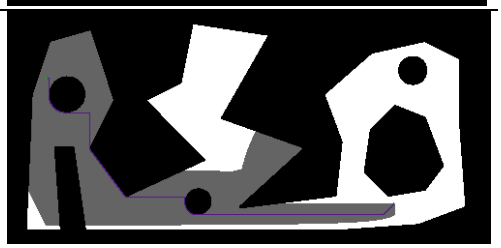
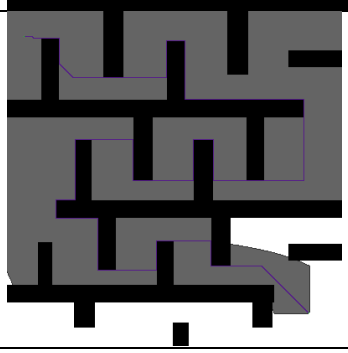
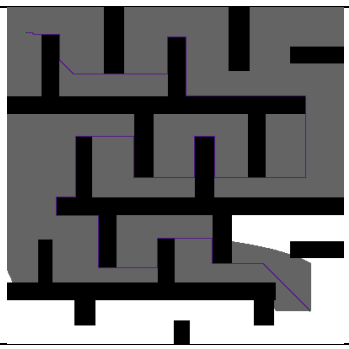
A* performance

	Map2	Map3	Map5
Cost	702	910	1616
Time taken	0.28465914	0.63534212	0.89967107

ANA* performance

Improve		Map2	Map3	Map5
1	Cost	868	1250	1668
	Time taken	0.0164439678	0.916981935	2.600676
	Sub-optimal E	1699069165076.462	1924144607210.1	2110531445965.63
2	Cost	762	916	1616
	Time taken	0.02896809	1.41226792	6.884980
	Sub-optimal E	1.8965436220453	2.076674553	1.58970031385
3	Cost	746	910	1616
	Time taken	0.09025692	1.678866	7.1304941
	Sub-optimal E	1.2543294080	1.42349018256229	1.00014875

4	Cost	702	910	
	Time taken	0.27231192	1.962807	
	Sub-optimal E	1.1563175419	1.000092566	
5	Cost	702		
	Time taken	0.4598569		
	Sub-optimal E	1.000020291178		

	A*	ANA*
Map2		
Map3		
Map4		
Map5		

From the comparison, we see A* and ANA* generate the same final optimal path, but ANA* has searched a broader area. Sub-optimal E of ANA* drop

dramatically at the second improvement, quickly converge to 1. Also, cost in ANA* quickly converge to optimal within two or three improvements. But all in all, in these maps, A* has better performance than ANA* by generating path quicker, especially in complex maps.