

Analysis of different algorithms for Maze solving

This document captures an analysis of different aspects of using different algorithms to solve the “maze problem” defined as, “Given a maze in the format of an image, find the shortest path from the source to the destination and highlight it.”

Algorithms tested

- Breadth-first search (BFS)
- A-star with Manhattan distance heuristic

Maze image information

- Image format : BMP (.bmp)
- Bytes per pixel : 3

Image	Resolution (width*height)	Clear pixel count	% of clear pixels	Length of shortest path (BFS)
1	10*10	43	43.00	15
2	15*15	100	44.44	44
3	41*41	801	47.65	308
4	201*201	20692	51.22	596
5	401*401	82724	51.45	1008
6	1940*2001	2006882	51.70	4572
7	2001*2001	2000001	49.95	24668
8	4001*4001	8000001	49.98	62544
9	6001*6001	18642114	51.77	19194
10	10001*10001	50000001	49.99	173778
11	15001*15001	NA	NA	NA

Running time

- Unit: second(s)
- Typical environment:
 - *OS*: Ubuntu 16.04
 - *Processor*: Intel i5 (7th gen) @ 3GHz
 - *Physical RAM*: 4GiB
 - *Swap space* : 8GB

Image	Breadth-first search (BFS)	A-star with Manhattan distance heuristic	% by which BFS is faster than A-star
1	0.003	0.001	-200.00
2	0.005	0.001	-400.00
3	0.002	0.001	-100.00
4	0.010	0.012	16.67
5	0.031	0.033	6.06
6	0.625	0.644	2.95
7	0.537	0.473	-13.53
8	2.376	2.406	1.25
9	6.848	9.332	26.62
10	64m23.195	NA	NA

Node expansion

Image	Breadth-first search (% expanded)	A-star with Manhattan distance heuristic (% expanded)	% by which A-star expanded fewer nodes than BFS
1	36 (83.72)	23 (53.49)	36.11
2	88 (88.00)	72 (72.00)	18.18
3	780 (97.38)	770 (96.13)	1.28
4	13866 (67.01)	10069 (48.66)	27.38
5	70167 (84.82)	39707 (48.0)	43.41
6	19494985 (97.14)	1248103 (62.19)	35.98
7	918257 (45.19)	837282 (41.86)	8.82
8	6201755 (77.52)	6023391 (75.29)	2.88
9	18642106 (100.00)	18636058 (75.29)	0.03
10	38464642 (76.93)	NA	NA