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
1	10*10	43	43.00
2	15*15	100	44.44
3	41*41	801	47.65
4	201*201	20692	51.22
5	401*401	82724	51.45
6	1940*2001	2006882	51.70
7	2001*2001	2000001	49.95
8	4001*4001	8000001	49.98

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	0.003	0.00
2	0.005	0.002	-150.00

Image	Breadth-first search (BFS)	A-star with Manhattan distance heuristic	% by which BFS is faster than A-star
3	0.002	0.003	33.00
4	0.010	0.014	28.50
5	0.031	0.035	11.42
6	0.625	0.746	16.22
7	0.537	0.649	17.25
8	2.376	2.976	20.16

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)	27 (62.79)	25.00
2	88 (88.00)	72 (72.00)	18.18
3	780 (97.38)	770 (96.13)	1.28
4	13866 (67.01)	10104 (48.83)	27.13
5	70167 (84.82)	39943 (48.28)	43.07
6	19494985 (97.14)	1248266 (62.20)	35.97
7	918257 (45.19)	837378 (41.86)	8.80
8	6201755 (77.52)	6023496 (75.29)	2.87