Multi-Agent Path Finding on Real Robots



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Problem Formulation

Multi-Agent Path Finding (MAPF) deals with the problem of finding collision-free paths for a set of agents. Each agent moves from its start location to its destination location in a shared environment represented by a graph.

5 6 7 8

9 10 11 12

13 14 15

Some extensions:

- weighted arcs (distances)
- robustness (gaps between robots)
- rotations as primitive actions (in addition to move and wait)

What happens if abstract MAPF plans are executed on real robots?

MAPF Scenario



Empirical Results

		Computed Makespan		Failed Runs		Number of Collisions		Total Time		$\operatorname{Max}\Delta\operatorname{time}$		
	classic	5.00	5.00	2.00	5.00	2.75	5.00	1.90	4.93	1.52	1.61	
	classic+wait	5.00	5.00	5.00	5.00	2.12	5.00	3.69	4.10	5.00	5.00	
	classic+robustness	3.95	3.95	5.00	5.00	5.00	5.00	4.12	3.98	2.64	2.74	
classic+wait+robustness		3.95	3.95	5.00	5.00	5.00	5.00	2.79	3.08	5.00	5.00	
	split	3.04	3.04	5.00	4.17	3.70	4.00	4.80	3.72	2.35	1.82	
	split+wait	3.04	3.04	5.00	5.00	2.73	5.00	4.11	3.50	5.00	5.00	
	split+robustness	2.87	2.87	4.17	4.17	4.33	4.50	3.67	3.57	3.14	2.69	
	split+wait+robustness	2.87	2.87	5.00	5.00	5.00	5.00	3.83	3.29	5.00	5.00	
	w-split	1.97	1.15	5.00	5.00	3.83	5.00	4.99	4.88	5.00	5.00	
	w-split+robustness	1.92	1.13	5.00	5.00	5.00	5.00	4.88	4.82	5.00	5.00	
							Best result in bold (larger values are better).					
Abstract models	Maps with 5 cm (left) and 10 cm (right) edges											

Comparison of **quality scores** (1 for the best result; 0 for failure; sum over five different maps) • **computed makespan** (objective of solver)

- failed runs (unfinished executions)
- **#collisions** (robots touch but do not fail)
- total time (real makespan during execution)
- max △ time (difference between fastest and
- slowest robot; all robots should finish at the same time)

