Conflict-Based Search for Optimal Multi-Agent Pathfinding

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Abstract: *We are assumed a customary of mediators in the multi-agent pathfinding problem (MAPF), each of which has its own start and goal positions. The objective is to discovery paths for each agent without causing any collisions. The majority of previous work on the optimal solution to this issue has useful single-agent exploration variations of the A* algorithm and treated each agent as a single "joint agent." The Conflict Based Search (CBS) optimum multi-agent pathfinding algorithm is the subject of this paper. CBS has two layer algorithm that does not use a single "joint agent" model to solve the problem. A Conflict Tree (CT), which is a tree based on conflicts between individual agents, is the high-level search engine. In the CT, each node represents a set of constraints on the agents' motion. To meet the high-level CT node's constraints, quick single-agent searches are carried out at the low level. CBS can frequently examine fewer states than A* while still maintaining optimality thanks to this two-level formulation. We discuss CBS's advantages and disadvantages. The Meta-Agent CBS (MA-CBS) algorithm is also discussed.MA-CBS is a broadening of CBS.MA-CBS, in contrast to basic CBS, permits low-level single-agent searches. Instead, agents can be combined into small groups of joint agents with MA-CBS. Performance is further enhanced and some of the drawbacks of basic CBS are reduced as a result. In point of fact, MA-CBS is a framework that can be layered on top of any MAPF solver that is both complete and optimal to boost its performance. A speedup of up to an order of magnitude over previous methods is demonstrated by experimental results on various problems. We are given a set of agents in the multi-agent pathfinding problem (MAPF), each of which has its own start and goal positions. The objective is to find paths for each agent without causing any collisions. The majority of previous work on the optimal solution to this issue has applied single-agent search variants of the A* algorithm and treated each agent as a single "joint agent." The Conflict Based Search (CBS) optimal multi-agent pathfinding algorithm is the subject of this paper. CBS is a two-level algorithm that does not use a single "joint agent" model to solve the problem. A Conflict Tree (CT), which is a tree based on conflicts between individual agents, is the high-level search engine. In the CT, each node represents a set of constraints on the agents' motion. To meet the high-level CT node's constraints, quick single-agent searches are carried out at the low level. CBS can frequently examine fewer states than A* while still maintaining optimality thanks to this two-level formulation. We discuss CBS's advantages and disadvantages. The Meta-Agent CBS (MA-CBS) algorithm is also discussed.MA-CBS is a broadening of CBS.MA-CBS, in contrast to basic CBS, permits low-level single-agent searches. Instead, agents can be combined into small groups of joint agents with MA-CBS. Performance is further enhanced and some of the drawbacks of basic CBS are reduced as a result. In point of fact, MA-CBS is a framework that can be layered on top of any MAPF solver that is both complete and optimal to boost its performance. A speedup of up to an order of magnitude over previous methods is demonstrated by experimental results on various problems.*

Keywords: Multi-Agent Pathfinding Problem

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