Efficient Near-Optimal Planning in Complex and Unstructured Domains

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Abstract

As robots move out of the laboratory and into an unstructured world, they are asked to address more and more complicated tasks. Rather grip an object, they are asked to pack a box; rather than move to a location, they are asked to clean a room. Most robot demonstrations require a human to work out the details of a viable plan to accomplish its task, allowing designers the opportunity to carefully engineer solutions to a sequence of well-specified and narrowly scoped tasks. Specifying these details is difficult in unstructured domains, and alternative approaches that automate this specification often rely heavily on approximations that prevent us from understanding when the system will fail. In this talk I describe algorithms for planning in domains with many objects and complex constraints, and show how these algorithms allow us plan efficiently while also making strong theoretical guarantees. Along the way I will present a theoretical framework for modelling such systems, a simple way of parameterizing problems that is both verifiable and empirically derivable, and a strategy for incorporating abstraction in a way that preserves our theoretical guarantees.

Bio

Will Vega-Brown is a doctoral candidate in the Robust Robotics Group at MIT working on high-level autonomy and decision making. His research enables robots to find high-quality solutions to complicated tasks, broadening the set of challenges robots can address and reducing the amount of human intervention and direction they require. He previously worked on modelling sensor and actuator uncertainty to improve the robustness of autonomous systems, with applications to high-speed autonomous flight and ground navigation. He received his bachelor's and master's degrees from MIT in 2011 and 2013, respectively, and is also a co-founder of Tagup, an industrial IoT and analytics company.

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