北京大学前沿计算研究中心
Center on Frontiers of Computing Studies, Peking University

静园5号院
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Mechanism Design for Defence Coordination

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2024年1月11日 星期四 10:30am

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Abstract

In many security scenarios, multiple defence agencies operate simultaneously to protect a shared set of targets. While all the defenders want the targets to be better protected, their valuations for the targets might be different. These unaligned incentives result in a game among the defenders. We study how to coordinate the defenders to improve the system efficiency. The task is twofold. First, we need to understand the equilibrium of the uncoordinated situation, as the baseline to improve. We formulate a new equilibrium concept combining the notions of Nash equilibrium and Stackelberg equilibrium, and prove its existence and tractability. Second, we take a mechanism design approach to coordinate the defenders, aiming to find a mechanism to generate joint resource allocation strategies. We seek a mechanism that satisfies several basic properties: it should improve every defender’s utility upon the uncoordinated baseline, and should be Pareto efficient and incentive compatible. For each possible combination of these basic properties, we either prove that it cannot be achieved by any feasible mechanism or provide a computationally efficient mechanism to achieve it.

Biography

Jiarui Gan is a Departmental Lecturer at the Computer Science Department, University of Oxford, working in the Artificial Intelligence & Machine Learning research theme. Before this he was a postdoctoral researcher at Max Planck Institute for Software Systems, and he obtained his PhD from Oxford. Jiarui is broadly interested in algorithmic problems in game theory. His current focus is on sequential information and mechanism design problems. His recent work has been selected for an Outstanding Paper Honorable Mention at the AAAI'22 conference.