

## Abstract

This paper fills a literature gap by investigating the strategic interactions between an attacker and a defender with a multi-period multi-target game. At each period, the defender allocates a limited amount of defensive resources over multiple targets, and the attacker assigns some attack probabilities to those targets. We consider four scenarios where the defender could be either myopic or long-sighted, and the defense could be carried over to future periods or not. Our analyses characterize the defender's optimal allocations in these four scenarios and develop an algorithm to identify the optimal allocations. We find that increases in defense carryover could lead to less allocation to defended targets from the second period at equilibrium, and lead to defending more targets. To gather empirical evidence regarding one key function of the model - success probability of attack, we conduct statistical analysis based on datasets from Global Terrorism Database, which is provided by National Consortium for the Study of Terrorism and Responses to Terrorism (START) and the Urban Area Security Initiative (UASI) grant allocations from FY 2004 to FY 2012. We conclude that in general, effects of defense resources on reducing success probability of attack are mixed due to scarcity of terrorism data.

## Citation

Shan, X. and J. Zhuang. "Modeling Cumulative Defensive Resource Allocation against a Strategic Attacker in A Multi-Period Multi-Target Sequential Game", *Reliability Engineering & System Safety*, 179: 12-26, 2018.