Optimal Security Investments in a Prevention and Detection Game

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ABSTRACT: Most security defenses can be breached by motivated adversaries, therefore in addition to attack-prevention technologies, firms investing in cyber-security for their information technology infrastructure need to consider attack-detection and restoration tools to detect intruders, and restore their system to a safe condition. Attackers face similar investment alternatives; they need to invest resources to finding vulnerabilities in a protected system, and once the protection has been broken, they need to invest in the infrastructure necessary to exploit these attacks and maintain stealthy persistence in the compromised infrastructure. We model this dual considerations as a dynamic programming problem between attackers and defenders and then study the Nash equilibrium of this game. Our goal is to find models and alternatives that can help us understand optimal security investments in prevention and detection against advanced rational adversaries.

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