A Game of Jamming: A Multi-Agent Game Theoretic Learning Based Cognitive Anti-Jamming Communication System to Combat an AI Jammer

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In many applications, there is a high risk of wireless links getting jammed, leading to potentially disastrous outcomes. Although cognitive radios (CR) are envisioned to be an effective solution against jammers, most proposals ignore the possibility that jammers may also be equipped with the same machine learning (ML) abilities. The goal of this project is to develop a CR which can withstand, or outperform, a sophisticated jammer with Artificial Intelligence that adapts to the radio's channel selections. Spectrum co-existence of the CR and the jammer is modeled as a non-cooperative stochastic game and game-theoretic learning is used for both to learn effective policies in response to each other's actions. The CR was designed to use reinforcement learning (RL) based on Win-or-Learn-Fast Policy Hill Climbing (WoLF-PHC) to learn how to make better future channel selections. The project also developed a cognitive jammer (CJ) that interweaves jamming and sensing and uses No-regret Learning (NRL) to zero-in on channels containing signals. Performance was evaluated by comparing the developed CR and a legacy radio both against the CJ as well as against a non-learning jammer. Results showed the ability of CRs to withstand attacks from smart jammers through anti-jamming protocols based on game-theoretic learning.

Awards Won:

Second Award of $1,500

National Security Agency Research Directorate : Second Place Award "Cyber Pioneer" of $1000

Association for Computing Machinery: Third Award of $1,500