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Practical applications of reinforcement learning for decision support in defence and security

Sequences of decisions that occur under uncertainty arise in a variety of settings, including transportation, communication networks, finance, defence, etc. The classic approach to find an optimal decision policy for a sequential decision problem is dynamic programming; however its usefulness is limited due to the curse of dimensionality and the curse of modelling, and thus many real-world applications require an alternative approach. Given its success in recent years, Reinforcement Learning (RL) has gained popularity as an approach to solve these types of problems. In addition, in the field of operations research, Powell's recently published unified framework for sequential decisions provides a methodology that links mathematical modelling, stochastic optimization, approximate dynamic programming, RL, simulation, as well as other related fields with the aim to model and solve sequential decision problems. In this talk we discuss two recent decision support applications—mass evacuation in the Arctic, and capital investment planning—that focus on using Powell's framework and RL concepts within defence and security. Lastly, ongoing activities within a newly formed NATO research task group that is focused on RL-based decision support will be highlighted.