

1. Research Title: Human Machine Teaming in Multi-Agent Reinforcement Learning

2. Individual Sponsor:

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3. Academic Area/Field and Education Level

Computer Science or Engineering/Electrical Engineering/Operation Research (MS or PhD)

4. Objectives:

The Mission Analytics Branch (711 HPW/RHWA) is conducting fundamental research on exploring AI and machine learning methods in the area of multi-agent reinforcement learning (MARL) to create virtual AI players that could assist human operators in flight path planning. A flight path planning board game developed by RHWA is used to simulate the mission environment in which AI agents, representing different air platforms, can be trained with reinforcement learning methods to discover and fly the best routes over both pre-defined as well as emerging targets to collect points, under the constraints such as platforms' collection footprints and probabilities, fuel capacities, varying launch sites, no-fly zones, and collision avoidance. The objective of this research is to explore methodologies that can incorporate human machine teaming (HMT) into an adversarial cooperative multi-agent reinforcement learning (MARL) framework to train AI agents with human inputs and demonstrations.

5. Description:

An adversarial cooperative MARL allows multiple agents to compete among each other for the highest individual target collection points while also contribute to the maximization of overall team points at the same time. The researcher will survey, formulate, and develop machine learning algorithms and approaches to answer any of the following questions: 1) What is the adversarial cooperative MARL framework that is best suited for seamless HMT in the reinforcement learning process? 2) How to realize a HMT mechanism for MARL through an analyst-agent dialog interface in which an analyst can offer interactive critics on an agent's chosen course of actions? 3) How to directly incorporate an analyst's demonstration of alternative courses of desirable actions into the MARL process? RHWAS will provide the electronic version of the board game preconfigured as the simulator for reinforcement learning. The student and advisor are welcome to propose a solution targeting one or more of these questions based on his/her research interest and degree program. The solution needs to be evaluated as a proof-of-concept with typical performance metrics employed in MARL.

6. Research Classification/Restrictions: Unclassified, no restrictions

7. Eligible Research Institutions: Universities (DAGSI)