

2020 DAGSI Research Topic

1. **Research Title:** RF Synthetic Data for Multi-level Modeling of Radar Systems Using Machine Learning

2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level:** Sensors/Machine Learning/Electrical Engineering/Computer Science (BA/BS, MS or PhD level)

4. **Objectives:** Develop and demonstrate a machine learned framework to generate multi-level data for Multi-input, multi-output radar systems and autonomous platforms. We are specifically interested in the scalability of this approach for object detection and stand-off tracking in surveillance of large multi-platform environment and application to autonomous unmanned aircraft vehicles.

5. **Description:** In the 2019 Artificial Intelligence Strategy, the U.S. Air Force declared its intent to employ artificial intelligence (AI) and dominate the air, space, and cyberspace domains. It is important to develop comprehensive RF models and synthetic data sets that enables modeling the sensor operations, sensor resource management, and multi-layer data fusion processes. Such model will allow substantially reduced cost of testing and find optimal performance parameters for best operational functionality and overcome combinatorial complexity issues of the system and the environment. There is a need for data to train the neural nets, but there are few data sets to address important radar applications. Here is a reason for dedicated data set, it is fine line between results produced by machine learning that are obvious and the results that are unconceivable and/or unbelievable. The research should focus on that fine line to push boundaries of applicability and transparency of the machine learning approaches. The researchers should develop machine learning to generate data for a potentially wide range of radar systems on both physical and operational levels that could be simulated using conventional computer systems. Develop procedures to incorporate synthetic data with experimental data as a baseline for machine learning. Analyze various types of datasets, evaluation protocols, performance measures, and data preprocessing steps applicable to this model. Explore global optimization methods for inter-level data exchange and global sensor parameters adjustments.

6. **Research Classification/Restrictions:** This research will be unrestricted and the results will be in the public domain. However to facilitate close collaboration between AFRL and the student, frequent visits to WPAFB will be required. The student and the faculty member are therefore required to be US citizens or permanent residents.

7. **Eligible Research Institutions:** All DAGSI

NOTE: Topics submitted to DAGSI must be approved for public release. Need PA Approval #