Tutorial title: **Introduction to Radar Exploitation via Cognitive/AI Processes**

Presenter(s):

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David Brown is a research engineer with the Advanced Electronic Warfare group in the Defense & Intelligence Solutions Division at Southwest Research Institute (SwRI) where he is a lead engineer for advanced electronic warfare (EW) system research & development. His research interests are centered on applied cognitive EW, including methodologies to push AI/ML algorithms to the sensor edge and smart data compression for congested data transport layers. Prior to joining SwRI, he held a variety of EW related R&D positions and was an adjunct professor at the Georgia Institute of Technology. In addition to engineering experience in EW, David gained practical experience in EW application as a B-1B Electronic Warfare Officer (EWO). David received undergraduate and graduate training in electrical engineering from Georgia Tech as well as Master of Arts and Master of Divinity from Liberty University. David is a Distinguished Graduate of the Joint Electronic Warfare Officer School and is the recipient of the AOC EW Pioneer Award and RF Award. He served as the co-chair of the Sensor Open Systems Architecture (SOSA) Low Latency Subcommittee, which focused on EW specific concerns within open architecture systems. David is an IEEE Systems Council Distinguished Lecturer as well as an active AOC member.

Tutorial Description

Outline:

- **Orientation to Radar Signal Exploitation (EW)**
  - **Historical Perspective**
  - **Systems Perspective**
- **Current State of the Art**
  - **Commercially Available Technologies**
  - **Open Architecture Implications for EW**
- **Advanced Research**
  - **Perspectives on Cognitive/AI Approaches to EW**
  - **Data Issues with AI Training in RF Domain**

Synopsis:

This tutorial will provide insight into non-cooperative radar signal exploitation (generically referred to as Electronic Warfare). The tutorial begins with orientation to radar signal exploitation, which is an introduction to electronic warfare (EW) concepts and principles necessary for modern combat systems. The intent is to familiarize the audience with EW concepts and achieve an understanding of how EW is used to interrupt radar processing chains. After orienting the student to the field, current state of the art is presented focusing on commercially available technologies and open architecture approaches. Finally, on-going research applying the revolutionary impact of cognitive, AI, and machine learning

processes to RF signal processing and decision making is presented, including training/validation data challenges.

This tutorial will be of interest to radar design engineers desiring a basic understanding of intentional interference sources (electronic warfare) from historical to modern perspectives. The student will gain an understanding of the origin and intended goals of the EW field along with system level considerations. The student will learn how open architecture designs are being applied to EW systems and will gain an appreciation of advanced topics in EW, including challenges of applying artificial intelligence / machine learning (AI/ML) algorithms to solve RF signal problems.

Presentation Material:

The material includes summaries of latest research which is currently undergoing review for USA ITAR release. Draft material is expected to be available in April 2024. However, this tutorial includes updated research but is similar in scope to previously successful presentations at:

- **2023 International Radar Conference (Sydney)**
- **Joint IEEE/AOC EW Event (Brisbane)**
- **Joint IEEE/AOC EW Event (Adelaide)**
- **2023 Radar Conference (San Antonio; during radar bootcamp)**

Expected Audience

Background:

This material is accessible to anyone with an undergraduate level understanding of RF and radar systems. The cognitive/AI concepts as well as data issues require a deeper of understanding of AI and machine learning principles but are still very accessible to early graduate student audience.

Estimate of attendance numbers: **40 based on previous audiences at similar events**