1) Title of the tutorial

Advanced Radar Detection and Applications

2) Instructors name and affiliation

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3) A 300 word abstract describing the proposed topic and including an outline of the contents

We teach advanced radar detection from first principles and develop the concepts behind Space-Time Adaptive Processing (STAP) and advanced, yet practical, adaptive algorithms for realistic data environments. Detection theory is reviewed to provide the student with both the understanding of how STAP is derived, as well as to gain an appreciation for how the assumptions can be modified based on different signal and clutter models. Radar received data components are explained in detail and the mathematical models are derived so that the student can program their own MATLAB or other simulation code to represent target, jammer and clutter from a statistical framework and construct optimal and suboptimal radar detector structures. The course covers state-of-the-art STAP techniques that address many of the limitations of traditional STAP solutions, offering insight into future research trends. Additionally, we cover applications of advanced detection algorithms including modern hardware realizations and other related applications such as COTS based distributed array STAP beamforming.

Topics:
Part 1 – Introduction, Classic Radar Detection cases.
Part 3 – Adaptive algorithms, Reduced rank algorithms, Multistage Wiener Filter.
Part 4 – Real world data environments, robust STAP algorithms, COTS distributed array algorithm and application, Summary.

4) Target audience and assumed knowledge

This tutorial is for anyone interested in learning advanced concepts and practical solutions to modern radar detection and estimation problems with emphasis on statistical adaptive signal processing. The students will also be able to use the course notes to simulate the radar target, clutter, jamming and processing algorithms using programming languages such as MATLAB. Students should have some basic background in areas of radar, signal processing and linear algebra to get the most benefit.