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Distributed Active and Passive Radar

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Abstract

Recently, passive sensing has received considerable interest at the Air force Research Laboratory. A passive radar system can detect and track targets of interest by exploiting readily available, noncooperative illuminators of opportunity, which is of great interest in both civilian and military scenarios due to a number of advantages. First, passive systems are substantially smaller and less expensive compared to active radar systems because they do not need transmitters. Second, the bistatic or multistatic configuration enables it to obtain spatial diversity of the targets' radar cross section, which leads to potential gains in detection and classification capabilities. Finally, many illuminators of opportunity are available for passive sensing, including frequency modulation (FM) radio, television, cell phone base stations, digital audio broadcasting (DAB), digital video broadcasting-terrestrial (DVB-T), and second generation digital video broadcasting-terrestrial (DVBT2) sources. This talk will review efforts currently taking place within the RF Technology Branch at AFRL, including modeling and simulation, algorithm development for Air/ground Moving Target Indication (A/GMTI) and Synthetic Aperture Radar (SAR), and experimentation. In particular, we consider centralized detection in distributed RF sensor networks. We present a comparative analysis of the generalized likelihood ratio test (GLRT) detection in active and passive networks including active multiple-input multiple-output (MIMO) radar (AMR), passive MIMO radar (PMR), and passive source localization (PSL). Our results demonstrate that PMR generalizes AMR and PSL in that PMR detection sensitivity may approximate that of AMR or PSL depending on the average direct-path-to-noise ratio (DNR). Thus, PMR may be regarded as the link between AMR and PSL sensor networks that unifies them within a common theoretical framework.

Biography

Dr. Braham Himed received his “Ingenieur d’Etat” degree in electrical engineering from Ecole Nationale Polytechnique of Algiers in 1984, and his M.S. and Ph.D. degrees both in electrical engineering, from Syracuse University, Syracuse, NY, in 1987 and 1990, respectively. Dr. Himed currently serves as Technical Advisor with the Air Force Research Laboratory, Sensors Directorate, RF Technology Branch, in Dayton Ohio, where he is involved with several aspects of airborne and spaceborne phased array radar systems. His research interests include detection, estimation, multichannel adaptive signal processing, time series analyses, array processing, space-time adaptive processing, MIMO radar, and waveform diversity. Dr. Himed leads the next generation over the horizon radar (NGOTHR) technology risk reduction initiative (TRRI), which is sponsored by the office of the secretary of defense (OSD). Dr. Himed is the recipient of the 2001 IEEE region I award for his work on bistatic radar systems, algorithm development, and phenomenology. He is also the recipient of the 2012 IEEE Warren White award for excellence in radar engineering. He is a Fellow of the IEEE and a member of the IEEE AES Radar Systems Panel. Dr. Himed is a Fellow of AFRL (class of 2013).

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