Emerging Mathematical and Algorithmic Methods in Electronic Support, Remote Sensing and Surveillance

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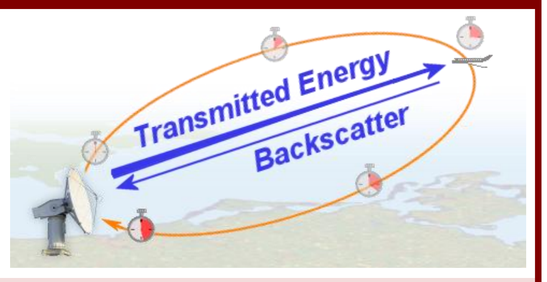
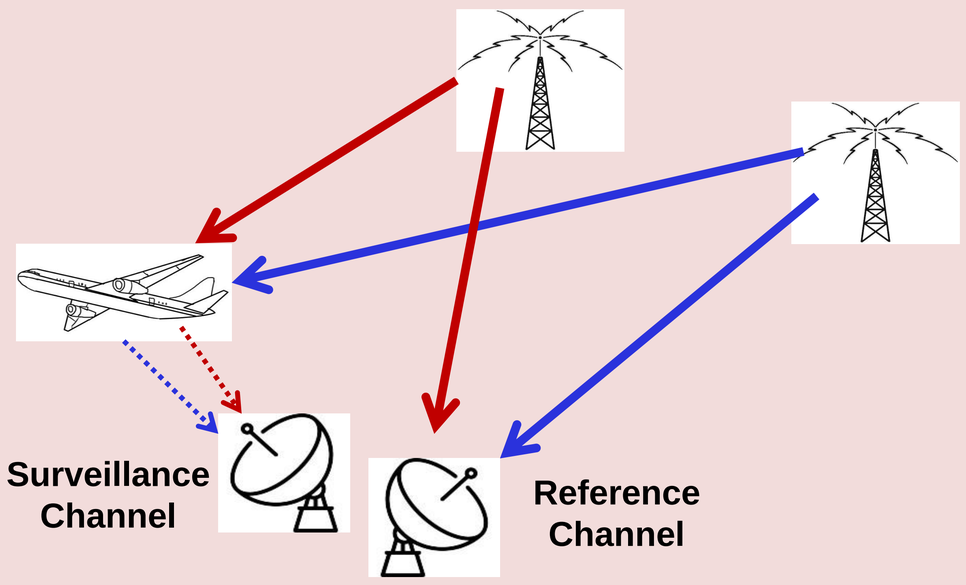
The ability to detect and characterize phenomena at a distance is fundamental in a wide spectrum of civilian and defence applications. Remote sensing employs optical, radio-frequency, acoustic and other measurement modalities to achieve this ability. As new technologies enable networked and other multi-sensor measurement schemes, new mathematical approaches are needed to allow us to exploit these schemes for better detection and characterization.

Australian Government
Department of Defence
Defence Science and Technology Group

Multi-channel Passive Radar

Most modern radars are ***active***: the radar transmits a signal, then receives and processes echoes scattered from the sensed environment or target





Passive radar does not transmit, rather it exploits opportunistic signals already present in the environment (e.g., terrestrial or satellite TV, digital radio, cellular)

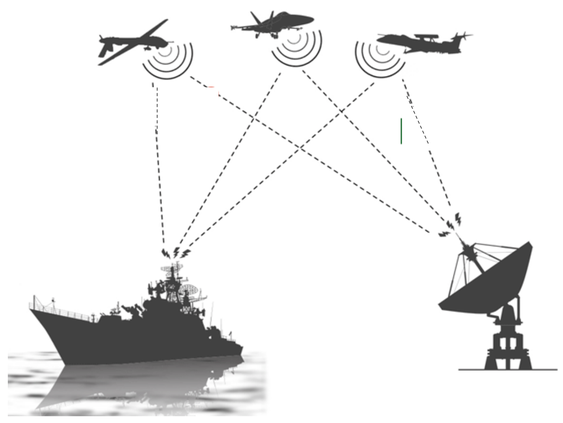
- Passive is “green:” it does not pollute the radio spectrum with additional transmissions
- It is relatively simple, covert, and intrinsically multistatic (good for detecting certain difficult targets)

Key Challenge:

- The receiver does not control the transmitted signal and generally knows only a measured (noisy) “reference” version ➔ methods used in active radar don’t work in passive!

This project is developing new statistical theory and corresponding practical algorithms for passive radar

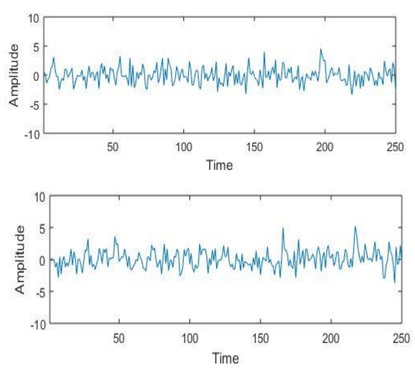
Electronic Support (ES)



Aircraft, ships, and other vehicles routinely emit electronic signals associated with navigation, sensing, and communication. ***Electronic support*** entails detecting, locating, and identifying or characterizing sources of electronic emissions.

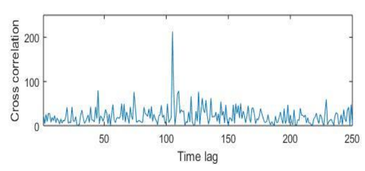
ES poses challenges distinct from those encountered in radar remote sensing:

- **Active radar**: The transmitted signal is known and is designed for the needs of the radar system
- **Passive radar**: The transmitted signal is unknown and is designed for a different purpose, but enough is known about the transmitter (location, frequency band, etc.) to enable collection of a useful, often strong, reference signal
- **ES:** Little may be known about the transmitter or the signal. Indeed, the first objective may be to determine whether a transmitter is even present before proceeding to determine its location and other characteristics.



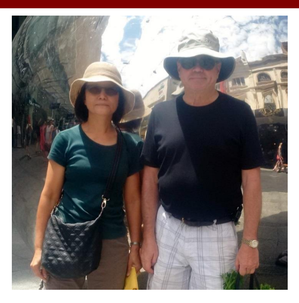
➔ Common signal component on the two channels?

Two-channel coherent processing leaves ➔ little doubt!



This project is developing multi-channel statistical theory for detecting and characterizing unknown signal sources

Hosts



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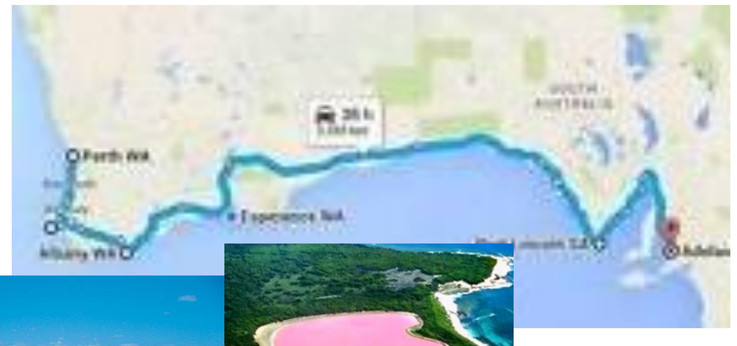
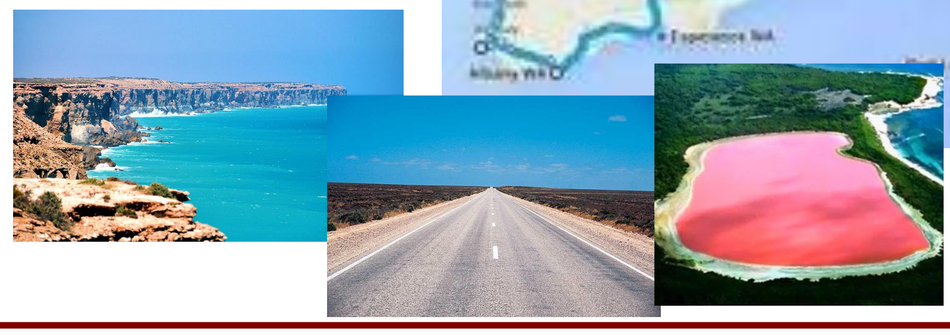
Grand Finale

- Adelaide to Perth
- Great Australian Bight / Nullarbor
- 3100 Km, 8 days
- 1989 BMW R80/RS motorcycle





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