CURRENT RESEARCH IN STATISTICAL SIGNAL PROCESSING

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February 28, 2001

OVERVIEW

- What is statistical signal processing?
- What are the tools and methodology?
- Overview of three active research projects:
  - Emitter differentiation
  - Tracking ground vehicle locations with microphone arrays
  - Separating signals in wireless communications

STATISTICAL SIGNAL PROCESSING

- Signal Processing: Extract information from measurements
  - Detect aircraft with radar
  - Receive cell phone signals at base station
  - Audio/image/video processing & compression
  - Adaptive filters in modems
  - Restore old music recordings
  - Medical imaging (ultrasound, MRI, CAT)
- Statistical Signal Processing:
  - Noise (errors) in measurements
  - The signals themselves may be modeled as random!

METHODOLOGY OF STATISTICAL SP

1. Formulate a math model for the measured signals (observations)
2. Derive fundamental *bounds* on performance
   a. "The number of classifiable signals is ≤ 12"
   b. "The mean-squared error of any unbiased estimate is $\geq 10^{-3}$"
3. Invent *algorithms* to extract the desired information
4. Evaluate algorithm performance with respect to fundamental bounds

(Note Claude Shannon and information theory)

THREE ACTIVE RESEARCH PROJECTS

- Emitter differentiation
- Tracking ground vehicle locations with microphone arrays
- Separating signals in wireless communications

Show methodology for each case:

- Mathematical model
- Fundamental performance bounds
- Algorithms and their performance