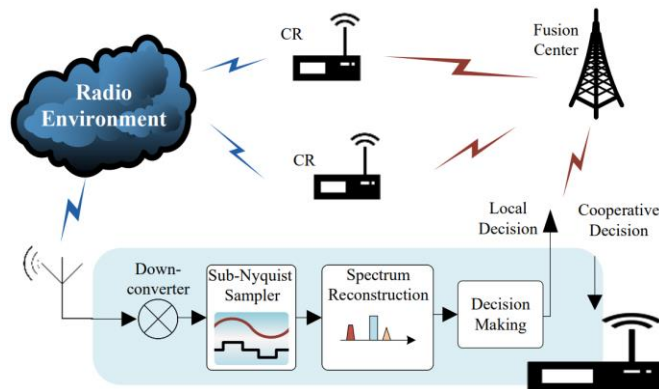


# Numerical Evaluation on Sub- Nyquist Spectrum Reconstruction Methods

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# Problems & Ideas

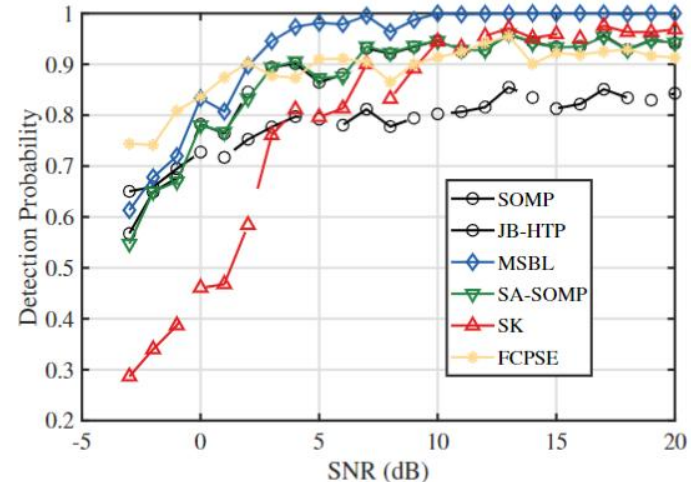
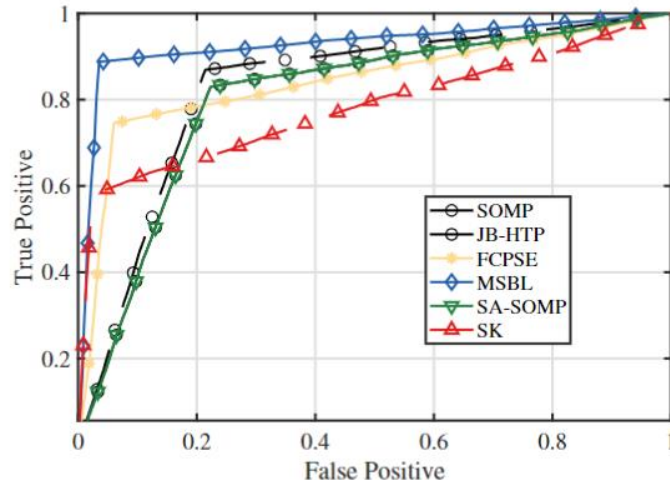
- Problems of spectrum utilization and traditional solutions:
  - A significant portion of the spectrum is underutilized by primary users, leading to inefficiencies.
  - Traditional wideband spectrum sensing methods are high-cost and power-intensive.
- The GBSense project innovatively addresses these challenges by employing advanced sub-Nyquist sampling methods, ensuring compatibility with low-power devices and focusing on effective spectrum reconstruction.



Left: Diagram of Cooperative Compressed Spectrum Sensing: A central Fusion Center communicates with multiple Cognitive Radio (CR) users and aggregates decisions. Each CR user consists of a sub-Nyquist sampler, spectrum reconstruction, and a decision-making unit. Right: The GBSense data collection and CSS algorithm testing platform built on the NI millimeter-wave transceiver system.

# Main Contributions

- Contributions:
  - Detailed the Compressed Spectrum Sensing (CSS) framework using multicoset sampling and provided a comprehensive overview of various compressed sensing reconstruction techniques.
  - Thoroughly evaluated four algorithms from the GBSense Challenge 2021, comparing their detection capabilities and computational efficiencies.
  - Highlighted avenues for future advancements in spectrum reconstruction, stressing the need for stability, decreased computational demands, and better adaptability to diverse noise conditions.



Left: Receiver operating characteristic (ROC) curves of the associated algorithms at a certain sparsity level. Right: Detection probability as a function of SNR for the associated algorithms.