ROHINI
COLLEGE OF ENGINEERING & TECHNOLOGY
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Minimum Variance (MV) / MVDR Beamformer

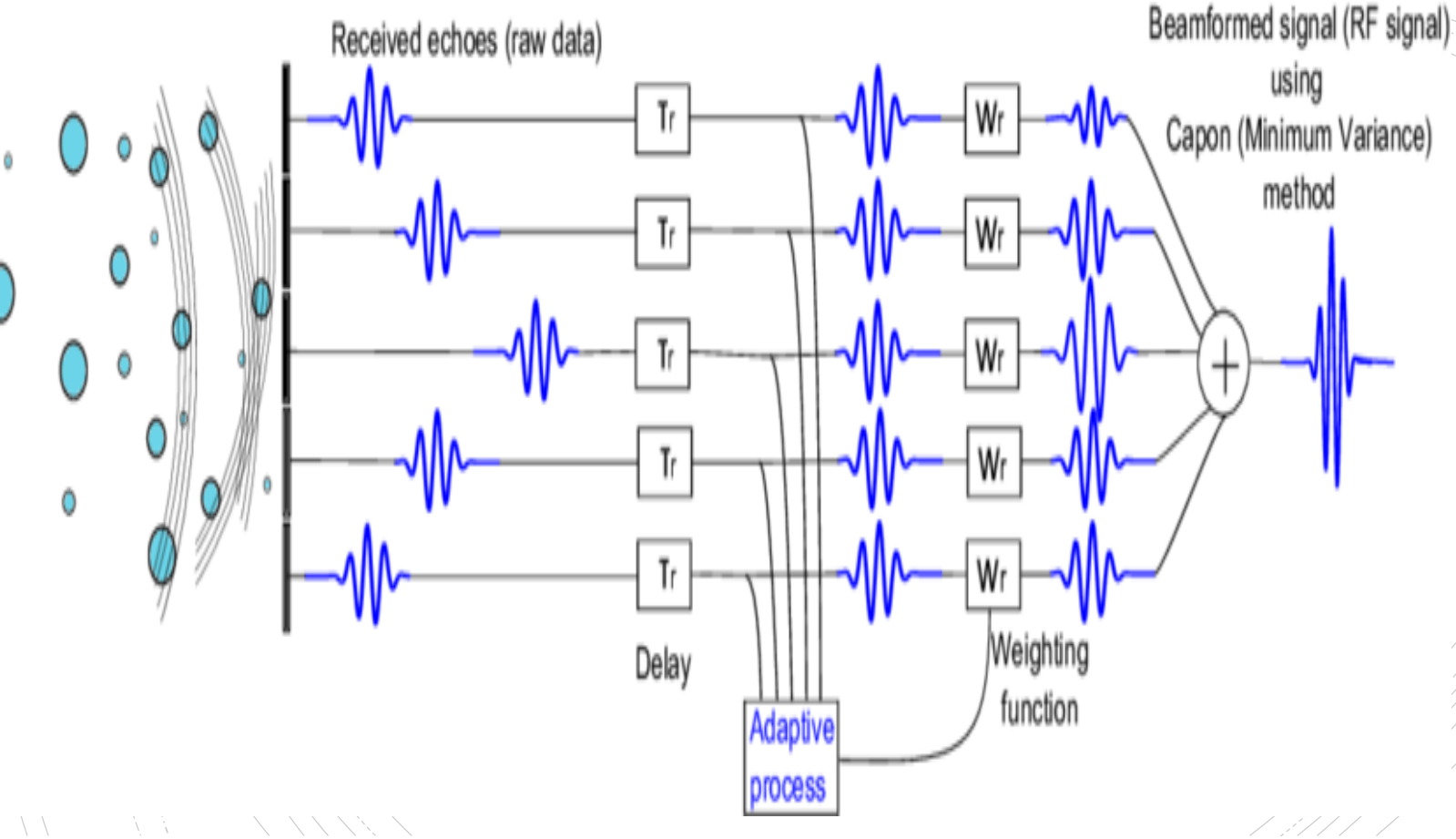
C.PRISCILLA/ AP/ECE

Definition

- Minimum variance in smart antennas refers to the **Minimum Variance Distortionless Response (MVDR) (or Capon) beamforming algorithm**, which minimizes the output power (variance) while maintaining the desired signal's strength by placing nulls in interference directions, significantly improving Signal-to-Interference-plus-Noise Ratio (SINR) for better signal reception in complex environments

How MVDR Works

- **Optimization Goal:** Find the best weight vector (adjustments for each antenna element) to minimize the total output power (variance).
- **Distortionless Constraint:** Ensures the desired signal isn't distorted by keeping its response at a fixed level (e.g., gain of 1).
- **Null Steering:** Effectively places deep nulls (directions of minimum reception) towards interfering signals, suppressing them.
- **Adaptive Nature:** Continuously updates weights as interference and signal directions change, making it suitable for dynamic environments.


Received echoes (raw data)
Tr
Tr
Tr
Tr
Tr
Wr
Wr
Wr
Wr
Wr
Beamformed signal (RF signal)
using
Capon (Minimum Variance)
method
Delay
Adaptive
process
Weighting
function

Benefits & Performance

- **Improved SINR:** Greatly enhances the ratio of desired signal power to interference and noise power.
- **High Resolution:** Offers better spatial resolution for separating closely located signals compared to simpler techniques like Bartlett processing.
- **Robustness:** Performs well in high interference scenarios, crucial for cellular networks and radar.