

Dual-Security in Integrated Sensing and Communication Systems

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Background

- Integrated sensing and communication (ISAC), as one of the IMT-2030, merged two functions into one system
- The **ubiquity** and **dual-use** of signals create severe vulnerabilities, risking exposure to **unauthorized eavesdropping** on both functions

System Model

- Considered one base station, comm user, target, comm Eve and sensing Eve (can be the same Eve)
- Multiple-Input Multiple-Output Orthogonal Frequency-Division Multiplexing (MIMO-OFDM)
- Surveillance ($y=Hx$) and reference signal (x), estimation via y/x

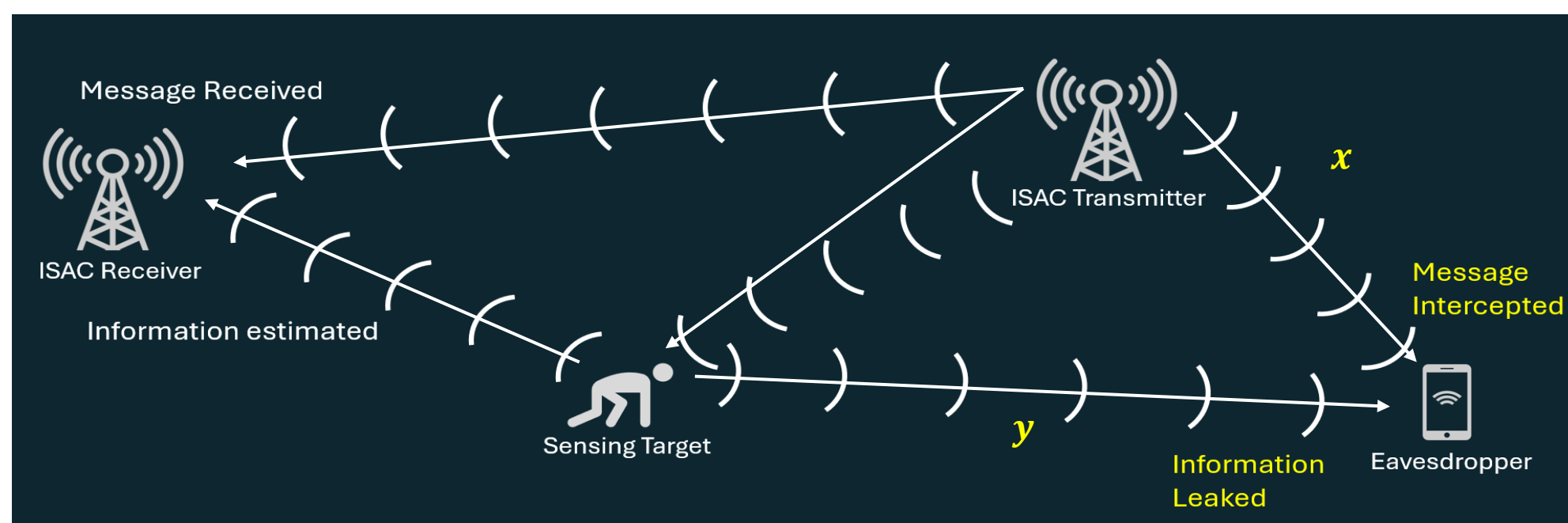


Figure 1: System Model

Results

- Delay-Doppler maps for base station and sensing Eve
- Created 3 artificial ghosts
- The sensing Eve may perfectly recover the reference signal (Fig. b, Fig. e) or not (Fig. c, Fig. f)

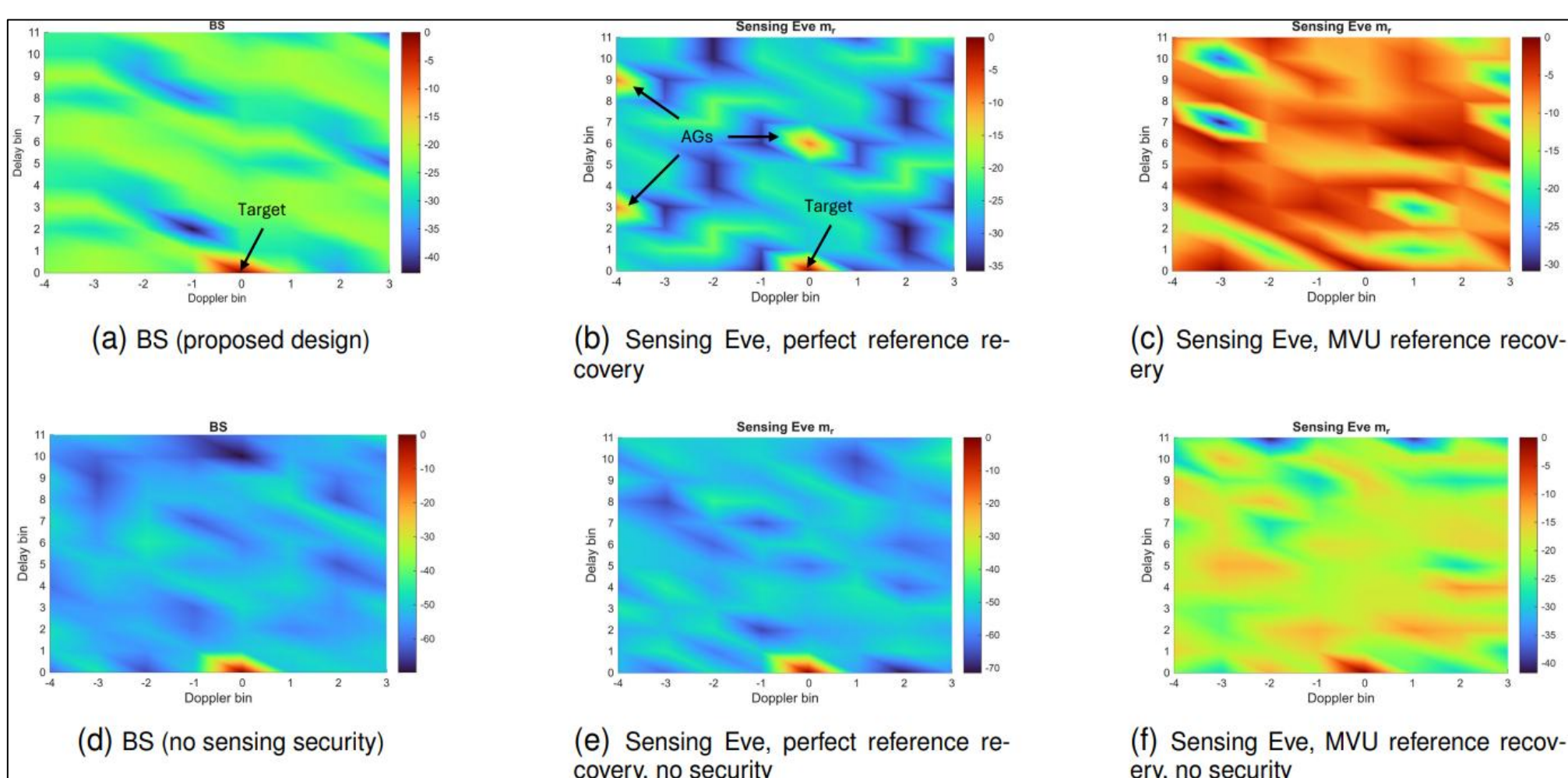


Figure 3: Delay-Doppler Maps

Reference

Yang, Y., Gautam, P.R., Bouazizi, Y., Breza, M. and McCann, J., 2026. Dual Security for MIMO-OFDM ISAC Systems: Artificial Ghosts or Artificial Noise. arXiv preprint arXiv:2602.20045.

The Security Challenge

- Most ISAC research focuses on communication security, **ignoring sensing security**
- Sensing security designs from sensor networks **can not** be applied to ISAC systems
- Encryption won't work for secure sensing: **no decryption** for detection and estimation

Dual-Secure Design

- Sensing accuracy for the BS: sensing SNR
- Sensing security via artificial noise (AN): sensing Eve's MIMO data rate
- Sensing security via artificial ghosts (AG): ambiguity function
- Communication performance and security: MIMO data rate and secrecy rate

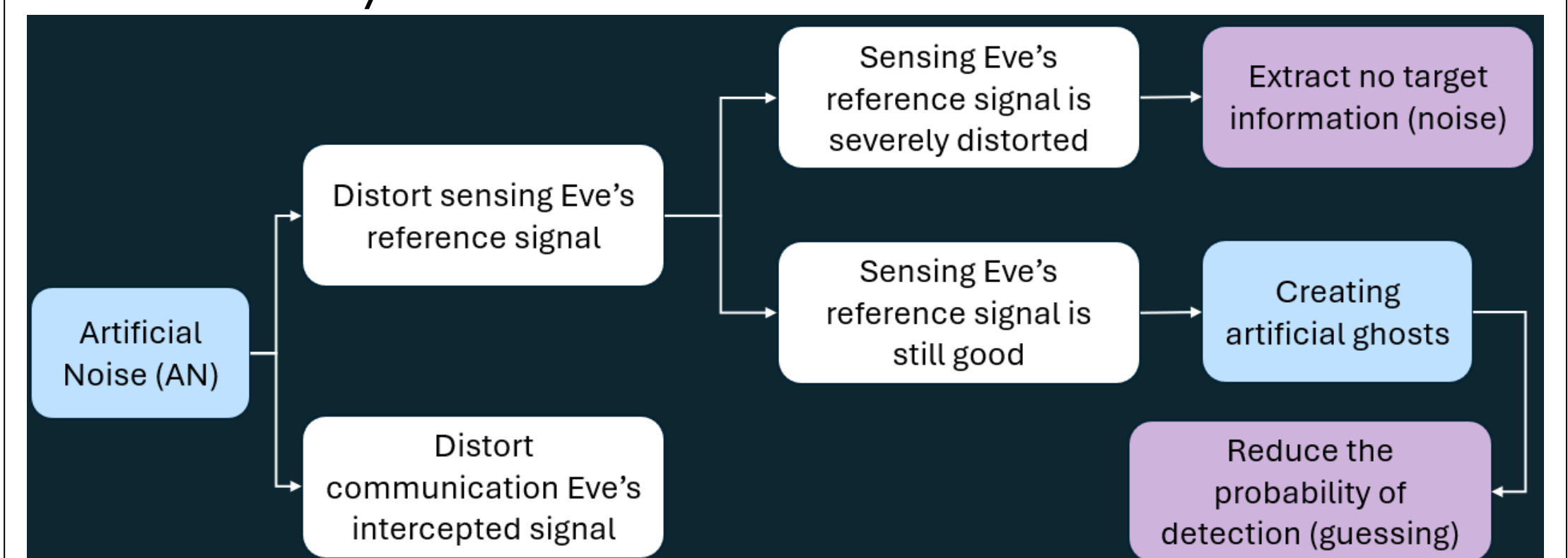


Figure 2: Dual-Secure Design

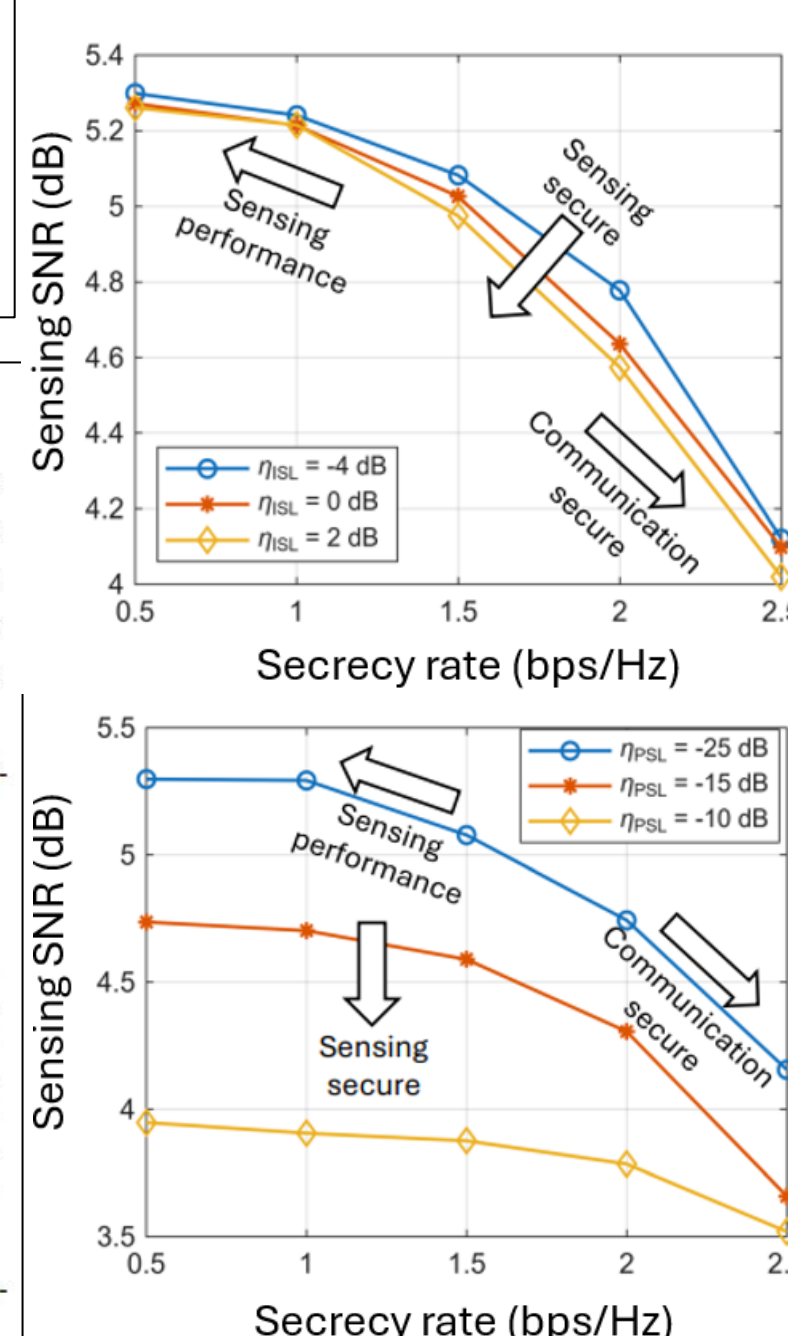


Figure 4: Trade-offs

Conclusion

- Dual-secured ISAC is **possible**
- Dual-secured ISAC comes **with cost**

Next step

- Smart attackers
- Dual-secured ISAC in dynamic environments
- Proof-of-concept



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Reference