

Opportunistic Passive Radar for Non-Cooperative Contextual Sensing



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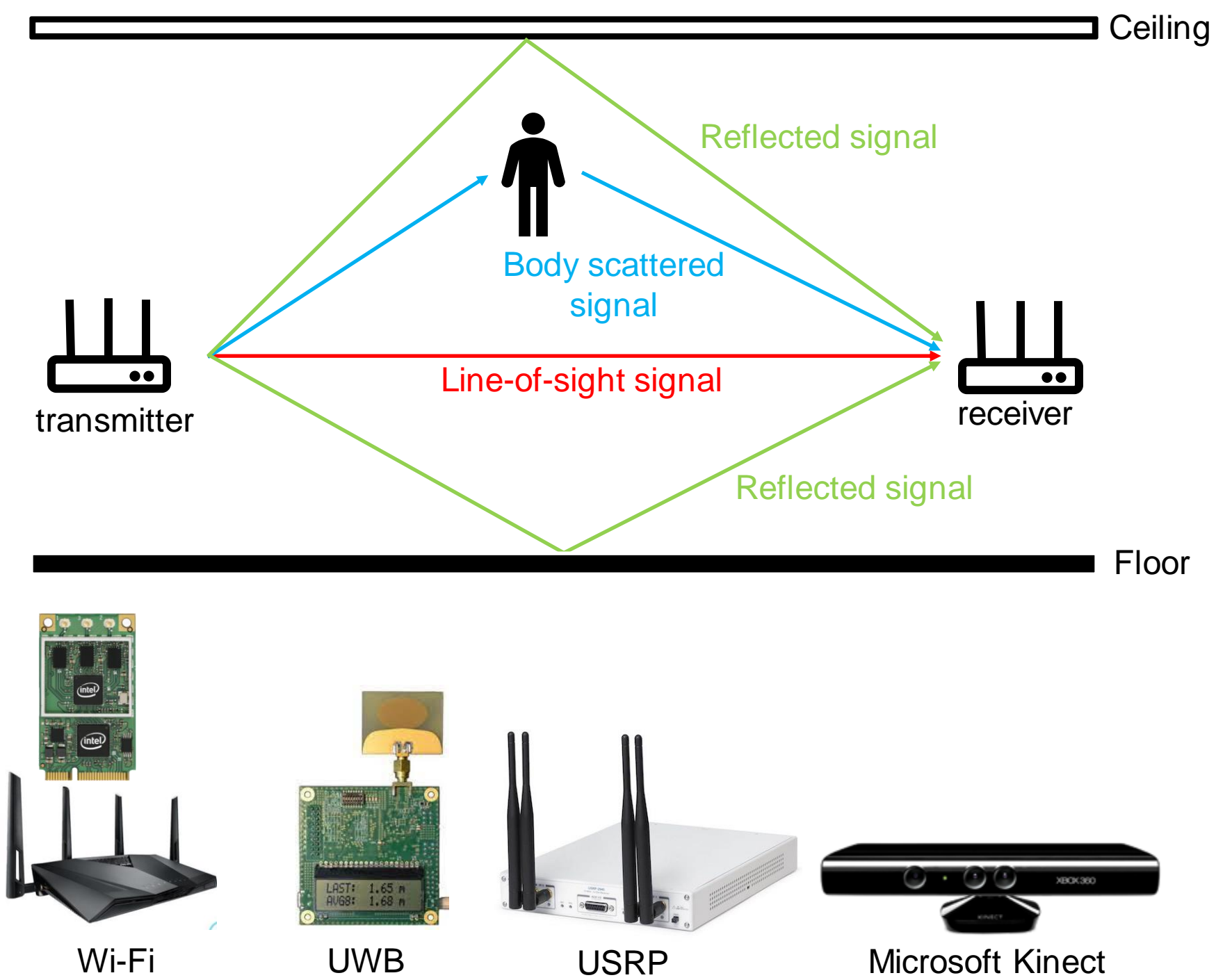
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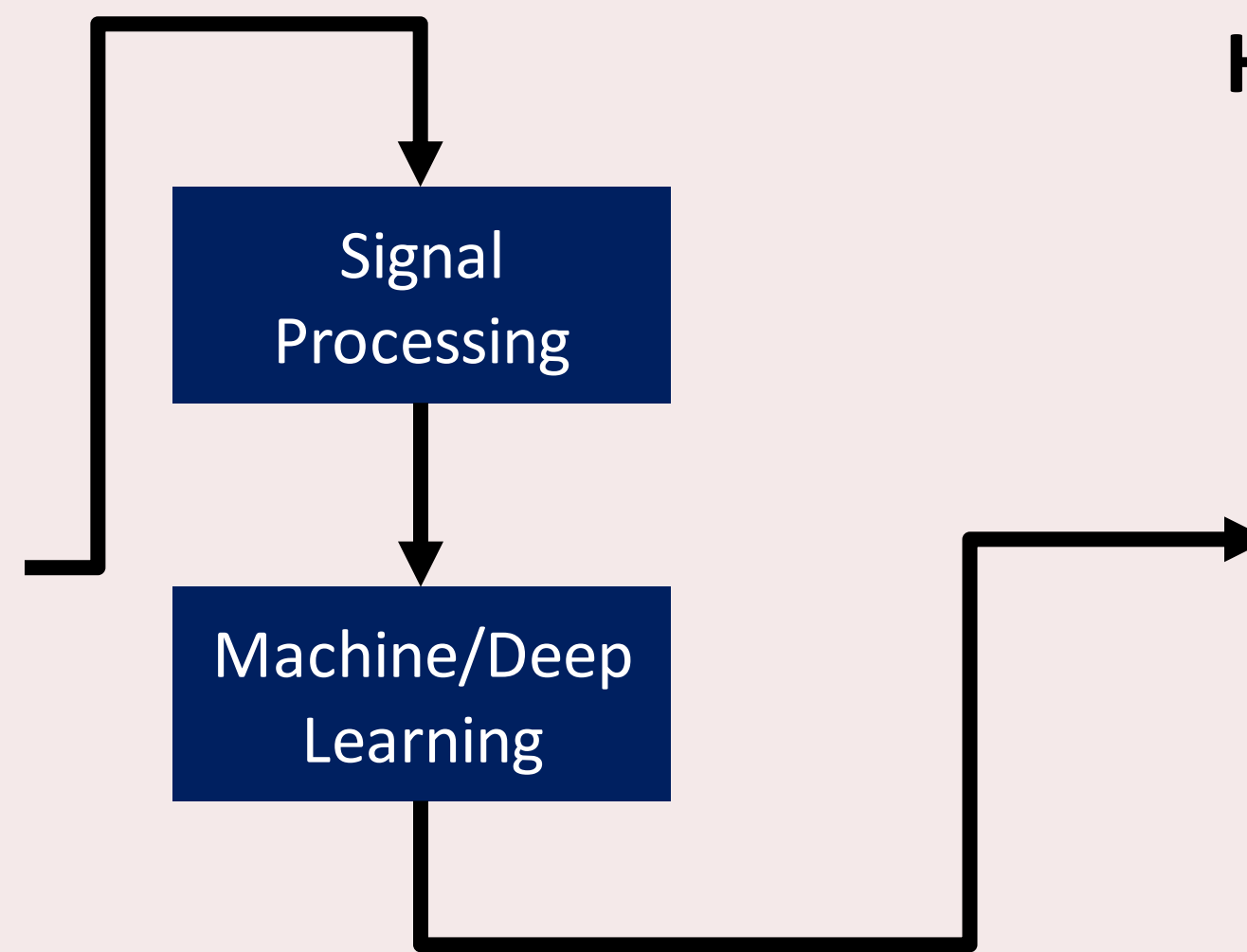
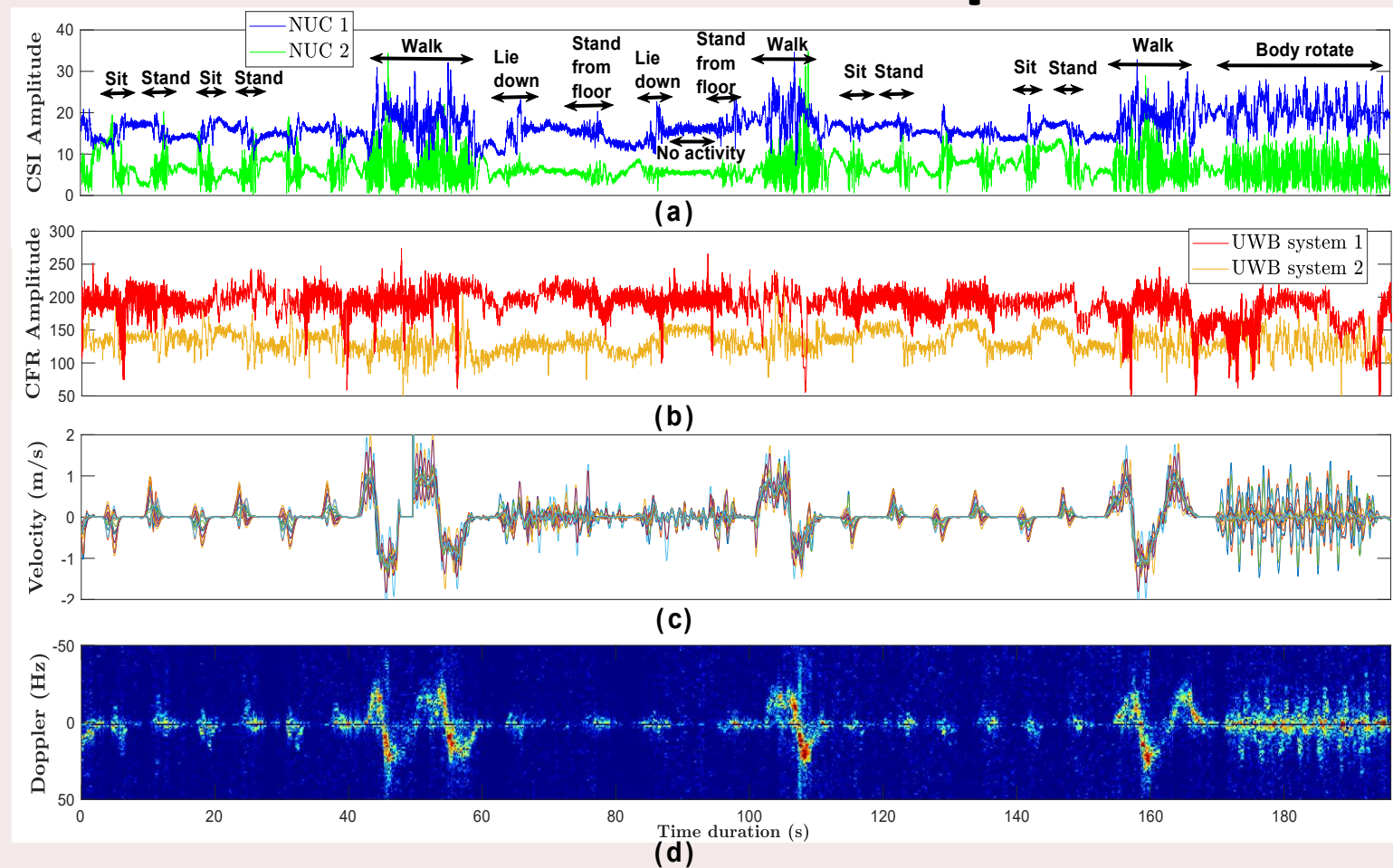
1. Introduction

- **OPERA** investigates new unobtrusive sensing technology for CONTEXTUAL SENSING - defined as concurrent physical activity recognition and indoor localization - to facilitate new applications in e-Healthcare and Ambient Assisted Living (AAL).
- The OPERA platform will be integrated into the SPHERE long term behavioural sensing machine gather information from various sensors (e.g., Wi-Fi, Ultra-Wideband (UWB), Kinect, micro-Doppler radar, etc.) around the home to monitor and track the signature movements of people.



2. Results – Human Activity Recognition

Data collection from multiple sensors

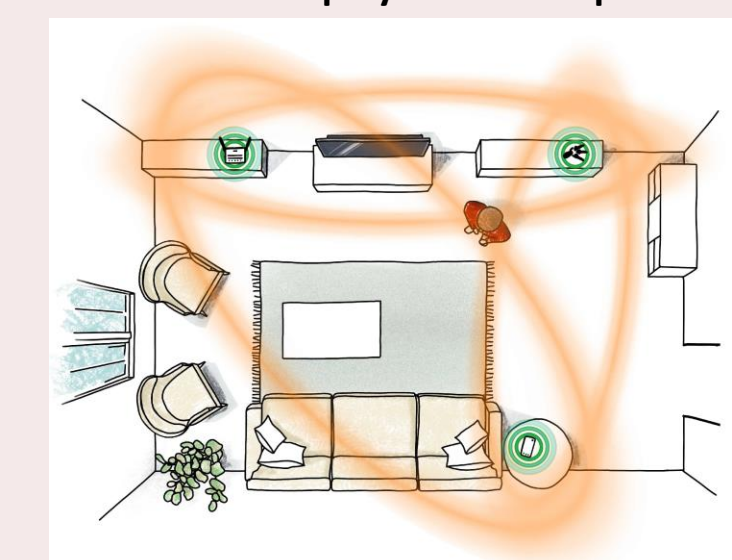


Human Activity Classification

bodyrotate	1	0	0	0	0	0
laydown	0	0.95	0.05	0	0	0
sit	0.02	0.02	0.91	0.03	0	0.03
stand	0.01	0	0.04	0.93	0.01	0
standff	0	0.03	0	0	0.97	0
walk	0.01	0	0	0	0	0.99
bodyrotate						
laydown						
sit						
stand						
standff						
walk						

3. Results – Passive Target Localization

UWB modules deployed at fixed positions

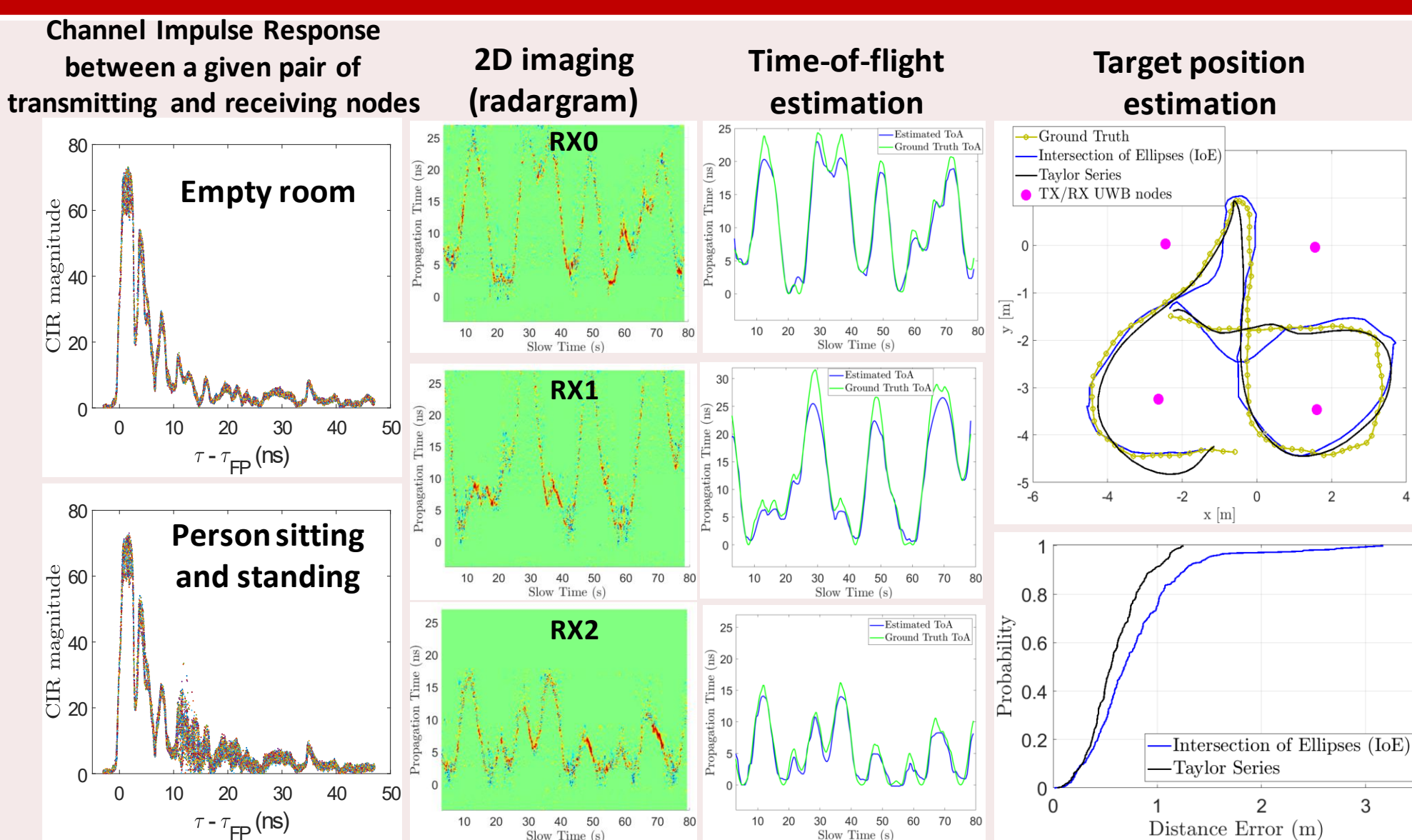


Transmitter position (x_t, y_t)
Receiver position $(x_r, y_r), i = 1, 2, K, N$
 (x, y) – target position (unknown)

Bistatic range of target for receiver i :

$$d_i = \sqrt{(x-x_t)^2 + (y-y_t)^2} + \sqrt{(x-x_r)^2 + (y-y_r)^2}$$

Find coordinates of target (x, y) , by solving the set of non-linear equations.



4. Conclusions

Use of passive sensing technology: a receiver-only radar network that detects the reflections of ambient radio-frequency signals from people for the purpose of device-free concurrent activity recognition and localization.

- No additional infrastructure required
- Low-cost and ease of deployment
- Works in the dark
- Privacy friendly (non-intrusive)
- Contactless (device-free) sensing

References

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