

Multi-human Tracking and Activity Recognition using mmWave Radar

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Research challenge

Indoor sensing becomes difficult when people cross paths, occlude one another or perform similar movements. Camera-only systems can also create privacy concerns.

Objective: Localize/track multiple targets and recognize single target activities & multi-target interactions using mmWave radar.

Experimental setup



8 m × 5 m indoor test area

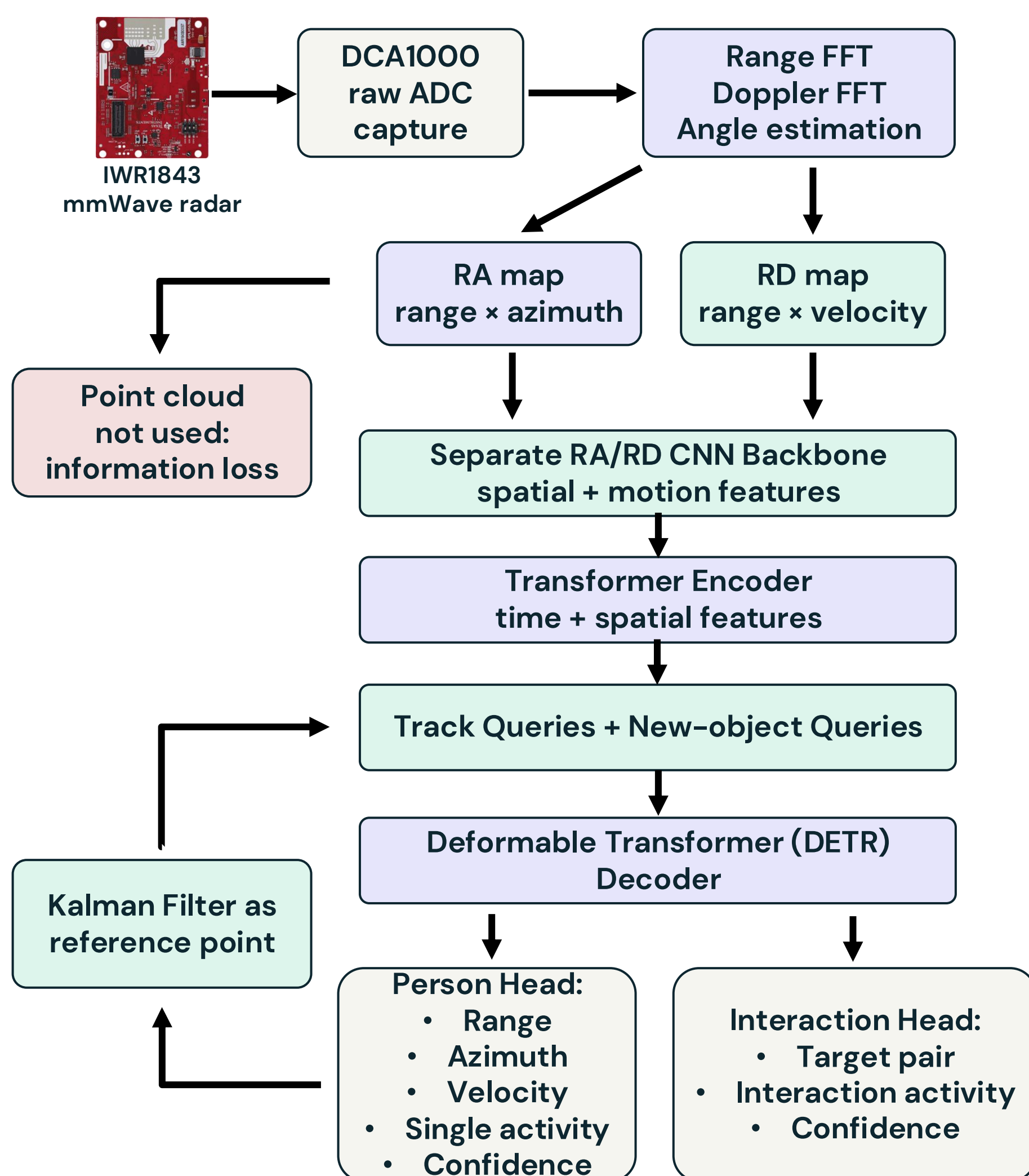
IWR1843 mmWave radar
77–81 GHz sensing

DCA1000 capture board
raw ADC sampling

ZED stereo camera
ground-truth reference

Method: radar maps to activity

The map-based path preserves dense spatial and motion evidence. The point-cloud branch is shown for context but is not used because conversion discards information.



Data collection

● = Normal activity ● = Dangerous activity

- | | | | |
|-------|-----------------|-------|---------------------------|
| ● IA1 | Walking | ● MA0 | Walking in parallel |
| ● IA2 | Dropping a bag | ● MA1 | Same way & together |
| ● IA3 | Waving | ● MA2 | Same way & coercing |
| ● IA4 | Throwing a ball | ● MA3 | Head-on & tying shoelaces |
| ● IA5 | Cleaning floor | ● MA4 | Head-on & stabbing |
| ● IA6 | Stealing cables | | |

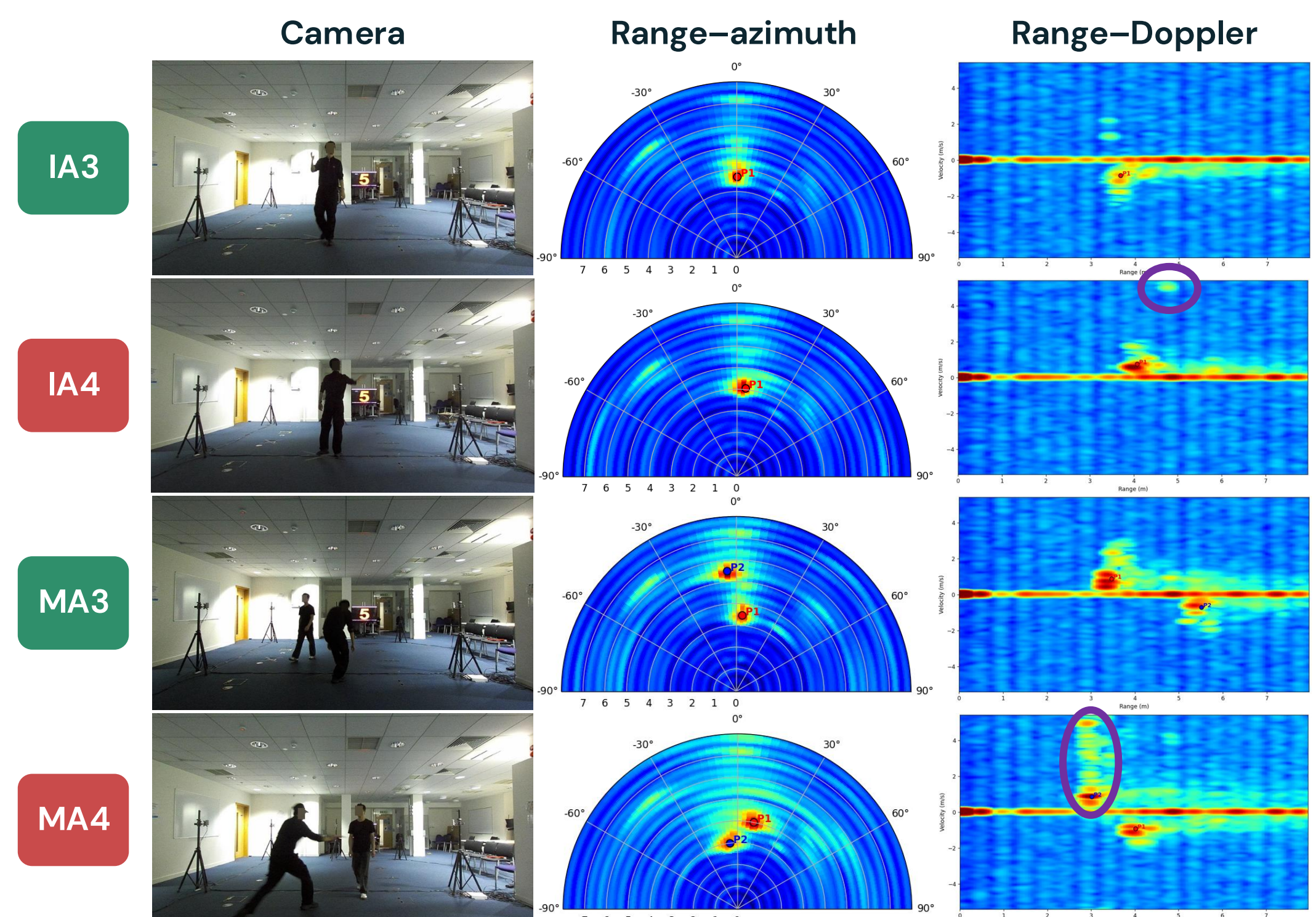
11 activities: 6 single-person + 5 multi-person · 8 participants
3,741 trials (~10 s each) · 10 FPS radar · 406,644 valid frames

Key findings

- RA maps preserve spatial structure; RD maps expose motion.
- Multi-person examples retain separable responses during crossing and close interaction.
- Temporal association and filtering stabilize localization evidence across frames.

Representative examples

Camera reference · RA map · RD map from the same frame



Conclusion

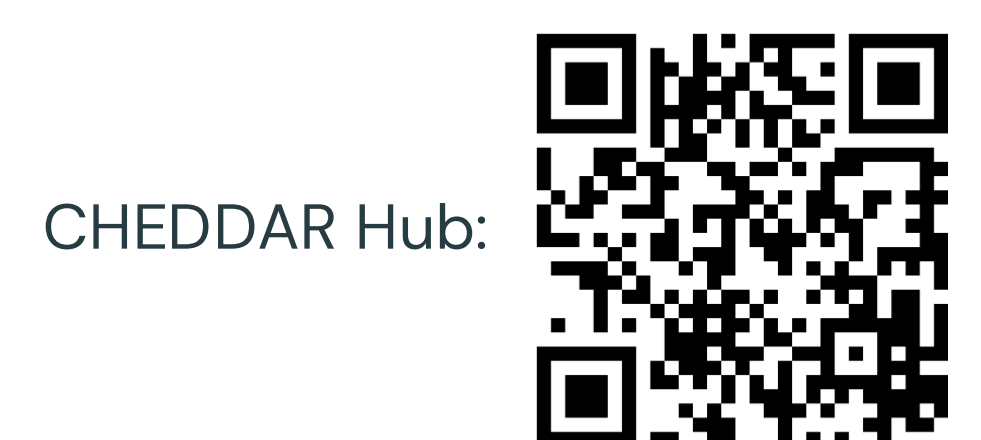
The project is still undergoing. Current localization losses are:
• Single-person: range 0.172 m · angle 0.531° · velocity 0.135 m/s
• Multi-person: range 0.331 m · angle 2.784° · velocity 0.239 m/s

Impact and next steps

Future work: complete full activity-recognition evaluation, expand participants and environments, and validate deployment for privacy-aware assisted living, safety monitoring and smart spaces.



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