Exploring mmWave Radar and Camera Fusion for High-Resolution and Long-Range Depth Imaging

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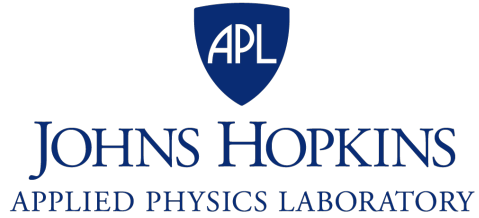
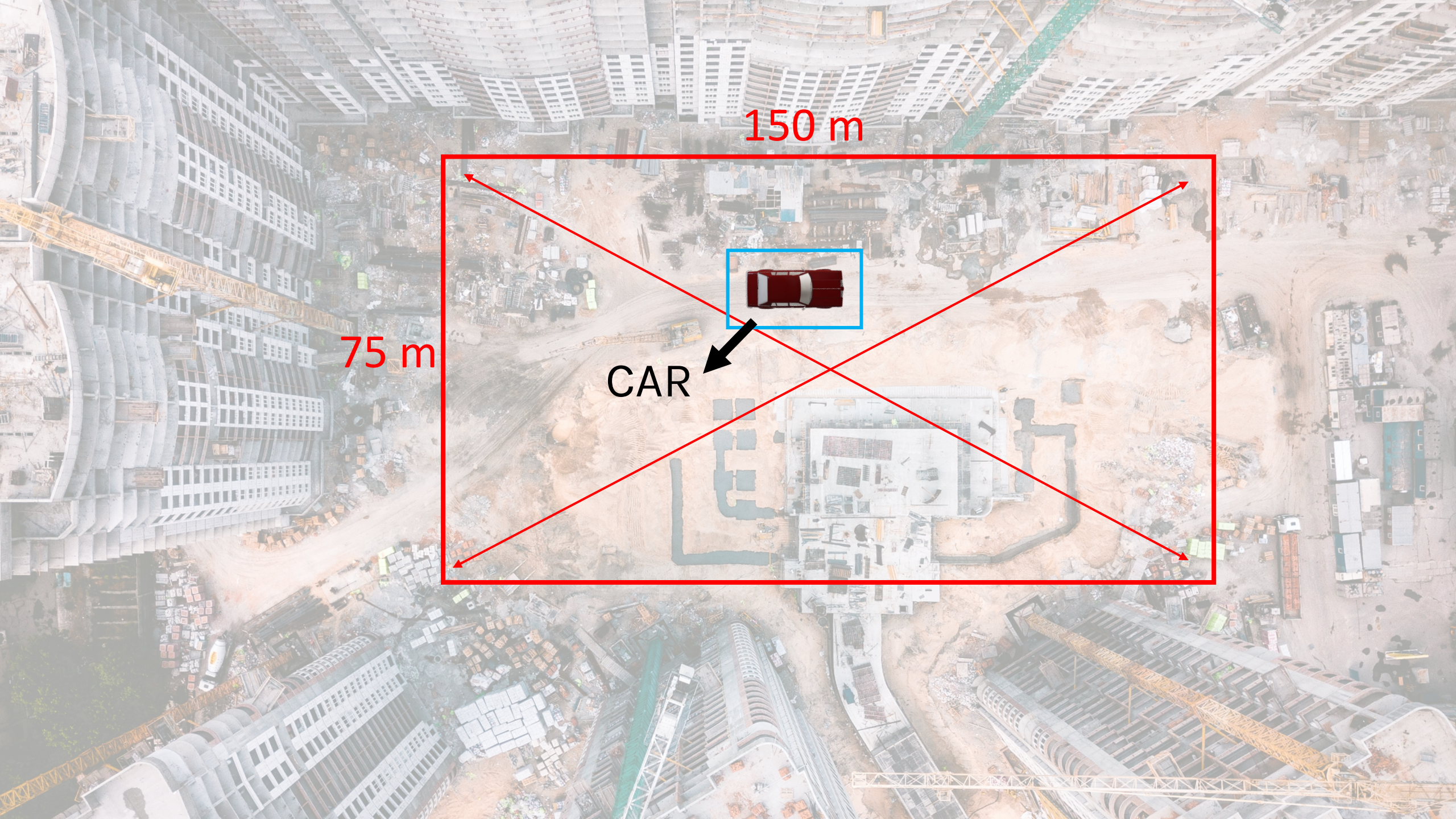
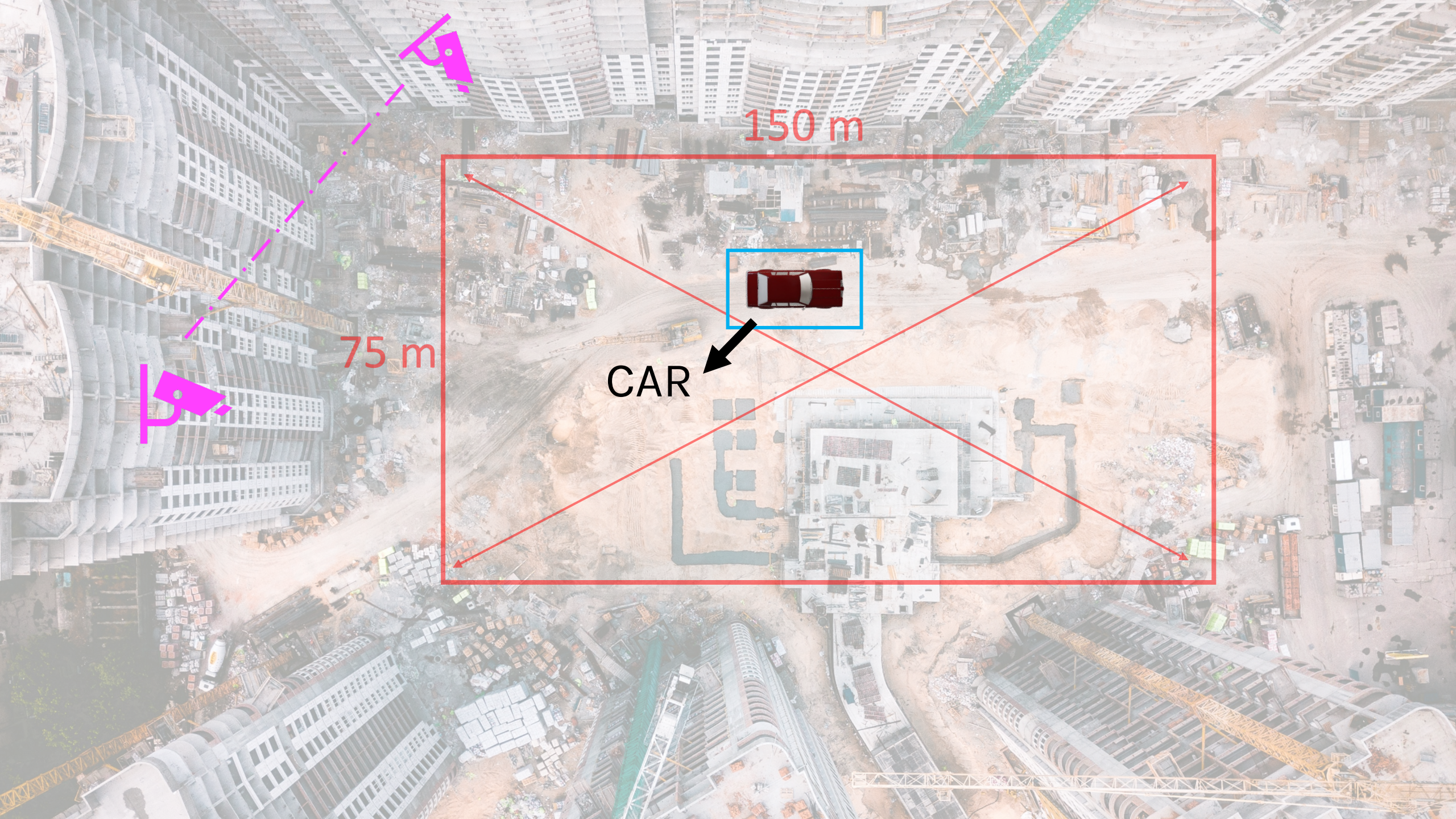
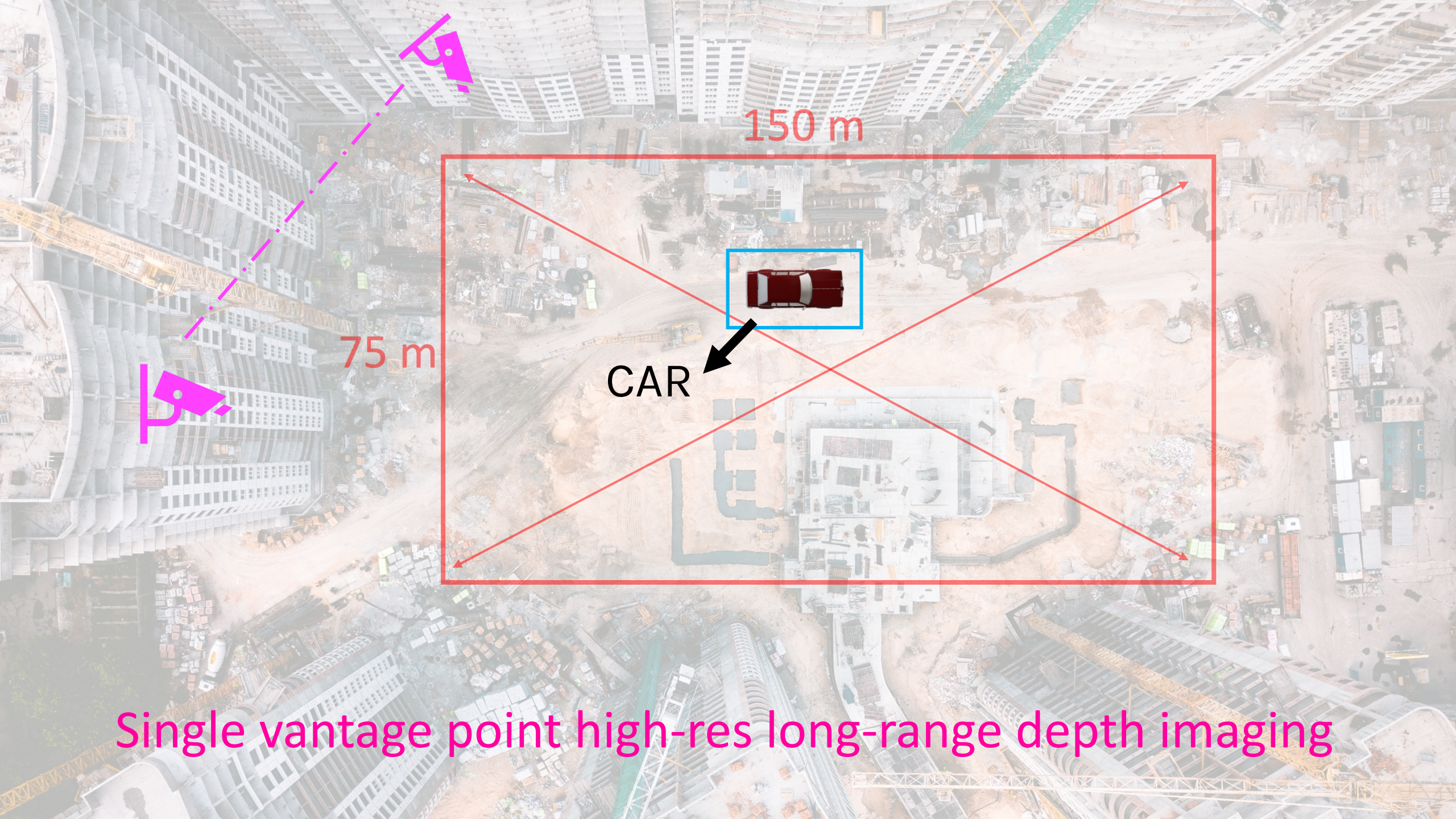


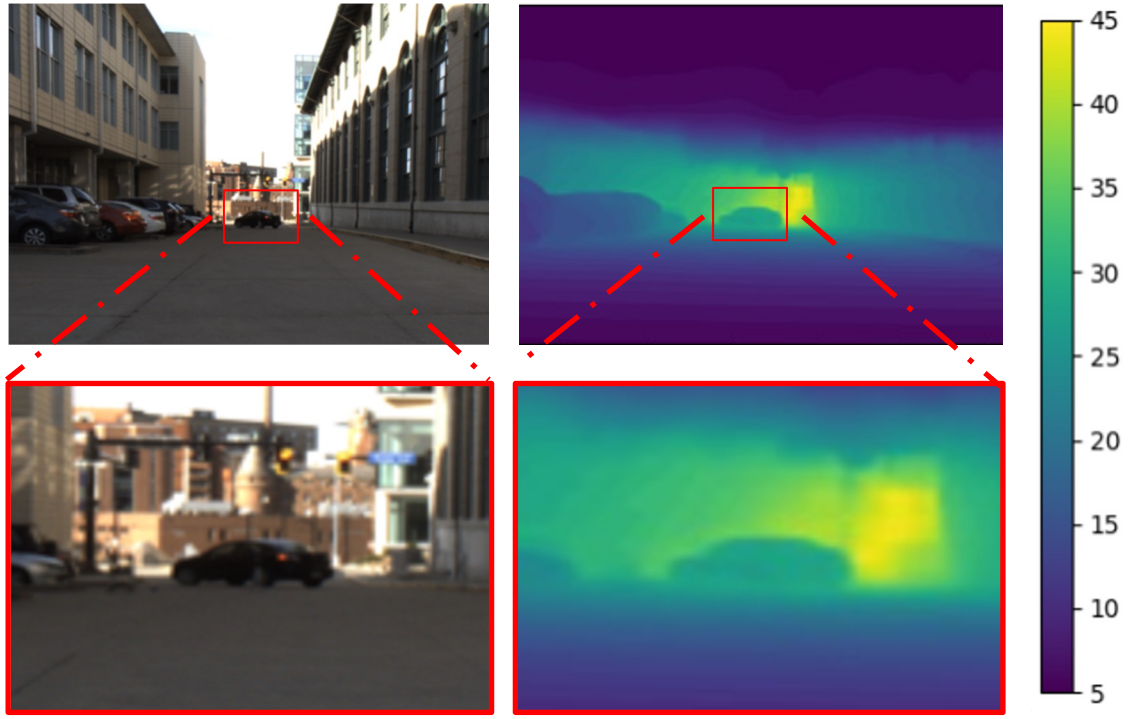

150 m
75 m
CAR


150 m
75 m
CAR



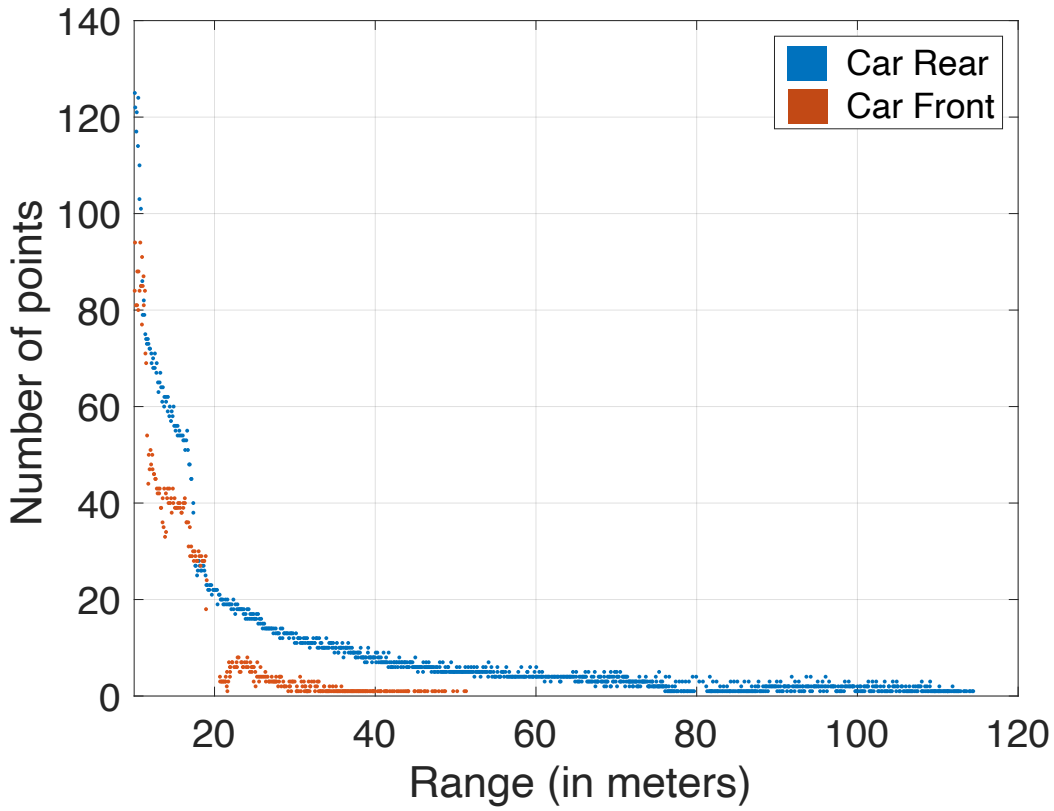
Single vantage point high-res long-range depth imaging

Options Today



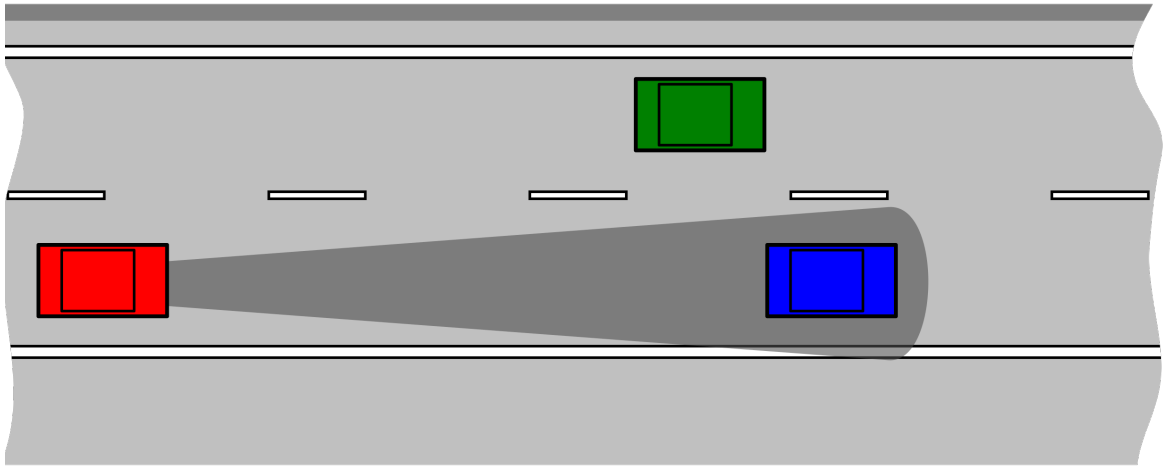
Monocular Depth Estimation

10s of meters depth error at long ranges



Stand alone lidar

Case for Radar



Cruise Control Radar already used for 100s of meters depth estimation

	Monocular Camera	Radar
Long-range Depth Estimation Accuracy	Poor	Good
Angular Resolution	Good	Poor

METAMORAN

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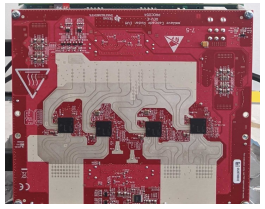
Camera

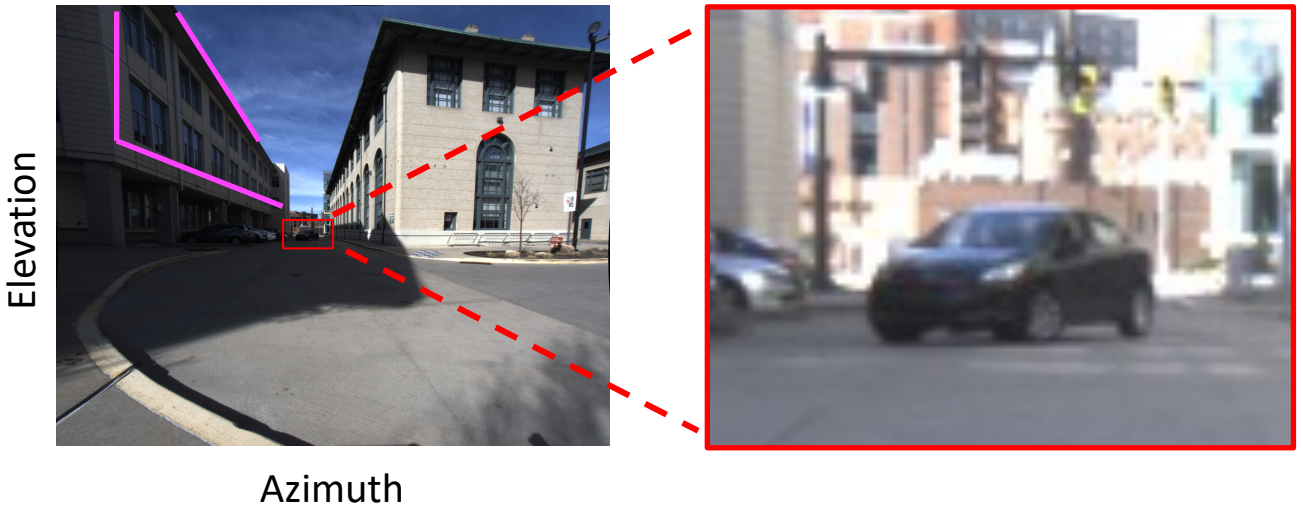


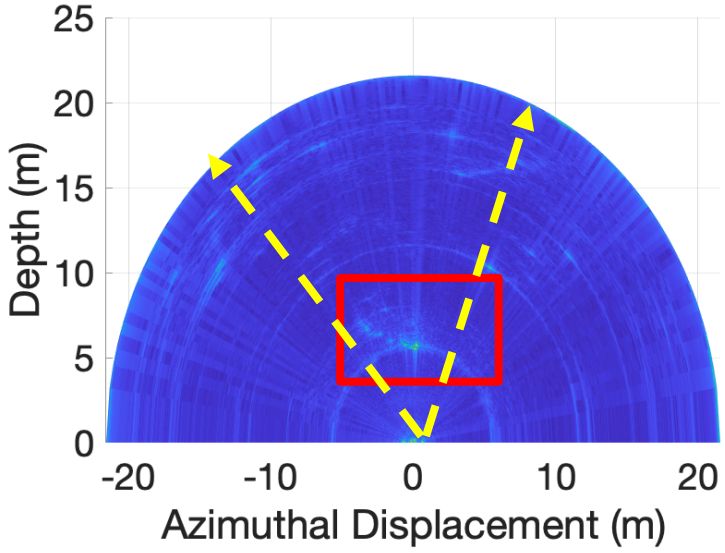
mmWave Radar

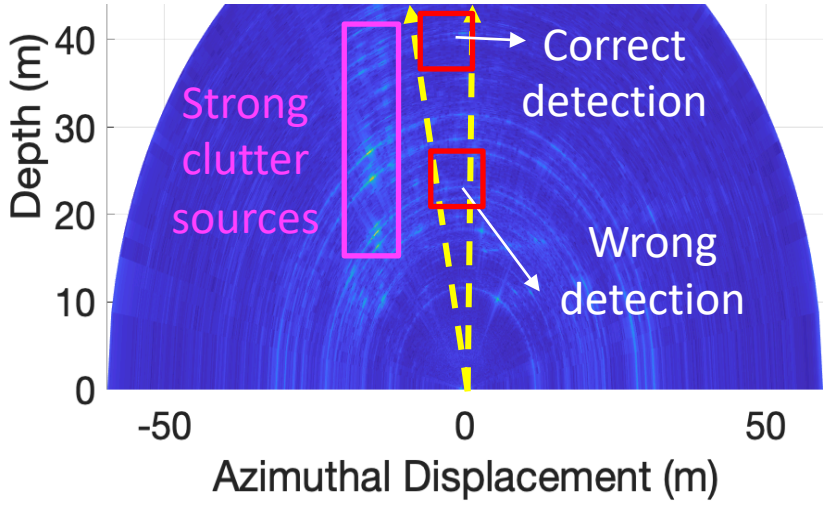
Fusion Dance From Dragon Ball

Challenges

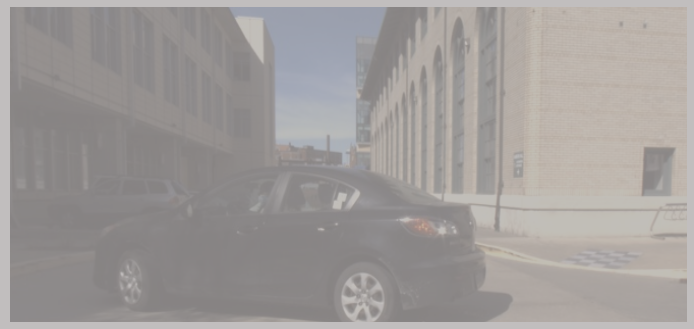
Elevation
Azimuth

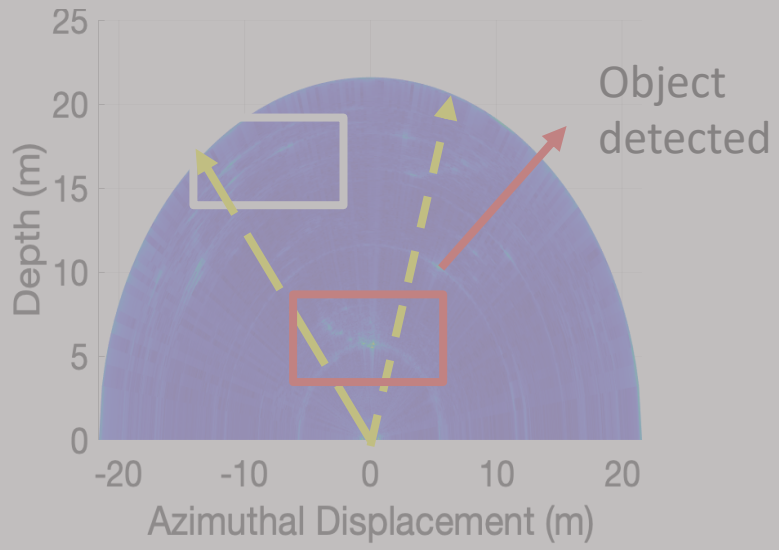

Elevation
Azimuth


25
20
15
10
5
0
Depth (m)
-20
-10
0
10
20
Azimuthal Displacement (m)


Strong clutter sources
Correct detection
Wrong detection
40
30
20
10
0
Depth (m)
-50
0
50
Azimuthal Displacement (m)

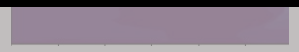
Robust Object Detection in Clutter





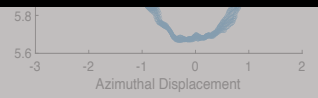
More details in paper

1. Clutter suppression
2. Creating a higher res depth image



3D object shape

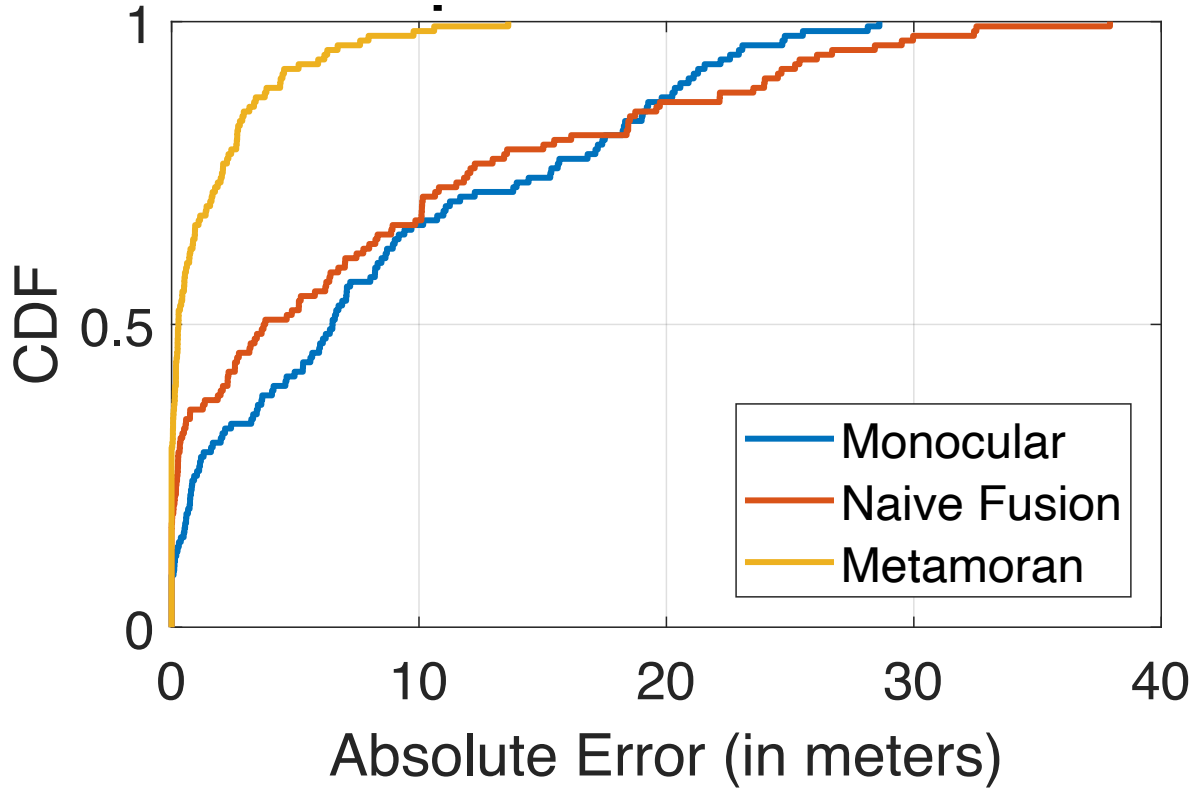
elevation slice



Contour

Synthesized Radar
Contour template

Results



Evaluation showing
- Error of 28 cm at long ranges
- 13x better than naïve radar-camera fusion and 23x better than monocular alone

Conclusion

Fuse mmWave radar and camera for single vantage point long-range depth imaging

System design to help radar leverage information from camera
- Detect true objects in radar at long ranges
- Suppress clutter
- Create high resolution depth images

Evaluation at long ranges of 100-300 meters

Resources: https://witechlab.com/metamoran

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