[Radar Musical Instrument]

In this work, we demonstrate the viability of mmWave sensors for acute hand gesture tracking by constructing a novel musical interface using non-contact gesture tracking to control musical output. To accomplish this goal, our approach extracts high-fidelity spatial and temporal features of the musician’s hand from the radar return signal. We present a novel super-resolution technique using a fully connected neural network to improve localization and reduce clutter. Further, we introduce a novel particle filter algorithm based on spatial and temporal corroboration to increase tracking performance. Pairing enhancement FCNN and particle filter shows up to 7 times improvement in tracking RMSE and enables much finer control of the instrument.

The Radar Musical Instrument leverages the strengths of mmWave imaging systems along with high-fidelity spatiotemporal signal processing algorithms and novel computer vision algorithms to create a high-resolution multi-application spatiotemporal sensing solution.

I can show you a demo of the musical instrument in action or answer any questions you have. Thank you.

[MIMO-ISAR]

In this work, we develop a fully integrated efficient millimeter-wave imaging system capable of reconstructing 3-D holographic images of hidden and concealed items. We present a novel efficient MIMO-ISAR image reconstruction algorithm and construct a mechanical scanner for synthesizing cylindrical and rectangular apertures. This project demonstrates numerous advantages over previous work by increasing spatial resolution and providing rotational invariance, while decreasing system cost, scanning time, and computational expense.

Verified by simulation and empirical measurement, our fully integrated system allows for efficient near-field MIMO-ISAR mmWave imaging offering an elegant solution to many near-field imaging and sensing problems including security sensing, through-the-wall imaging, and concealed weapon detection.

If you have any questions, I would be glad to answer now. Thank you.