

Development of a Closed Loop FMCW Radar Device to Extract Biometric Data for Security and Irregularity Detection

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Refined Problem Statement

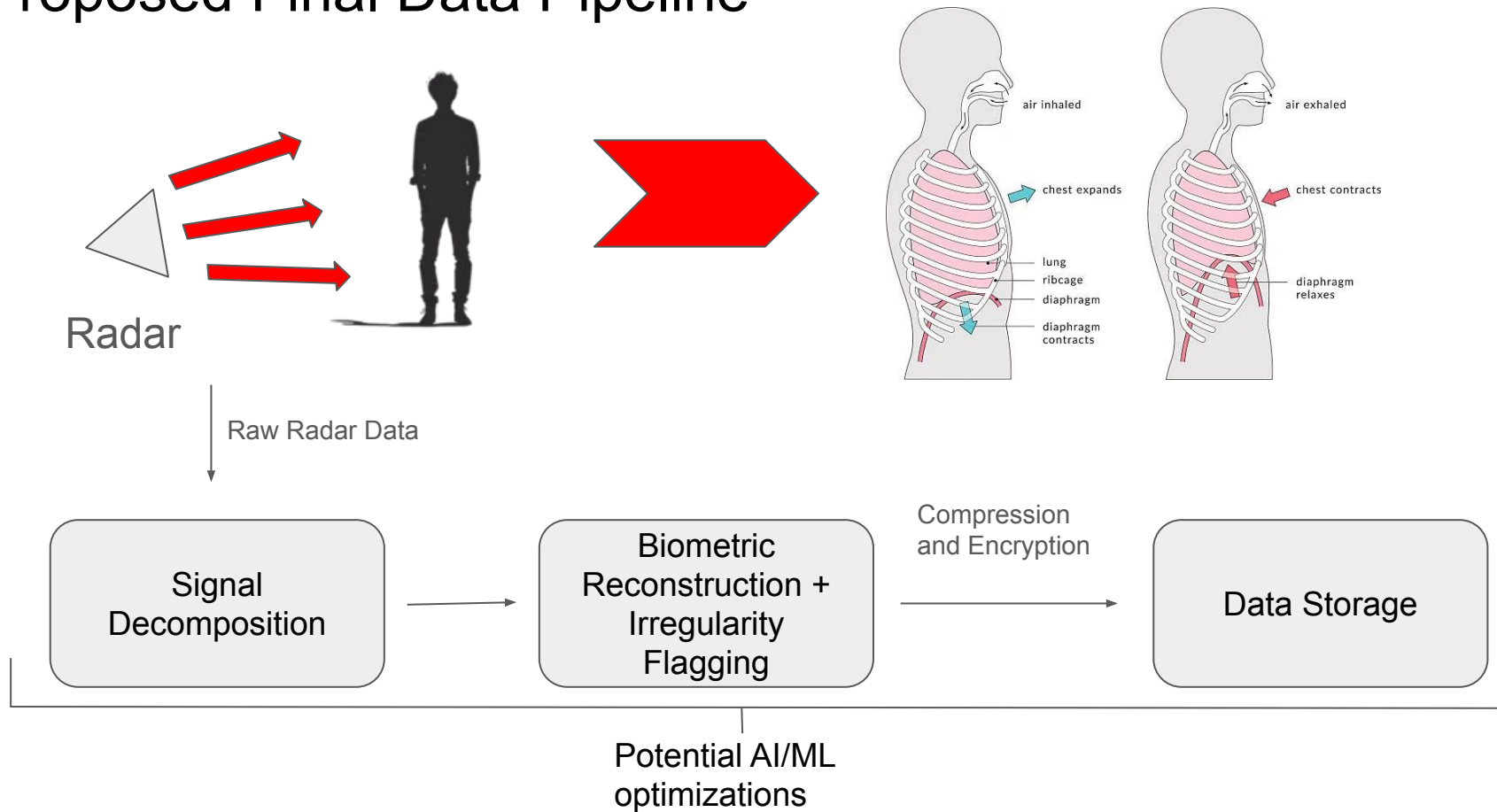
This project aims to develop an accurate and optimal algorithm to extract and store biometric data from a Frequency Modulated Continuous Wave radar within an easily-used device for data privacy and early irregularity detection.

Lit Review

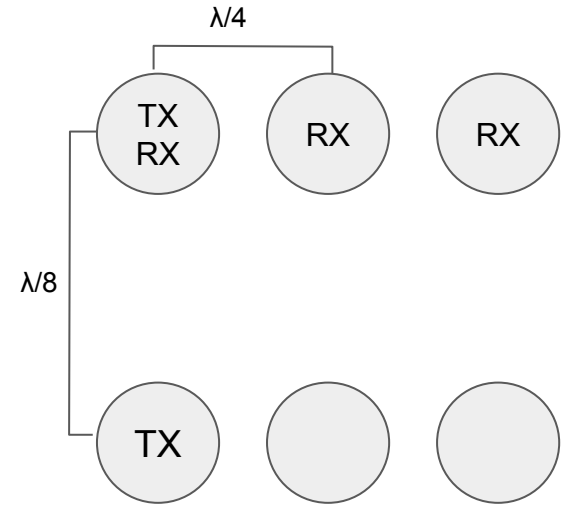
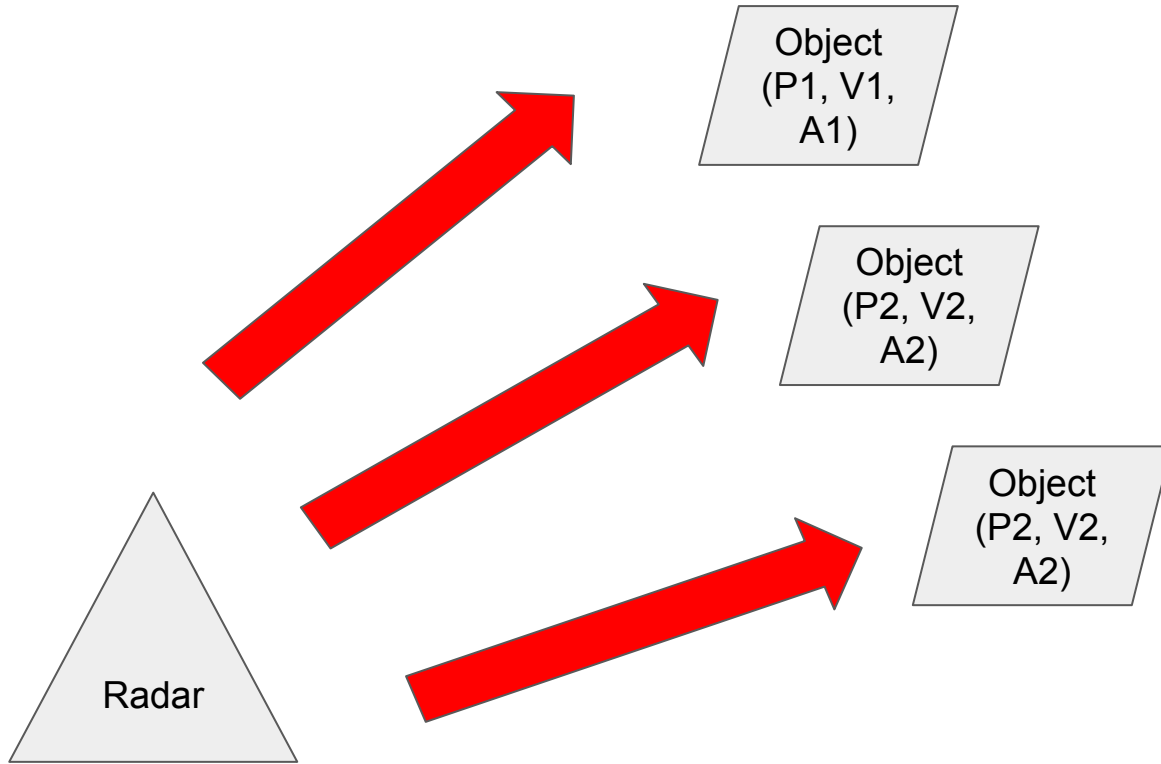
A Low-Complexity Compressed Sensing Reconstruction Method for Heart Signal Biometric Recognition - Jian Xiao, Fang Hu, Qiang Shao, Sizhuo Li (2019)

- Compressed Sensing (Simultaneous Sampling and Compression)
 - Avoids resource waste
 - Helps with device size and power consumption constraints
- Could optimize data flow and increase usability for device

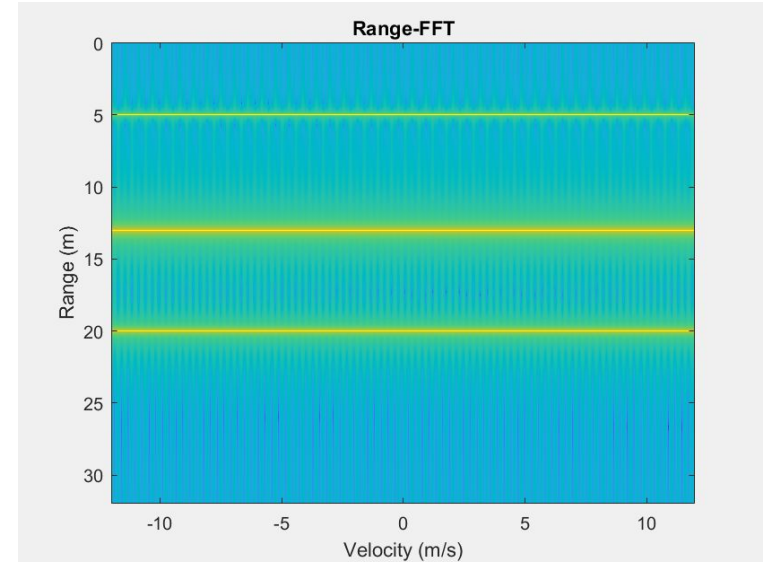
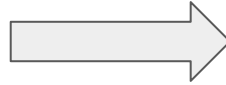
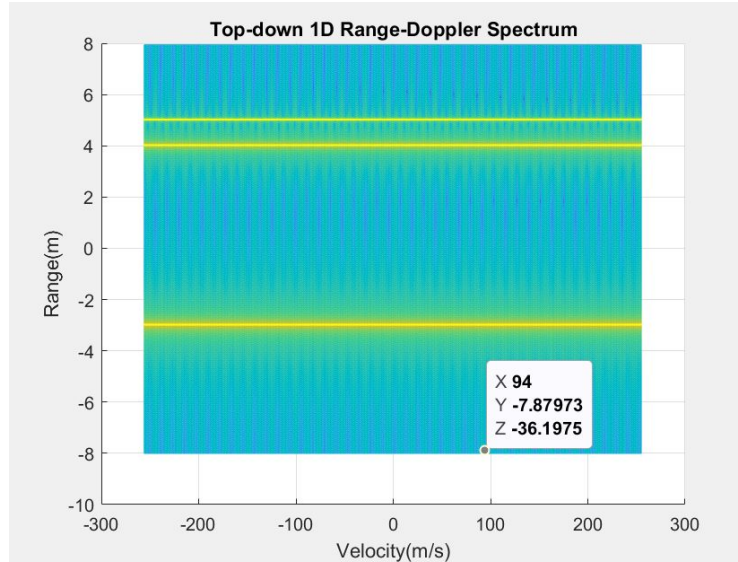
Proposed Final Data Pipeline



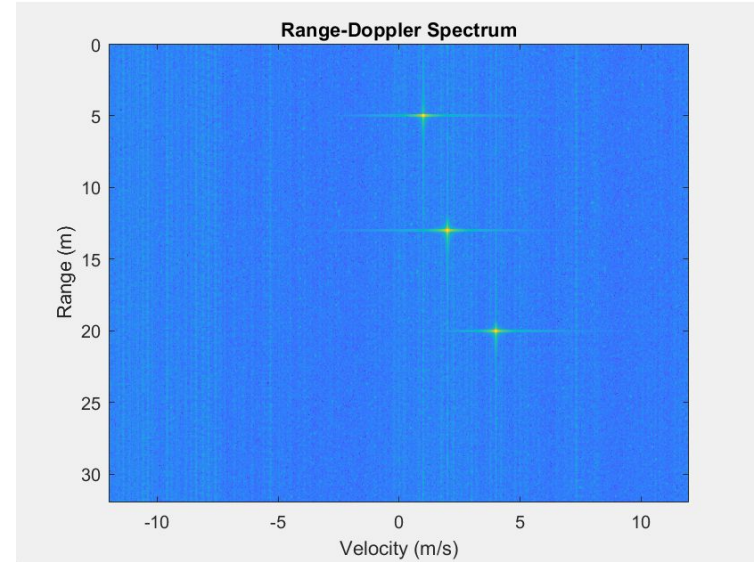
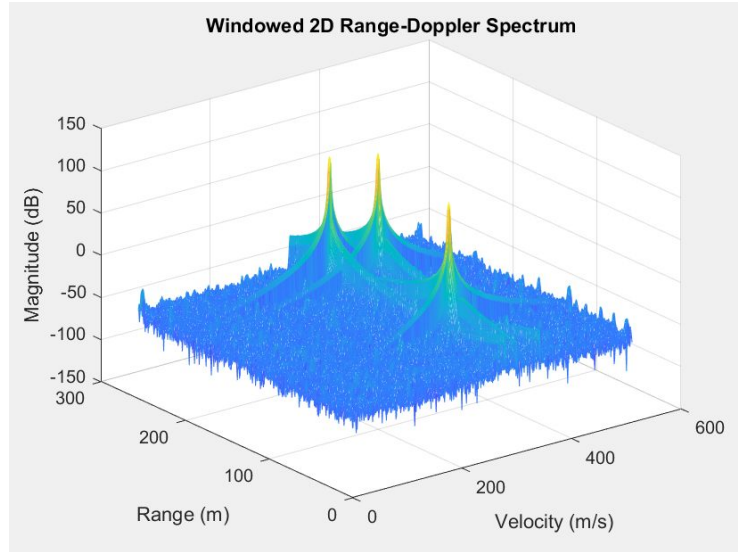
Simulation Setup



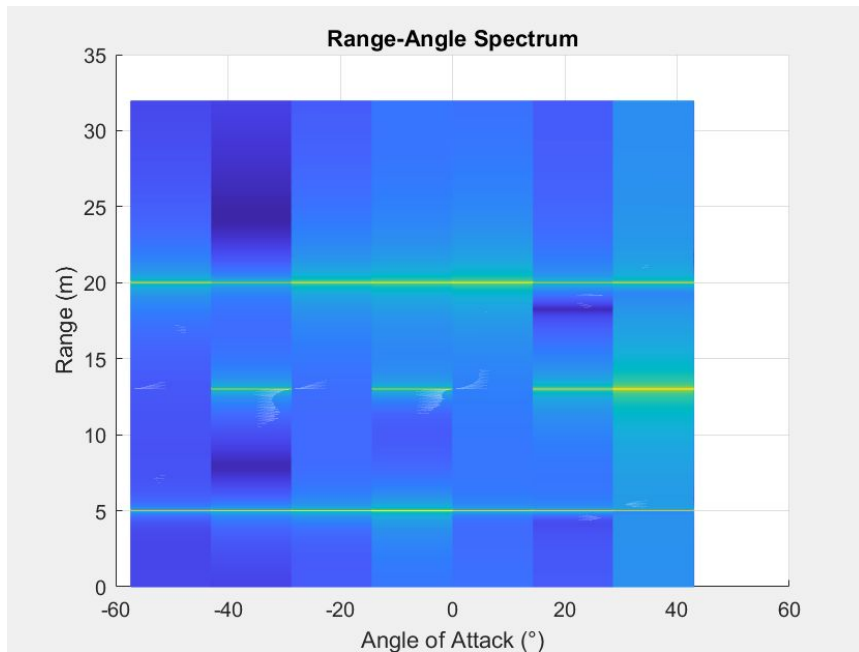
Fixes Relating to Understanding and Physical Constraints



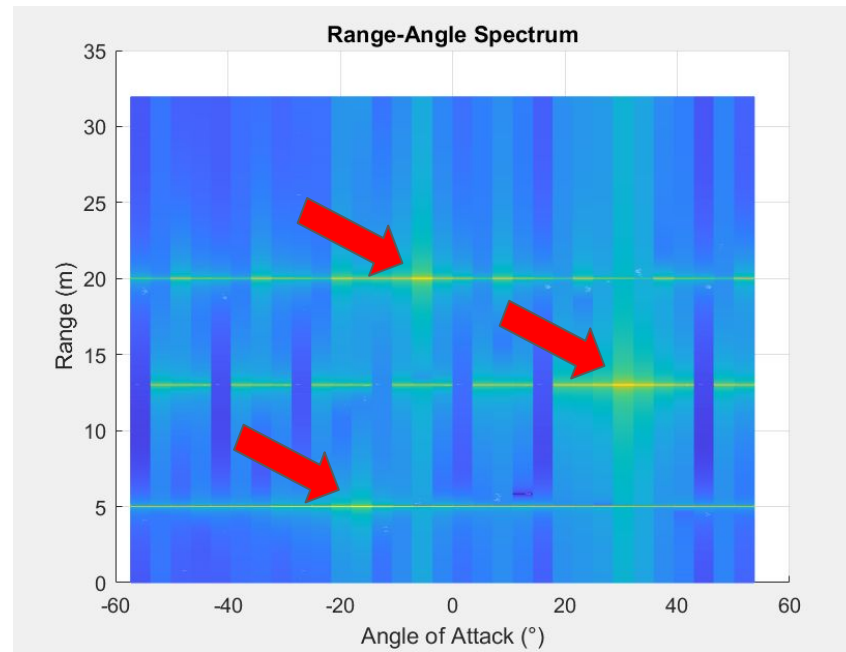
Fixes Relating to Understanding and Physical Constraints



Concerns with Angle of Attack Estimation



8-Channel Output



16-Channel Output

Future Experimental Design

- Finish base signal decomposition alg. (CFAR, SNR Opt)
- Optimization of computation speed and accuracy
 - Test Fourier vs. Wavelet Transform
 - Potential use of Quantum Fast Fourier Transform (QFFT)?
- Testing on best encryption/transmission/storage methods
- Neural network implementation?
- Physical Design Consideration

References

- Rao, S. (n.d.). *Introduction to mmwave Sensing: FMCW Radars*. Texas Instruments.
https://www.ti.com/content/dam/videos/external-videos/en-us/2/3816841626001/5415203482001.mp4/subassets/mmwaveSensing-FMCW-offlineviewing_0.pdf
- Xiao, J., Hu, F., Shao, Q., & Li, S. (2019, December 3). *A low-complexity compressed sensing reconstruction method for heart signal biometric recognition*. MDPI. <https://www.mdpi.com/1424-8220/19/23/5330>