# Localization and Monitoring Using Passive RF on the Internet-of-Things (Part 2!)

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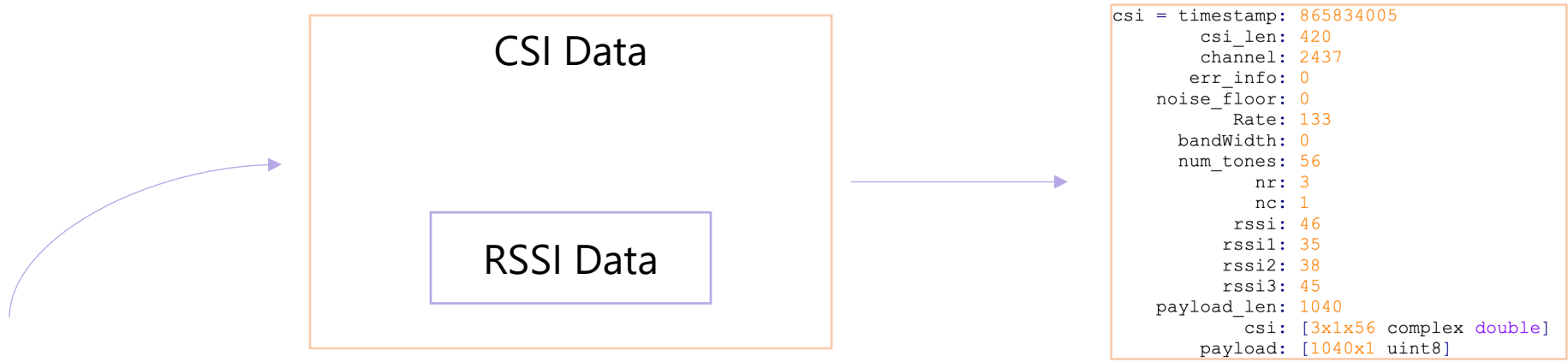
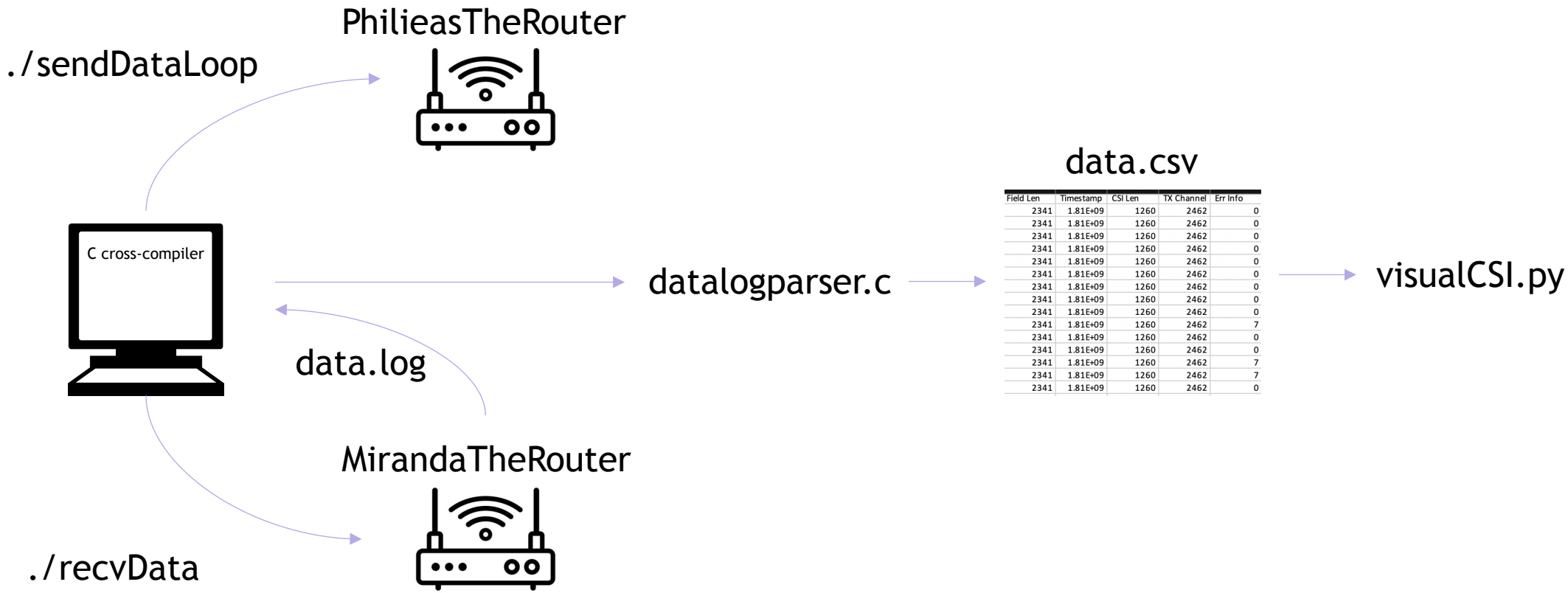
# Background

- RSSI (Received Signal Strength Indicator)
- Atheros CSI (Channel State Information) Tool



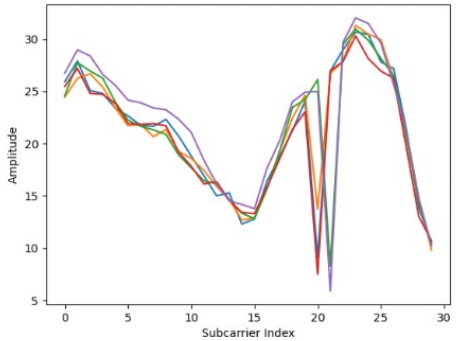
# Setup Pipeline



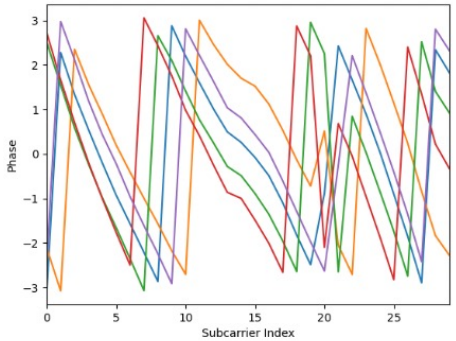

| Field Len | Timestamp | CSI Len | TX Channel | Err Info |
|---|---|---|---|---|
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 7 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |
| 2341 | 1.81E+09 | 1260 | 2462 | 7 |
| 2341 | 1.81E+09 | 1260 | 2462 | 7 |
| 2341 | 1.81E+09 | 1260 | 2462 | 0 |

# Experimentation

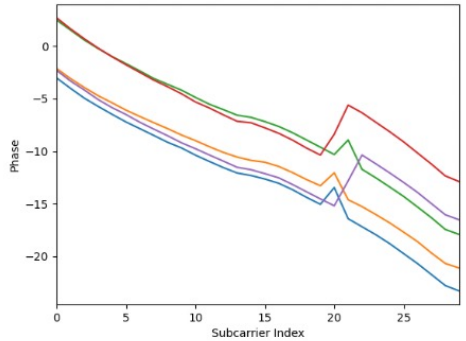

# Densepose Paper Replication



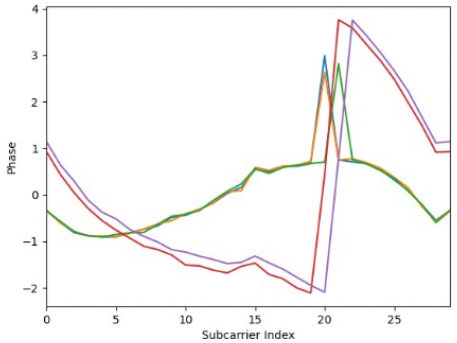

(a) Original CSI Amplitude



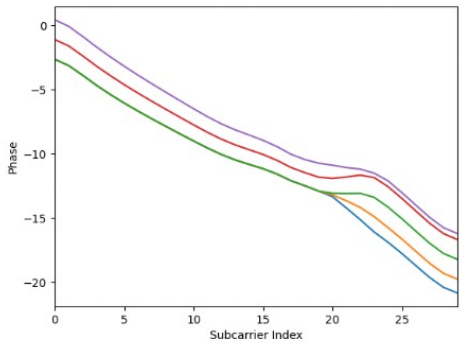

(b) Original CSI Phase



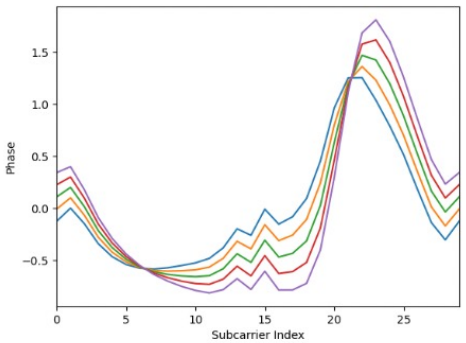

(c) Phase after unwrapping




(d) Phase after unwrapping + linear fitting




(e) Phase after unwrapping + filtering




(f) Phase after unwrapping + filtering + linear fitting

Linear Fitting:

$$\alpha_1 = \frac{\Phi_F - \Phi_1}{2\pi F}$$

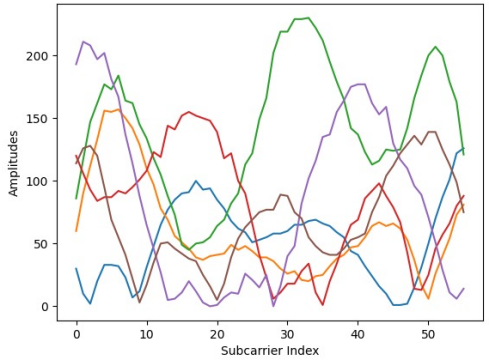
$$\alpha_0 = \frac{1}{F} \sum_{1 \le f \le F} \phi_f$$

$$\hat{\phi_f} = \phi_f - (\alpha_1 f + a_0),$$

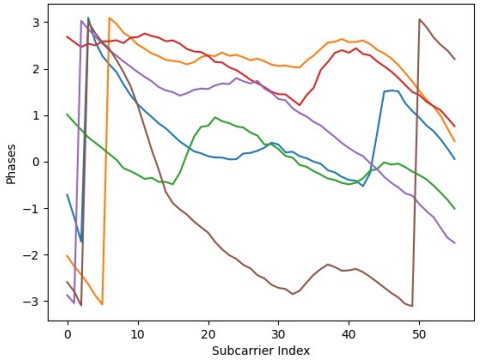
Densepose From WiFi: https://arxiv.org/pdf/2301.00250.pdf

# Densepose Paper Replication

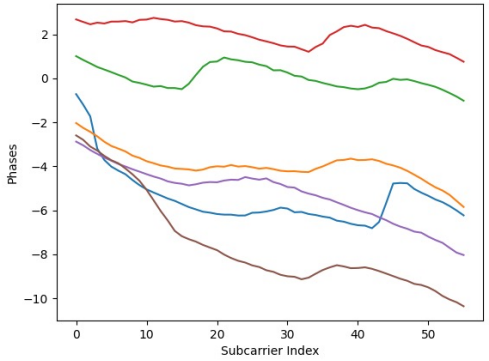
Original CSI Amplitude



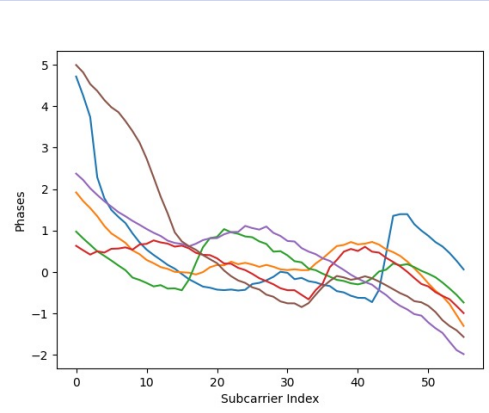

Original CSI Phase



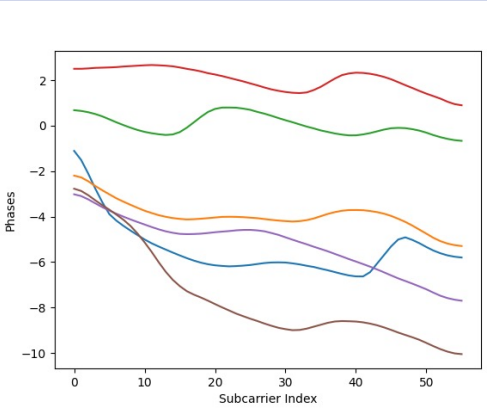

Phase after unwrapping



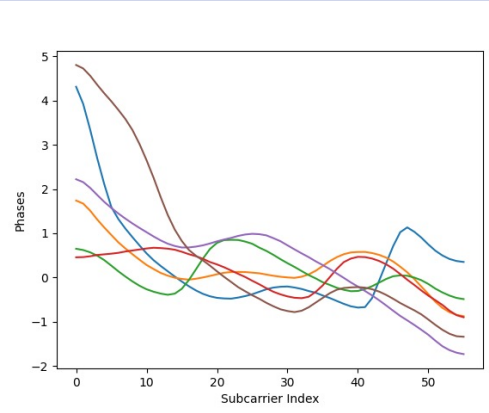

Phase after unwrapping + linear fitting




Phase after unwrapping + filtering




Phase after unwrapping + filtering + linear fitting



# Next Steps

- Optimize the setup pipeline (Real-time CSI/Amplitude Monitoring?)
- Explore/Test how the Densepose dataset works (Try with real images first instead of WiFi signals)
- Begin replicating/implementing the DensePose from WiFi paper
- Ethics discussion soon…