

Physics-Guided Sim2Real Framework with Edge Deployment Integration

Data Acquisition  
(Raw CSI  
Streams)

Preprocessing  
(Sync, Denoise,  
Normalization)

Physics Modeling  
(Multipath, Human,  
Environment)

Parameterized Synthesis  
(Scenario + Channel  
Control)

Enhanced Model  
(CNN + SE + Temporal  
Attention)

Calibrated  
Output

Enhanced Model Architecture

Input CSI  
[B, 128, 52]

Stem Layer  
Conv2d(1→160), BN + SiLU  
1,760 params

Block1: DepthwiseSeparable  
160→160 + SE(r=12)  
31,693 params

Block2: DepthwiseSeparable  
160→320 + SE(r=12)  
70,266 params

Block3: DepthwiseSeparable  
320→320 + SE(r=12)  
122,906 params

Temporal Attention  
MultiHead(320, heads=4)  
411,520 params

Classifier  
Linear(320→8)  
2,568 params

GPU Speedup: 64.1×  
Throughput: 607 sps  
Latency: 5.29 ms

Total Parameters: 640,713  
Memory: 2.44 MB  
Edge Ready: Production