AI-RAN Alliance Hackathon 2025 Proposal

Project Title: AI-Based UE Positioning for RAN Optimization  
GitHub Repo: https://github.com/Soumitri-pycode/ai-ran-ue-positioning

# 1. Executive Summary

This proposal introduces a prototype leveraging supervised deep learning to enhance UE positioning accuracy within 5G/6G Radio Access Networks. It utilizes standardized OTDOA/NRPPa measurements with PRS, processed via a CNN model, for sub-meter accuracy. The use case focuses on public safety and uRLLC, addressing emergency responder tracking in real-time.

# 2. Problem Statement

Standard positioning mechanisms face limitations in multipath-rich environments, resulting in positioning errors and delayed responses. This is critical for public safety, uRLLC, and autonomous applications. Conventional OTDOA lacks adaptability, while AI offers dynamic, real-time correction capability.

# 3. Proposed Solution

Our solution is a CNN-based supervised learning model that estimates (x, y, z) positions from PRS and OTDOA logs. The system ingests power delay profiles and RSTD metrics, applying spatial pattern learning. Output is integrated into a RIC xApp for visualization and decision-making.

# 4. System Architecture & Tech Stack

- PRS transmitted from gNBs  
- UE records RSTD and timing data  
- GNE aggregates logs centrally  
- CNN model estimates UE coordinates  
- RIC xApp visualizes and integrates estimates into the RAN control loop  
Tech Stack: Python, PyTorch, Kafka, OAI, TensorBoard

# 5. Dataset & Evaluation

Synthetic or simulated datasets will be generated using RAN simulators or OAI logs. Evaluation metrics include RMSE (<1.5m target), 95% confidence ellipse (CEP), and comparison with baseline OTDOA trilateration.

# 6. Use Case: Public Safety / uRLLC

Supports emergency response operations through accurate indoor/outdoor UE tracking. Use cases include firefighter navigation, disaster zone response coordination, and real-time health/safety telemetry.

# 7. Development Timeline (6 Months)

- Month 1: Data simulation + architecture design  
- Month 2–3: CNN model development + evaluation  
- Month 4: Kafka integration + inference engine  
- Month 5: RIC xApp integration + visualization  
- Month 6: Final evaluation + GitHub release

# 8. Expected Impact

The system will deliver sub-meter accurate UE positioning in dense RAN environments. It will reduce latency in uRLLC, enable RAN-aware geolocation services, and demonstrate the feasibility of AI-native enhancements to 5G/6G location systems.

# 9. Contact

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