3GPP RAN Rel-19 Workshop RWS-230171

June 15th-16th, 2023, Taipei, Taiwan

Agenda Item: 5

AI-ML for Air interface

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Key objectives

- Rel-18 AI/ML for NR Air Interface SI
  - Studied use cases
    - CSI compression (2-sided)
    - CSI prediction (UE-side)
    - Spatial and temporal domain beam prediction (NW-side, UE-side)
    - Direct AI/ML and AI/ML assisted positioning (NW-side, UE-side)
  - Studied general framework, protocol, and signaling aspects
- Proposed Rel-19 WI scope
  - Specify the green highlighted use cases
    - Specification of yellow pending RAN Plenary discussion
  - Specify protocol and signaling aspects for supporting the use cases
    - Focus on inference (i.e., offline training) and collaboration level y (i.e., no model transfer)
    - RAN4 performance requirements expected to be done as part of the project too

CSI feedback enhancement

- Motivation
  - CSI compression is an important **representative use case** for two-sided AI/ML framework
  - Significant system-level performance gains are observed relative to the non-AI/ML benchmark ([1], [2])
    ~ 15% gain in UPT, ~ 50% reduction in CSI feedback overhead
  - Further (unexplored) **potential gains** are expected with **temporal compression** and **localized models**.

- Proposal: specify CSI compression using **two-sided AI/ML model** in R19 WI
  - Data collection, including assistance information for categorizing the data
  - Ensuring compatibility between the CSI generation model at UE and CSI reconstruction model at gNB
  - CSI configuration aspects related to CSI reporting payload size and format
  - Model management (monitoring, switching, deactivation, fallback, etc.)

[1] Chairman's Notes, RAN1 #113, May 2023
[2] R1-2306063, Feature lead summary (9.2.2.1), RAN1 #113, May 2023

Beam management

- Motivation
  - Both **spatial domain** and **temporal domain beam prediction** achieves good gain over the non-ML baselines.

- Proposal: specify **spatial-domain and temporal-domain beam prediction** at **NW** and **UE sides** in R19 WI
  - UE capabilities, features, and configurations related to beam prediction
  - Data collection for training and monitoring: measurement, RS configurations
  - Assistance information for beam shape, beam codebook, and Set A/B relations
  - Enhanced measurement reporting
  - LCM: Signaling for enabling functionality/model-ID based LCM

Positioning accuracy enhancements

- Motivation
  - Both direct AI/ML and AI/ML assisted positioning can achieve multifold (e.g., 10 times) enhancement gain to horizontal positioning accuracy than conventional positioning methods under both mild and heavy NLOS settings [RAN1-111 observations]

- Proposal: specify **Direct AI/ML Positioning** and **AI/ML Assisted Positioning** at **NW** and **UE sides** in R19 WI
  - UE capabilities, features, and configurations related to AI/ML positioning
  - Data collection: Measurement/labeling quality, labeling assistance, RS configurations, etc.
  - LCM: Signaling for enabling functionality/model-ID based LCM between LMF and other entities (i.e., UE and gNB/TRP)
  - Monitoring: Monitoring labeling assistance and other related signaling, etc.
  - Inference: Enhanced measurement reporting, etc.

Protocol and signaling aspects

- Specification focusing on **inference** operations
  - Training is done offline, and models are fully tested and identified offline.
- Specification focusing on **Collaboration level y**
  - No model transfer; model delivery is transparent to 3gpp signaling over the air interface.
- **UE capability signaling**, including **model** and **functionality identification**
- Functionality-/model-ID-based **Life Cycle Management** (LCM) for UE-side and two-sided models
  - Activation, deactivation, switching, fallback, monitoring
- **Data collection** for training, monitoring, and inference.

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