Smarter technology for all

3GPP TSG RAN Meeting #101
Bangalore, India, September 11-15, 2023

RP-232145

Agenda Item:	8A.2.1
Source:	Lenovo
Document for:	Discussion

Views on Further Study on AI/ML for NR Air Interface Enhancement in Rel-19

2023 Lenovo. All rights reserved.

Current status in Rel-18 SI: general aspects

- A general AI/ML framework
  - *Include model training, model management, data collection, model inference and model storage*

- Network-UE collaboration levels
  - *Level x: No collaboration*
  - *Level y: Signaling-based collaboration without model transfer*
  - *Level z: Signaling-based collaboration with model transfer*

- Life-cycle management (LCM) principles
  - *Functionality-based and Model-ID-based LCM*
    - *Different manageable granularity for UE-side or UE-part of two-sided models, based on identified configurations.*
  - *Relevant operations and functions*
    - *Performance monitoring, activation/deactivation, selection, switching, updating and fallback.*

Lenovo 2023 Lenovo. All rights reserved.

Current status in Rel-18 SI: sub use cases

- CSI feedback enhancement
  - *Spatial-frequency domain CSI compression using two-sided AI model*
  - *CSI prediction using one-sided model*
- Beam management (BM)
  - *BM-Case1: Spatial-domain DL Tx beam or beam pair prediction*
  - *BM-Case2: Temporal DL Tx beam or beam pair prediction*
- Positioning accuracy enhancement
  - *Direct AI/ML positioning*
  - *AI/ML assisted positioning*

- Evaluations
  - *The RS and CSI feedback overhead reduction can be observed with some configurations and simulation assumptions.*
    - *CSI feedback compression, BM-Case1*
  - *The estimation accuracy can be improved with some configurations and simulation assumption.*
    - *Positioning and CSI prediction*
- Potential specification impact
  - *Model inference*
  - *Data collection*
    - *E.g., label data for training and monitoring*
  - *Performance monitoring*

***Observation 1**: The number of sub use cases could be too large for the normative stage.*

***Observation 2**: Some features in AI/ML are deprioritized, such as model transfer, online training.*

Lenovo 2023 Lenovo. All rights reserved.

General views on AI/ML for air interface enhancement in Rel-19

- The next stage of Rel-18 SI on AI/ML for NR air interface enhancement can include two items:
  - ***Rel-19 WI: AI/ML for NR air interface***
  - ***Rel-19 SI: Study on AI/ML for NR air interface – Phase 2***

Rel-18 SI: Study on AI/ML for NR air interface enhancement

- General aspects
  - LCM
- Sub use cases
  - CSI feedback enhancement
  - Beam management
  - Positioning accuracy enh.
- Performance evaluation
- Specification impact

Rel-19 WI: AI/ML for NR air interface

- Specify signaling and procedures to support LCM, e.g., identification, activation/deactivation.
- Specify relevant AI/ML operations on selected sub use cases, e.g., data collection, model inference, performance monitoring and fallback schemes

Rel-19 SI: Study on AI/ML for NR air interface – Phase 2

- Remaining issues deprioritized in Rel-18, e.g., model transfer, online training
- Further study on some sub use cases in Rel-18, e.g., CSI prediction
- Study on some new use cases, e.g., mobility

Lenovo 2023 Lenovo. All rights reserved.

Rel-19 WI: AI/ML for NR Air Interface

- **Motivation**
  - *Specify the relevant procedures to **support AI/ML functionality/models***
  - *Specify the **AI/ML-related operations on the selected sub use cases** with representative model deployment and observed enough gains from Rel-18 study.*
- **Objectives**
  - *Specify signaling and procedures to support AI/ML functionality-based/model-ID-based LCM*
    - *LCM operations, e.g., functionality/model identification, switching, activation/deactivation, selection, etc.*
  - *Specify the below representative sub use cases:*
    - *Spatial-Frequency domain CSI compression with two-sided model*
    - *Spatial domain beam prediction with single-sided model*
    - *Both Cases 2 and Case 3, including direct AI/ML and AI/ML-assisted Positioning*
  - *Specify the support on relevant AI/ML operations, at least including*
    - *Efficient methods for data collection, e.g., training and monitoring data*
    - *Performance monitoring procedure, e.g., configuration, trigger and report and potential fallback.*
    - *Model inference, e.g., configuration of model input for different conditions*

Lenovo 2023 Lenovo. All rights reserved.

Rel-19 SI: Study on AI/ML for NR Air Interface – Phase 2

- **Motivation**
  - *Remaining issues from Rel-18 SI, e.g., model transfer, online training and two-side training.*
  - *More potential use cases can be further studied to explore more potential benefits from AI/ML, e.g., CSI feedback compression with multi-TRP, mobility enhancement and interference management.*

- **Objectives**
  - *Study the specification impacts to support more potential AI/ML functions*
    - *Enhancement to support model transfer, online training, two-side training and tuning*
    - *Collaborative/distributed model training and inference*
  - *Further study the performance and specification impact of new use cases in Rel-19*
    - *CSI feedback compression for multi-TRP scenario*
    - *Interference management, e.g., interference prediction and interference avoidance through intelligent resource allocation*
    - *Mobility enhancement, e.g., assist parameter adjustment, reduce HO failure and target cell prediction (RAN2 led)*
    - *Beam failure and radio link failure prediction (RAN2 led)*

Lenovo 2023 Lenovo. All rights reserved.

Summary

- In Rel-19, the study on AI/ML for NR air interface enhancement can include two items, one is WI to specify relevant AI/ML operations, the other is SI to further study AI/ML for more use cases.

- **Rel-19 WI:** AI/ML for NR air interface
  - Specify the relevant procedures to support AI/ML functionality/models
  - Specify relevant procedures on the selected sub use cases with representative model deployment and observed enough gains from Rel-18 study.

- **Rel-19 SI:** Study on AI/ML for NR air interface – Phase 2
  - Study remaining issues from Rel-18 SI, e.g., model transfer, online training
  - Study more potential use cases can be further studied to explore more potential benefits from AI/ML, e.g., CSI feedback compression with multi-TRP, mobility enhancement, beam failure/RLF prediction and interference management

Lenovo 2023 Lenovo. All rights reserved.

thanks.

Smarter technology for all

Lenovo