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Lenovo

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Views on AI/ML for Air Interface in Rel-19

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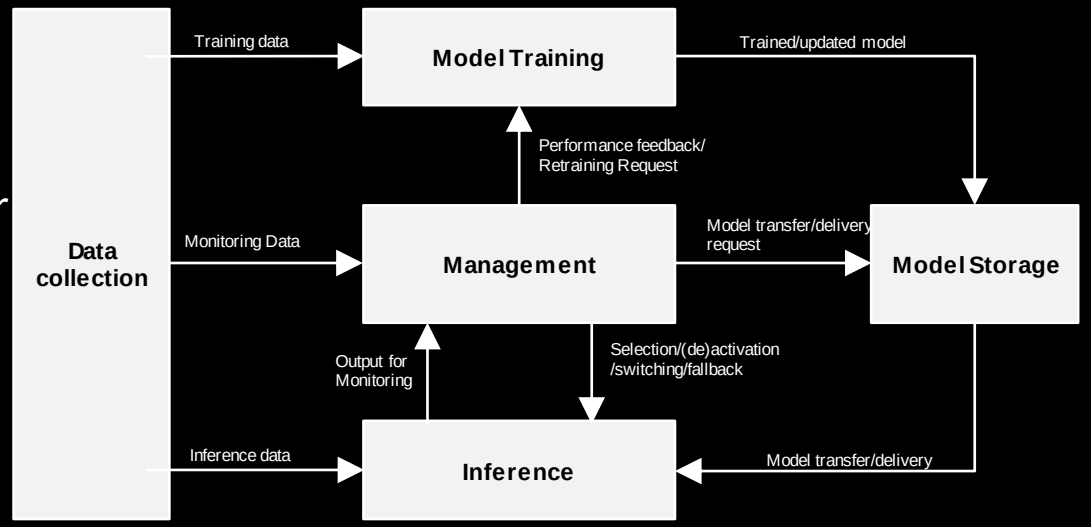
Rel-18 SI: general aspects

- 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.*



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Rel-18 SI: sub use cases

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

- Conclusions from RAN WG1:
  - ***Recommendation*** *for normative work for:*
    - *BM-Case1*
    - *BM-Case2*
    - *Direct AI/ML positioning*
    - *AI/ML assisted positioning*
  - ***No consensus*** *for normative work recommendation:*
    - *CSI compression*
    - *One-sided CSI prediction use-case*

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Views on the conclusions of Rel-18 SI

- As all of the recommended use-cases are based on single-sided model, we may be able to come up with common AI/ML operations to support different use cases, during the normative work.
  - *E.g., the signaling and procedures to support functionality/model-ID based LCM*

- Since the CSI compression and prediction use cases have not been fully concluded in SI, especially the two-sided model related operations, it is suggested to continue the study for these two sub use cases.
  - *E.g., performance gain for both use cases, pairing mechanisms for two-side model operation.*

- For the general framework, solid and common understanding of some issues mainly related to two-sided model are essential before start of the normative-work, and therefore these issues may require further study
  - *E.g., functionality/model-ID based procedure, model update, and online training/tuning of single-side of a two sided model*

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

- The next stage of AI/ML for air interface should include two-parts :
  - **Rel-19 WI: AI/ML for air interface**
    - Specify signaling/procedures for RAN1 recommended use cases
  - **Rel-19 SI: Study on Two-sided AI/ML Model for NR air interface**
    - Further study on the challenges identified during Rel-18 SI, with the focus on supporting two-sided models

2024				2025			
Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Rel-19 SI: Further study (RAN1/2/4)

Rel-19 WI: AI/ML for air interface (RAN1)

Rel-19 WI: AI/ML for air interface (RAN2/4)

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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 sufficient 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 sub use cases:*
    - *Beam management sub-use-cases: BM-Case1 and BM-Case2*
    - *positioning sub-use-cases: Direct AI/ML Positioning and AI/ML assisted positioning (all 5 use-cases)*
    - *Further study of CSI prediction use-case and specify if observed acceptable performance*
  - *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*

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Rel-19 SI: Study on Two-sided AI/ML Model for NR Air Interface

- **Motivation**
  - *Complete the **framework study** required for supporting of two-sided models' development/operation*
  - *Determine **solutions for Rel-18 identified challenges***
  - *Study of the AI/ML features/procedures deprioritized during the Rel-18 SI*
  - *Start with CSI-compression use-case, other two-sided use cases can be further studied based on progress and potential benefits.*
- **Objectives**
  - *Complete the **framework study** and determine **solutions for Rel-18 identified challenges***
    - *Identifying inter-vendor procedures for model training*
    - *Model identification/pairing procedure for two-sided sub use case.*
    - *UE side and NW side performance monitoring.*
    - *UE side and NW side efficient data collection procedure*
  - *Study of deprioritized features/procedures and potentially more use cases associated with two-sided models:*
    - *Enhancement to support model transfer, online training, two-side training and tuning*

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Summary

- In Rel-19, 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

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

- **Rel-19 SI:** Study on Two-sided AI/ML models for NR air interface
  - Complete the framework required for supporting of two-sided models' development/operation
  - Determine solutions for Rel-18 identified challenges
  - Study of the AI/ML features/procedures deprioritized during the Rel-18 SI
  - Start with CSI-compression use-case, other two-sided use cases can be further studied based on progress and potential benefits

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thanks.

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