China Academy of Telecommunication Technology

3GPP TSG RAN Meeting #102
Edinburgh, Scotland, December 11-15, 2023

RP-233011

Consideration on AI/ML for air interface

CATT

Background

- **The following observation was made in RP-232611 at RAN#101**

Observations based on the input in this meeting

- Consider support single sided models for,
  - Positioning, further discuss whether to support all 5 sub use cases.
  - Beam management for DL Tx prediction in both UE-sided and NW sided model,
- Consider support of single sided model for CSI prediction, if it is recommended to proceed with normative work taken all WG's outcome in Q4-23 into account
- Consider support two-sided model for CSI compression, if it is recommended to proceed with normative work taken all WG's outcome in Q4-23 into account
- Consider support the necessary/recommended LCM components for selected sub use cases
- RAN4 requirements and test cases for AI/ML enabled features

- **RAN1 SI on AI/ML in air interface was extended in 2023Q4. The extended RAN1 study on (1) general framework and (2) CSI feedback are considered completed in RAN1#115.**
- **RAN2 SI is considered completed in RAN2#124.**
- **RAN4 SI is considered completed in RAN4#109.**

High-level consideration

- **Situation of studied sub use cases**
  - CSI feedback
    - Neither CSI compression nor CSI prediction is recommended for normative work. Main reasons have been identified.
  - Beam management
    - Both BM-Case1 and BM-Case2 are recommended for normative work. Focus on DL Tx beam prediction.
  - Positioning enhancement
    - Recommended for normative work in general. RAN1 has not considered (de)prioritization for 5 cases (1/2a/2b/3a/3b).

- **LCM procedures**
  - Several aspects has been studied, including data collection, model/functionality identification, model transfer/delivery, report of applicable functionalities/models, etc. Fundamental LCM operations should be taken into consideration for normative work。
  - But not all the aspects are concluded on the necessity and feasibility. Note that the necessity of data collection for UE side model training and model transfer is unclear from RAN2 SI outcome, in which no recommendation was made.

- **Proposal 1: AI/ML for air interface is proceeded as WI + SI in Rel-19.**

Use cases of WI and SI

- **Outcome of sub use case study**

Use case	Sub use case	RAN1 outcome	RAN2 outcome	RAN4 outcome
CSI feedback enhancement	**CSI compression**	Not recommended to normative work.	No intention for down-selection	Not fully complete the study on two-side model testing
	CSI prediction	Not recommended to normative work.		No obvious feasibility issue
Beam management	**BM-Case1: Spatial domain**	Recommended		No obvious feasibility issue
	BM-Case2: Time-domain	Recommended		No obvious feasibility issue
Positioning accuracy enhancement	**Direct AI/ML positioning**	Recommended. RAN1 has not considered down-selection between 5 sub cases (1/2a/2b/3a/3b).		No obvious feasibility issue
	AI/ML-assisted positioning			No obvious feasibility issue

- **Proposal 2: For Rel-19 AI/ML for air interface, parallel WI and SI can be proceeded for different sub use cases:**
  - **WI: Beam management and positioning accuracy enhancement**
  - **SI: CSI compression and CSI prediction**
    - **RAN1 focuses on addressing reasons of no recommendation as captured in TR 38.843, including model transfer as part of the training collaboration of two-sided model;**
    - **RAN4 focuses on completing two-side model testing study.**
  - **Further consider whether to include CSI compression and CSI prediction into Rel-19 WI in a later phase based on outcome of Rel-19 SI.**

Life cycle management

- **Both functionality-based LCM and model-ID-based LCM have been studied during SI.**
- **A unified LCM is possible, since RAN1 agreed that model ID (if needed) can be used in a Functionality for LCM operations.**

Functionality-based LCM

- Relatively simple - largely follows legacy UE capability/feature framework
- Good balance between complexity and flexibility: NW manages functionality-level control, while UE manages model-level control

Can be used in a Functionality for LCM operations

Model ID

Model-ID-based LCM

- More flexible and finer model control
- Aggressive change on top of legacy UE capability/feature framework
- Non-negligible offline engineering is required, e.g. model identification Type A.

- **However, data collection for UE side model training (e.g. UE/NW to OTT server) or model transfer have not been recommended by RAN2. They shall not be included in normative work unless necessity and feasibility are justified.**

- **Proposal 3: For Rel-19 WI of AI/ML for air interface, support a unified LCM framework**
  - **Support activation, deactivation, selection, switching, fallback, performance monitoring, with optional model ID;**
  - **Support data collection in 3GPP framework, with optional dataset/model ID;**
  - **Support online model identification (Type B1, B2), assuming that offline model identification (Type A) can be supported without specification impact.**

Conclusion

Proposal 1: AI/ML for air interface is proceeded as WI + SI in Rel-19.

Proposal 2: For Rel-19 AI/ML for air interface, parallel WI and SI can be proceeded for different sub use cases:

- **WI: Beam management and positioning accuracy enhancement**
- **SI: CSI compression and CSI prediction**
  - **RAN1 focuses on addressing reasons of no recommendation as captured in TR 38.843, including model transfer as part of the training collaboration of two-sided model;**
  - **RAN4 focuses on completing two-side model testing study.**
- **Further consider whether to include CSI compression and CSI prediction into WI in a later phase based on outcome of Rel-19 SI.**

Proposal 3: For Rel-19 WI of AI/ML for air interface, support a unified LCM framework

- **Support activation, deactivation, selection, switching, fallback, performance monitoring, with optional model ID;**
- **Support data collection in 3GPP framework, with optional dataset/model ID;**
- **Support online model identification (Type B1, B2), assuming that offline model identification (Type A) can be supported without specification impact.**

THANK YOU