3GPP TSG RAN#102
December 11 – 15, 2023
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9.1.1.1

Rel-19 AI/ML for Radio Interface

Scope

Mediatek Inc.

AI/ML for CSI use cases

Outcome of SI

- The main effort in Q4 was to finalize the view on CSI enhancement use cases. The following outcome was agreed in RAN1#115 for those use cases:
  - **CSI Compression**
    - From RAN1 perspective, there is no consensus on the recommendation of CSI compression for normative work.
    - At least the following aspects are the reasons for the lack of RAN1 consensus on the recommendation of CSI compression for normative work.
      - Trade-off between performance and complexity/overhead
      - Issues related to inter-vendor training collaboration
    - Other aspects that require further study/conclusion are captured in the summary
  - **CSI Prediction**
    - From RAN1 perspective, there is no consensus on the recommendation of CSI prediction for normative work.
    - The reason for the lack of RAN1 consensus on the recommendation of CSI prediction for normative work is due to
      - Lack of results on the performance gain over non-AI/ML based approach and associated complexity
    - Other aspects that require further study/conclusion are captured in the summary.

Proposed way forward for CSI use cases

- **Our Recommendation on CSI compression**
  - Propose to continue study in Rel-19 on CSI Compression, with more emphasis on framework aspects, especially on **how to reduce the overall level of device and ecosystem complexity** involved
    - This should involve further study on Model Transfer aspects for 2-sided model
  - It was mentioned during the RAN1 discussion that “maybe CSI Compression is not the best use case for 2-sided model”. However, we do not believe it would be useful to start brainstorming other potentially “2-sided model friendly” use cases at this stage.

- **Our Recommendation on CSI prediction**
  - Propose to exclude this topic from both SI and WI in Rel-19 since non-AI based prediction can achieve similar performance with lower complexity.
  - However, if further studies were to go ahead, it would be needed to identify scenarios in which AI/ML can significantly outperform non-AI baselines (no scenario identified so far), considering the additional device complexity

AI/ML “Normative” work in Rel-19

AI/ML for Beam Management

- Performance and complexity
  - Promising gain in spatial spatial domain (Case 1) and moderate gain in temporal domain (Case 2) compared to non-AI baseline
  - Appealing complexity compared to other sub use cases studied in Rel-18
  - Well generalizable AI/ML models over various scenarios evaluated in Rel-18
- Spec impact and workload
  - Spec impact: Limited impact as another one-sided sub use case
  - Overall workload: Manageable workload given significant progress made in Rel-18
- **Our Recommendation for AI/ML Beam Management scope**
  - Specify AI/ML for beam management with special focus on spatial domain as 1st priority and temporal domain as 2nd priority in Rel-19.

AI/ML “Normative” work in Rel-19

AI/ML for UE Positioning

- Considerations
  - Significant enhancement in positioning accuracy when AI/ML is leveraged in direct or assisted form
  - Complexity tends to be high compared to AI/ML models used for beam management sub use case
  - Feasible label-based and label-free monitoring solutions
- Spec impact and workload
  - Spec impact: Limited spec impact with minor challenges in data collection
  - Overall workload: Manageable workload considering maturity of the topic
- **Our Recommendation for AI/ML Positioning scope**
  - MTK suggests AI/ML for positioning for normative work with focus on both AI-direct and AI-assisted methods in Rel-19
  - Focus on “NW-sided” sub-use cases. See Annex”

Normative work on AI/ML in Rel-19

Scope of Lifecycle Management (LCM) – part I

- **Functionality for one-sided model should progress to normative work**
  - Only use cases requiring one-sided model have so far shown benefit
  - Support both UE-side model and NW-side model
- **Functionality-based should be 1st priority for normative work**
  - ''Functionality" corresponds to much coarser granularity of configurations/conditions than "model", and allows coarser granularity of control
  - "Functionality-based" approach simplifies the NW control and allows more UE freedom
  - Harmonization of functionality-based LCM and model ID based LCM can be discussed in the normative phase

Normative work on AI/ML in Rel-19

Scope of Lifecycle Management (LCM) – part II

- **We recommend a study phase to conclude on data collection for UE-side model training**
  - RAN2 lists all the possible solutions without study and analysis.
  - RAN2 should focus on the solutions which has 3GPP impact and cooperate with SA when necessary.
- **We recommend to continue study model transfer/delivery for UE-side model**
  - No UE side model is available for delivery/transfer before data collection can be done
  - No urgency for normative work on model delivery/transfer when data collection is under study
- **We recommend that further work on LCM general aspects is driven by RAN2**

Overall Rel-19 work structure for AI/ML

- There will be study aspects and normative work aspects in Rel-19
- We recommend that study aspects for CSI use cases should be performed as a continuation of the existing Rel-18 Study Item
  - If a “study phase” as part of the work item was instead preferred, we would recommend a clear deadline (no later than RAN#105) to decide on next steps
- Further study outcomes should be documented in the existing AI/ML TR 38.843
- A Work Item can be started for AI/ML “normative” aspects

Thank you!

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Appendix A: Positioning Case Studies

Rel-18 SI

- **The five use cases agreed to study in Rel-18 SI**
  - Case 1: UE based positioning with UE side model, for direct AI/ML or AI/ML assisted positioning
  - Case 2a: UE assisted/LMF based positioning with UE side model, for AI/ML assisted positioning
  - Case 2b: UE assisted/LMF based positioning with LMF side model, for direct AI/ML positioning
  - Case 3a: NG-RAN node assisted positioning with gNB side model, for AI/ML assisted positioning
  - Case 3b: NG-RAN node assisted positioning with LMF side model, for direct AI/ML positioning

MTK preferred