Views on AI/ML for Air Interface in R19

CAICT

Reviews on AI/ML for Air Interface in R18

The Study of AI/ML for NR Air Interface in R18 has established solid foundation for the AI/ML based design in 5G-A and 6G

General frameworks

- Terminology
- Functional framework
- Collaboration levels
- LCM process
- Interoperability and testability

Evaluation methodology

- Dataset construction
- Model training types
- Model generalization
- KPIs

Typical use cases

- CSI Feedback enhancement
- Beam management
- Positioning accuracy enhancement

General views on AI/ML for Air Interface in R19

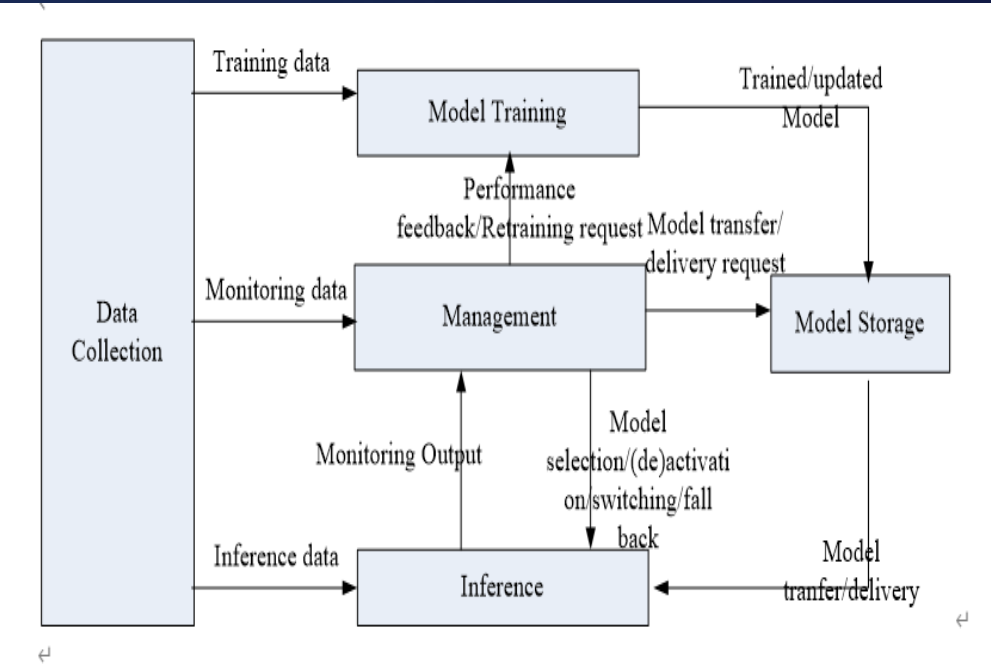
1. Specification for General framework
2. Specification for different use cases
3. Study for more use cases

Specification for general framework

Specify a flexible and extensible framework for AI/ML based use cases

- Focus on LCM process
  - Functionality-based LCM
  - Model-ID-based LCM

- Potential specification aspects
  - PHY layers
  - Protocol layers
  - Interoperability and testability



The specification of AI/ML for Air Interface should cover both general part and use cases special part.

Specification for CSI feedback

CSI compression

- **Representative use case for two-sided model**
- Good performance of feedback accuracy and overhead reduction
- Reuse the legacy frameworks for Type I/II codebook
- Type 1 Joint training and Type 3 Separate training should be considered

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CSI prediction

- AI/ML based CSI prediction shows good performance over traditional prediction algorithm
- CSI prediction in R17 should be considered as starting point
- LCM for UE side model could be used as baseline

CSI compression and CSI prediction should be considered in R19 WI

Specification for Beam Management

BM-Case1
(Spatial-domain DL beam prediction)

- With limited input (measurements of Set B), AI/ML could provide high accuracy prediction results for top 1/K beam(s) of all beams (Set A)
- AI/ML model at NW and UE could be considered
- Enhancements for measurements and training are required
- LCM process should be specified

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BM-Case2
(Temporal DL beam prediction)

- AI/ML could provide prediction accuracy gain with less measurements overhead comparing with non-AI scheme
- AI/ML model at NW and UE could be considered
- LCM process should be specified

BM-Case1 and BM-Case2 should be considered in R19 WI

Specification for Positioning

Gains

- The accuracy of positioning could be improved with AI/ML in IIOT scenario
- The performance gain will decrease with realistic constraints

Challenges

- Ground truth label
- Model generalization
- Synchronization error
- Imperfect measurement
- …..

Specification

- new measurement and/or existing measurement enhancement
- Data collection for training/monitoring
- Other LCM related signaling/configuration/measurement/report

Direct AI/ML positioning and AI/ML assisted positioning should be considered

– FFS: all cases(Case 1/2a/2b/3a/3b) should be specified

Study for more use cases

- AI/ML based Mobility enhancement (RAN2-led)
  - SA2/RAN3 have specified AI/ML based mobility enhancement
  - AI/ML based solution could be applied to air interface to improve the performance of mobility
    - HO/CHO，Beam management, RLF recovery……
  - Performance evaluation for different AI/ML based solutions

- Other use cases
  - Channel estimation
  - Joint design of channel estimation and CSI feedback
  - ……

Summary

- AI/ML for Air Interface in R19 should cover both general part and use cases special part
- All representatives use cases identified in R18 should be specified
- Study on AI/ML based mobility enhancement could be considered (RAN2-led)
- New use case(s) for study could be considered with lower priority

Thanks