

Retrieval Augmented Task-Oriented Semantic Parsing

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1. Task Oriented Semantic Parsing

- Structured prediction task with pre-defined structure elements
- Given a utterance perform a semantic into pre-defined *intent*, and corresponding *slots* with example specific *slot-values*.

Utterance: Driving directions to the Eagles game

Semantic Parse: [IN:GET DIRECTIONS Driving directions to [SL:DESTINATION [IN:GET_EVENT the [SL:NAME_EVENT Eagles] [SL:CAT_EVENT game]]]]

Tree Representation:

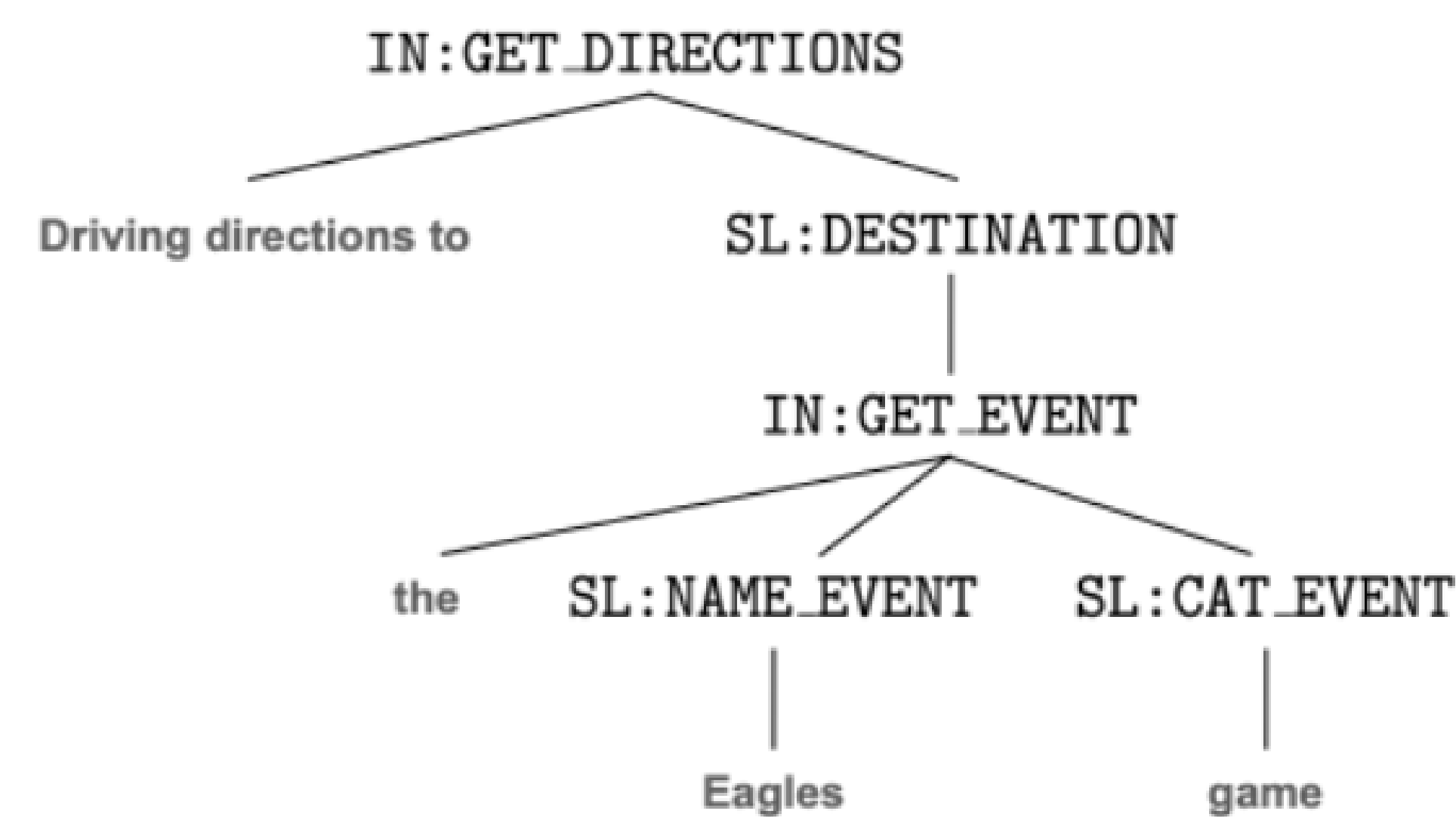


Figure 1: An compositional query from TOP dataset.

- Example TOP-V2 dataset (Chen et. al., 2020)

2. Retrieval Augmentation Technique

Retrieve and Augmenting Similar Example

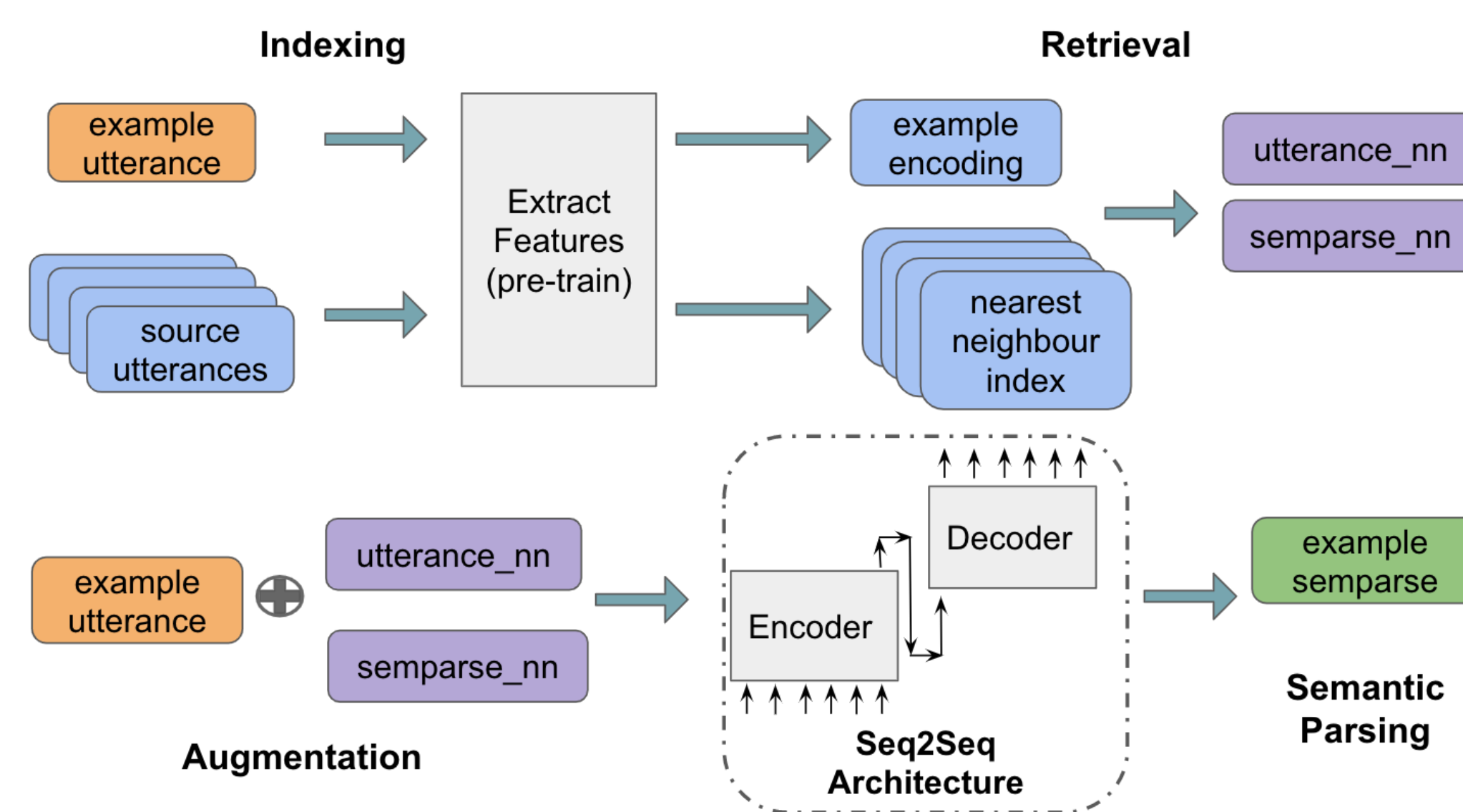
initial utterance : "please add 20 minutes on the lasagna timer"
expected semparse(decoupled): [in:add_time_timer [sl:date_time 20 minutes] [sl:timer_name lasagna] [sl:method_timer timer]]

nn utterance : "add ten minutes to the oven timer"
nn semparse (coupled): [in:add_time_timer add [sl:date_time ten minutes] to the [sl:timer_name oven] [sl:method_timer timer]]

final utterance : [in:add_time_timer add [sl:date_time ten minutes] to the [sl:timer_name oven] [sl:method_timer timer]] | please add 20 minutes on the lasagna timer
expected semparse (decoupled): [in:add_time_timer [sl:date_time 20 minutes] [sl:timer_name lasagna] [sl:method_timer timer]]

Augment the *semparse* or even *utterances*.

3. Proposed Approach: RetroNLU



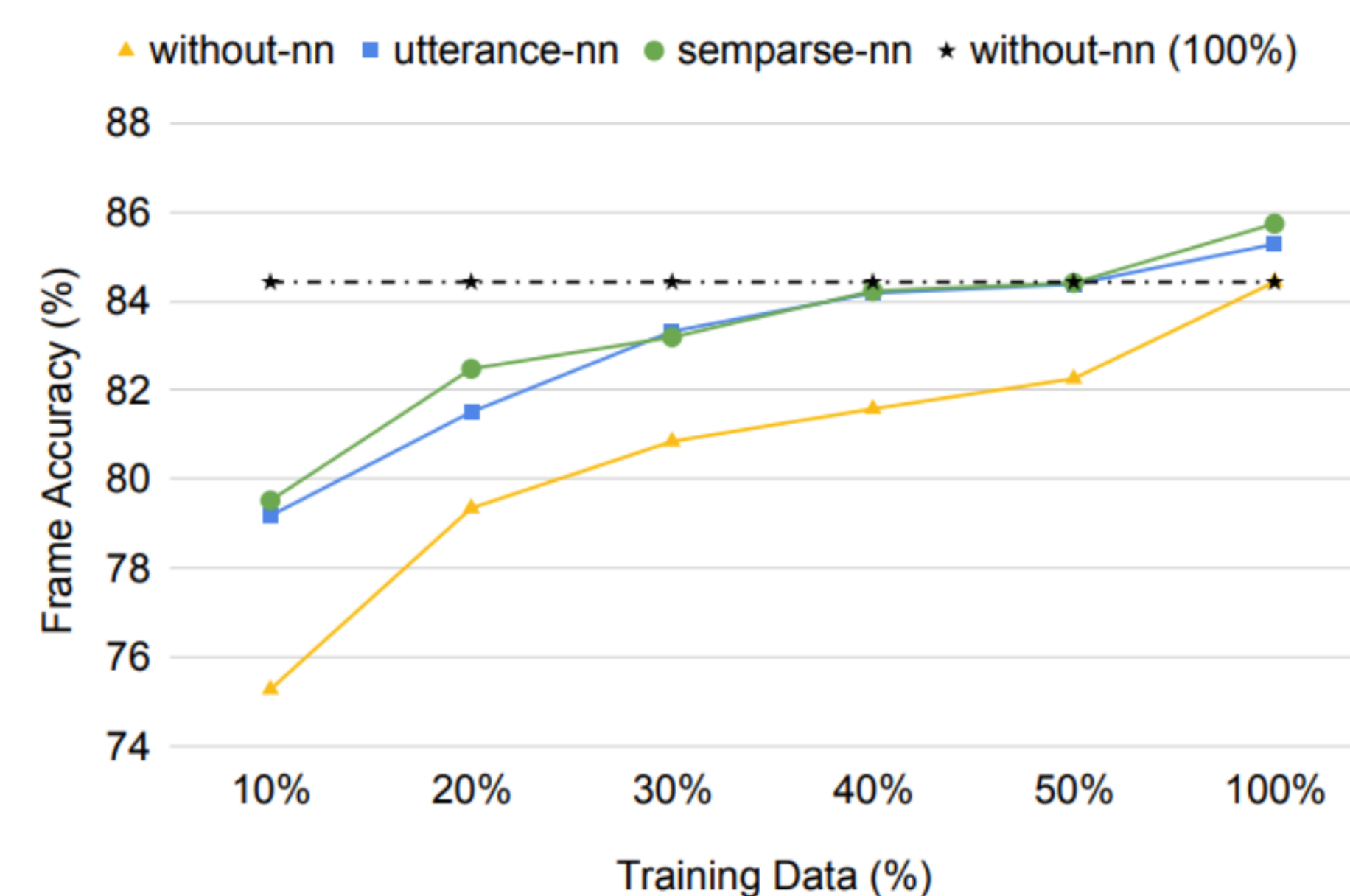
4. Our Contributions

- Explore RetroNLU: a retrieval based approach for task-oriented semantic parsing.
- RetroNLU utilize explicit memory of retrieve examples which model adapt for similar utterance.
- We analyse the robustness and sensitivity of RetroNLU in several dimensions:

- Data Efficiency: Performance improvement
- Limited Supervision Setting: Using unlabeled source
- Robustness to Noise: Sensitivity to Retrieval
- Utterance Complexity: Complex and Rare utterances
- Knowledge Efficiency: #NN

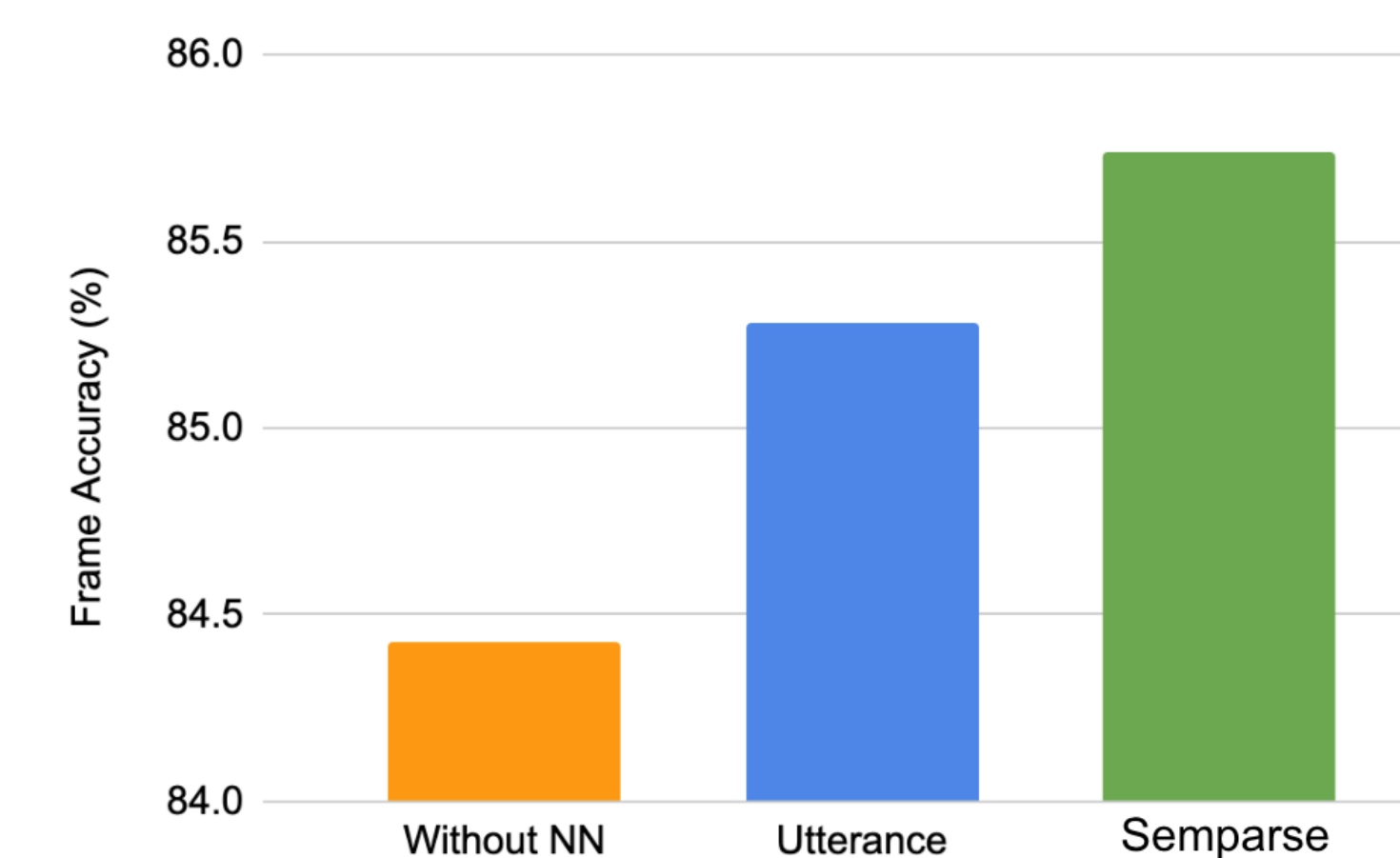
5. Data Efficiency

Can retrieval based on non-parametric knowledge alleviate reliance on parametric knowledge?



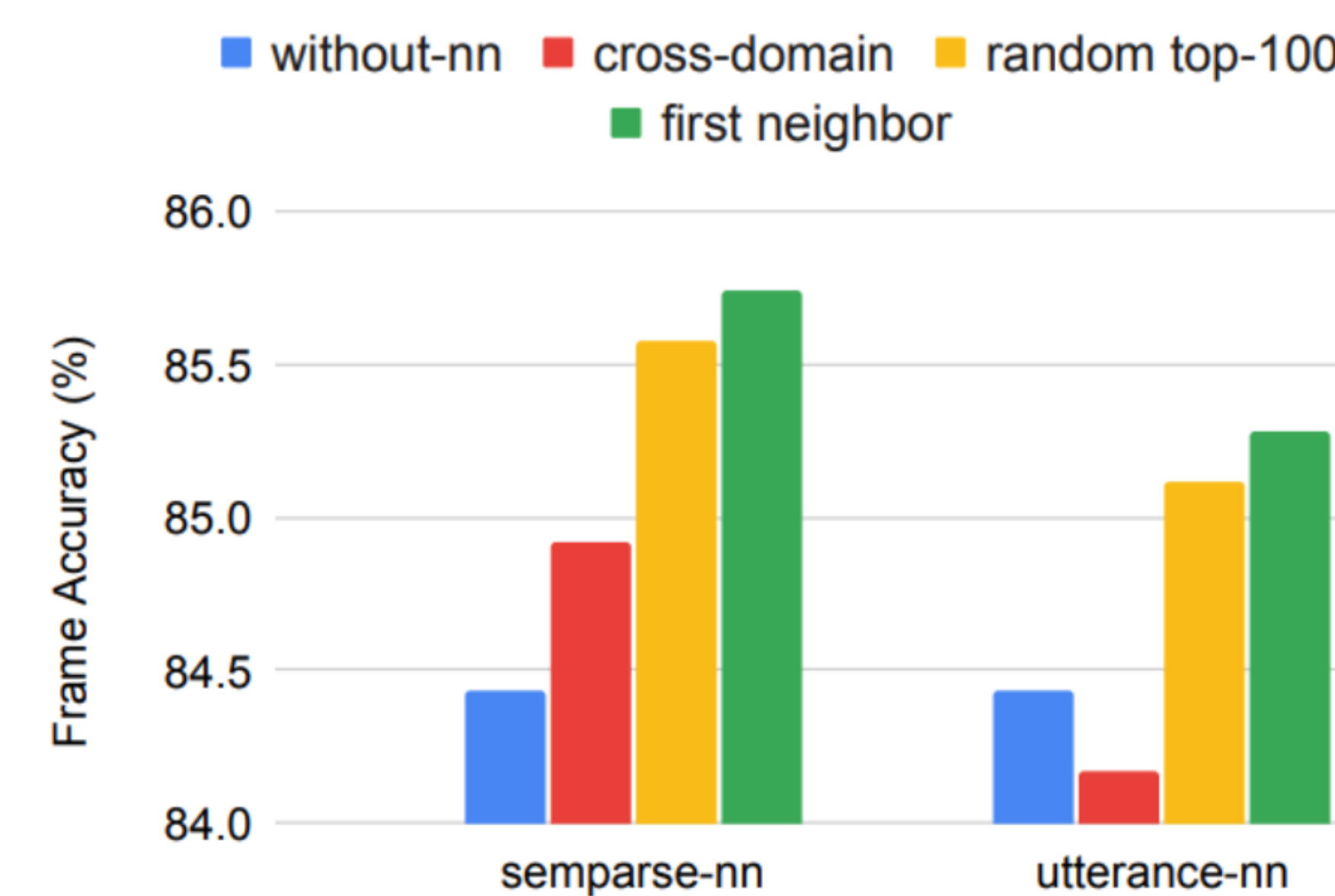
6. Limited Supervision

Can we enhance models with unlabeled non-parametric over structurally labeled knowledge?



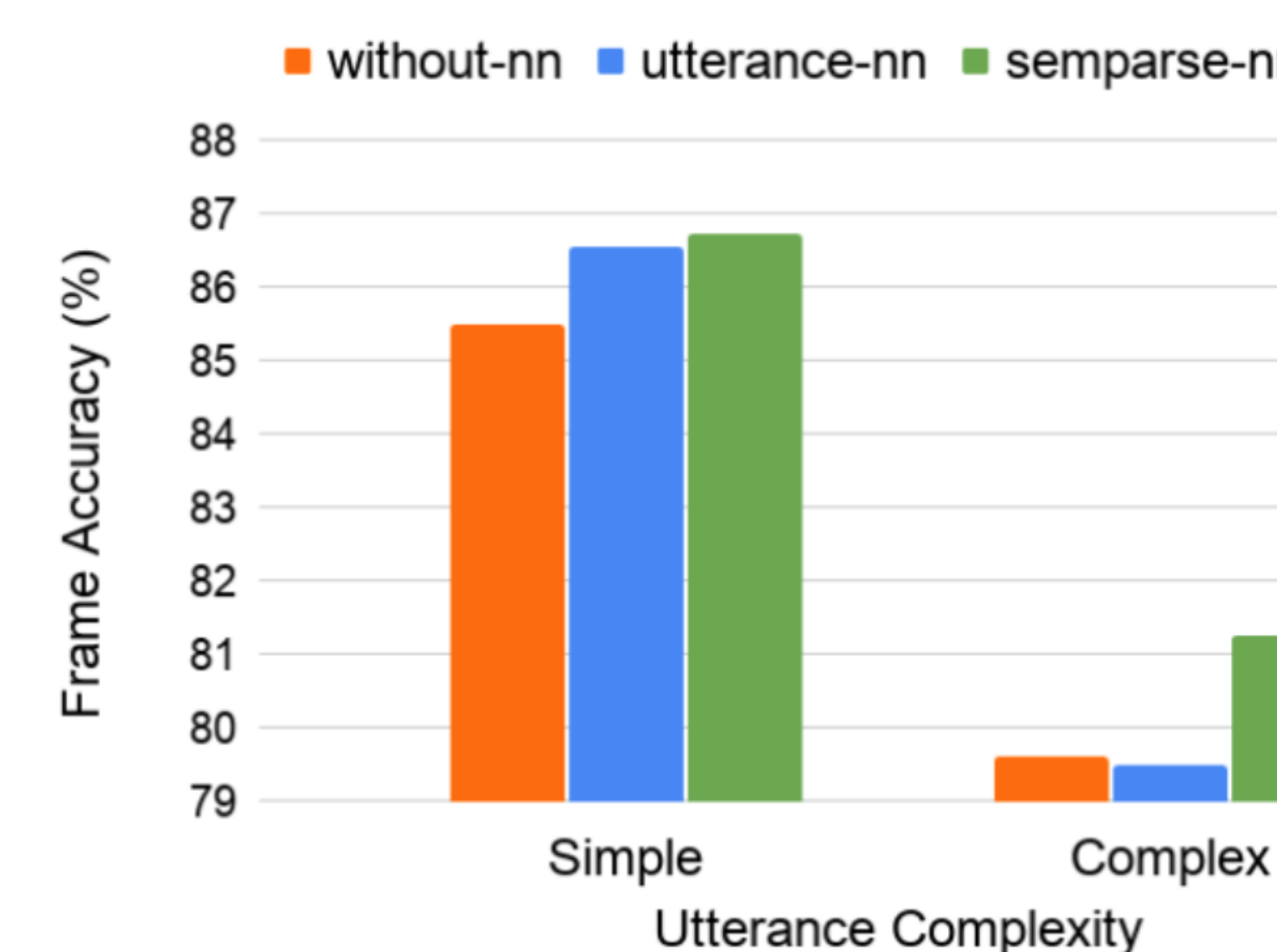
7. Robustness to Retrieval Noise

Model opt for parametric knowledge rather than non-parametric knowledge in a resilient manner.



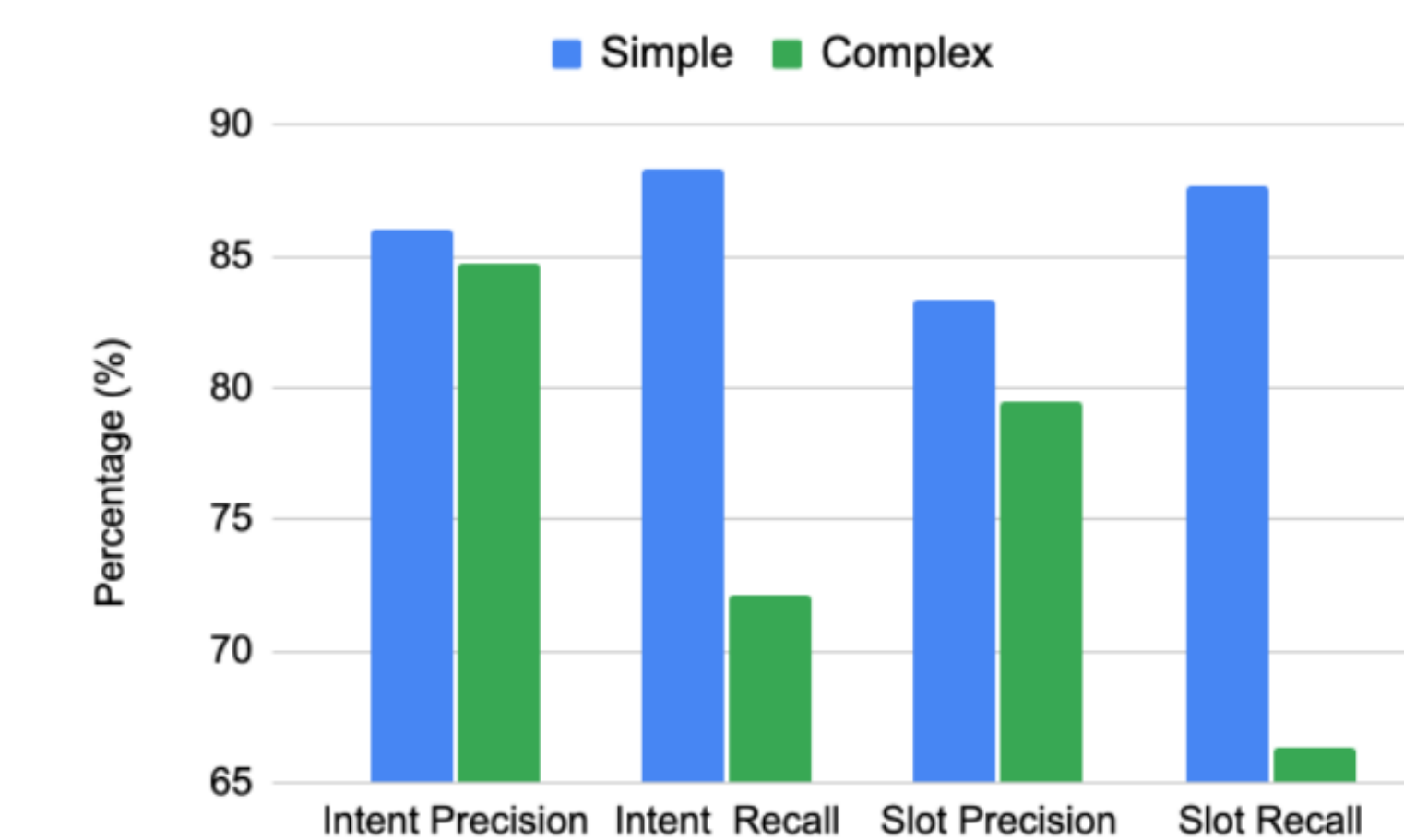
8. Utterance Complexity

Non-parametric knowledge addition effective for both uncommon and complex utterances.



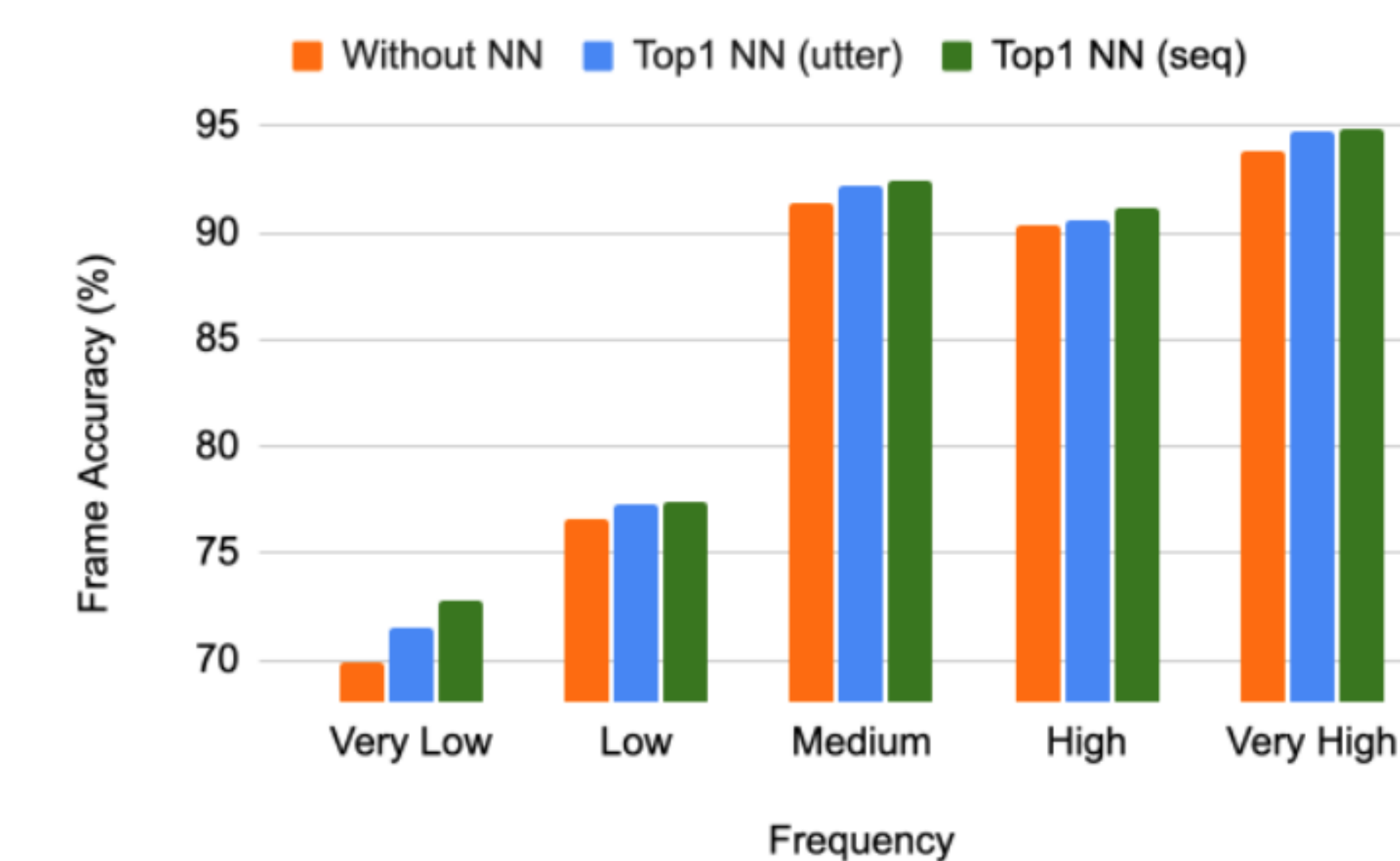
9. Retrieval Simple vs Complex

- Retrieval NN better for simple than complex
- Recall suffer the most for complex queries
- Slot retrieval decreases much more than intent



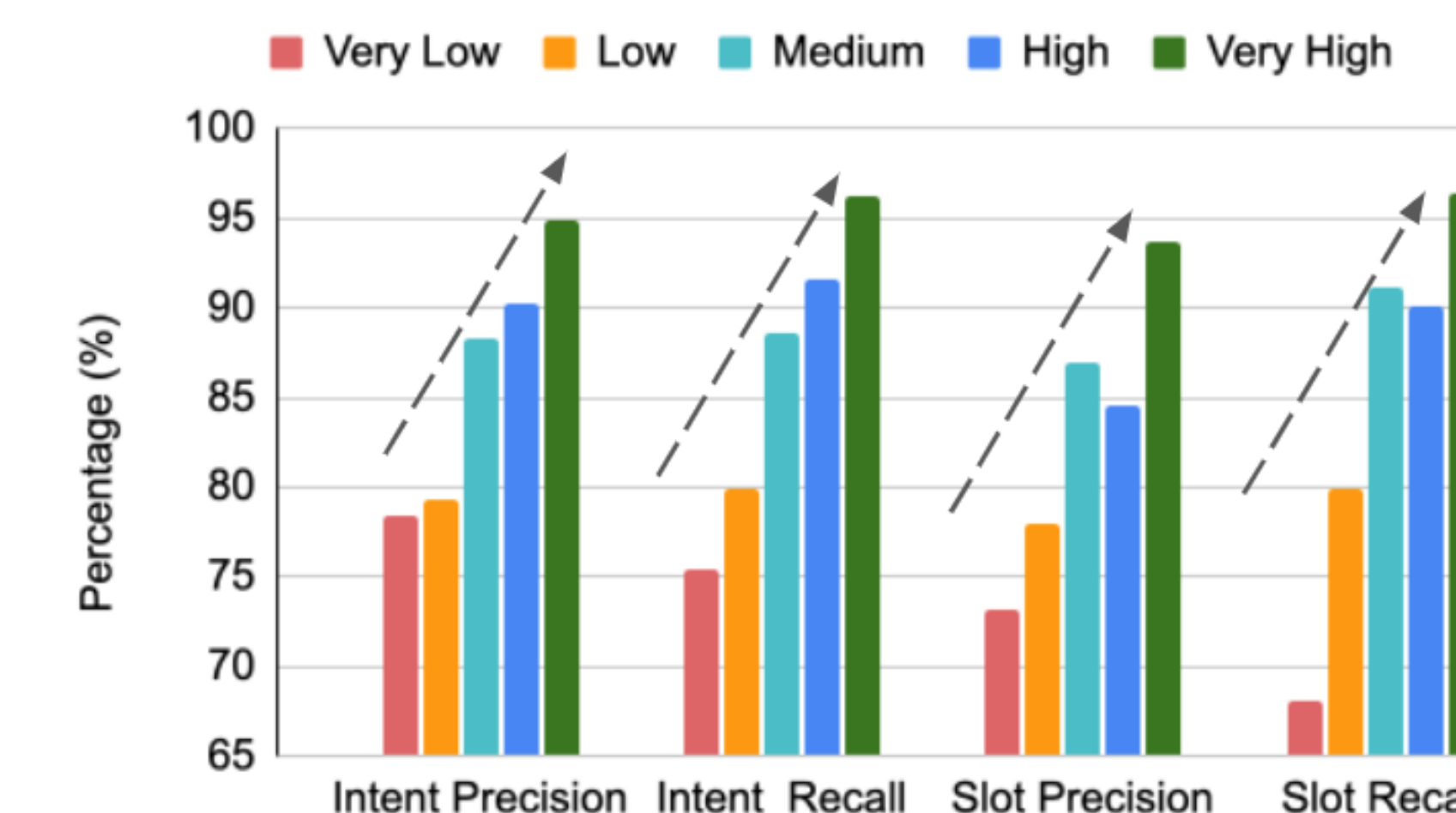
11. Rare vs Frequent Utterances

- performance increase with frequency
- performance improve more for very lower frequency



- Retrieval: Rare vs Frequent

- Retrieval NN better with high frequency
- expected at more examples of similar frame structure
- Similar trend for intent and slot for precision and recall



Data and Software:

<https://retronlu.github.io/>