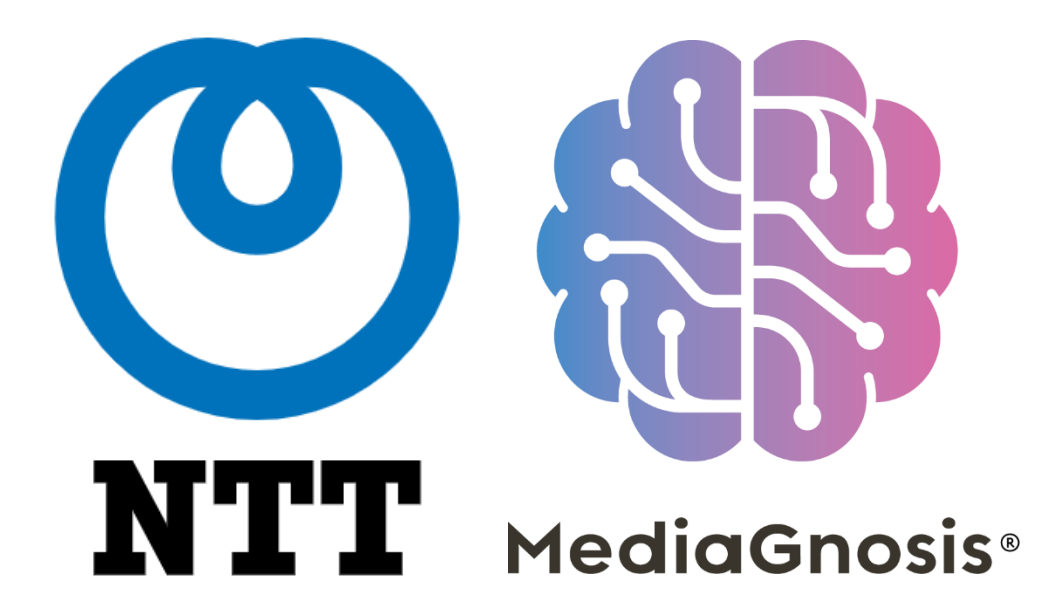


# Retrieval, Masking, Generation: Feedback Comment Generation using Masked Comment Examples



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**Motivation:** To generate feedback comments such as hints or explanatory notes for grammatical errors

**Problem:** The conventional method that rewrites retrieved feedback comments did not perform well because editing tokens that do not require rewriting is unavoidable

**Proposal:** Retrieval, masking, and generation method to mask tokens that need to be rewritten in a feedback comment and generate a new feedback comment by predicting masked tokens

**Achievements:** Evaluation experiments on feedback comment generation for grammatical error correction demonstrate that the proposed method performs better than conventional methods with both automatic and manual evaluation

## Background

### Feedback comment generation

- Given an input text and position that shows where to comment, a system generates feedback comments [1]
- The system should explain why they are wrong, not enough to point out or correct errors

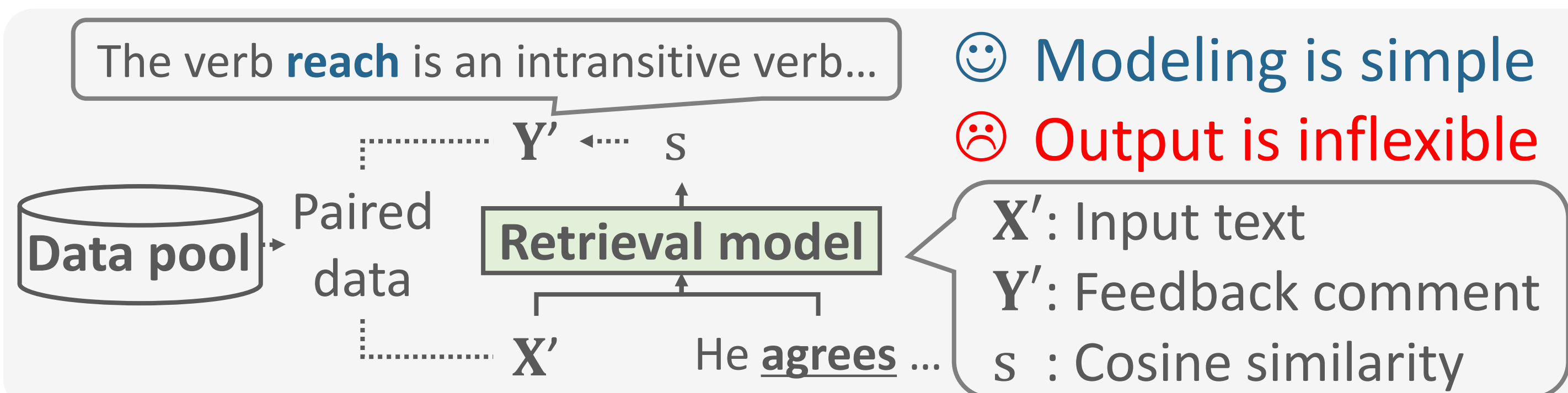
**Input text:** He agrees the opinion.

**Feedback comment:** The verb agree is an intransitive verb and cannot take direct objects. Add the appropriate preposition.

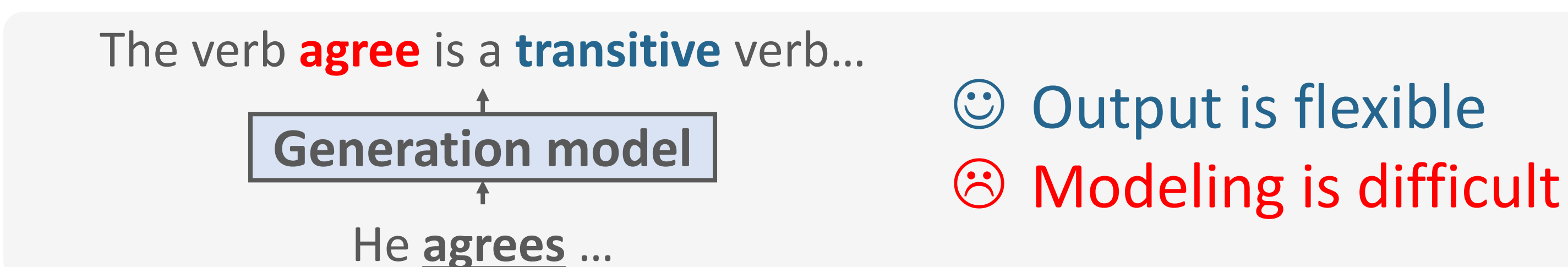
- This system would be extremely beneficial for language learners

## Conventional Methods

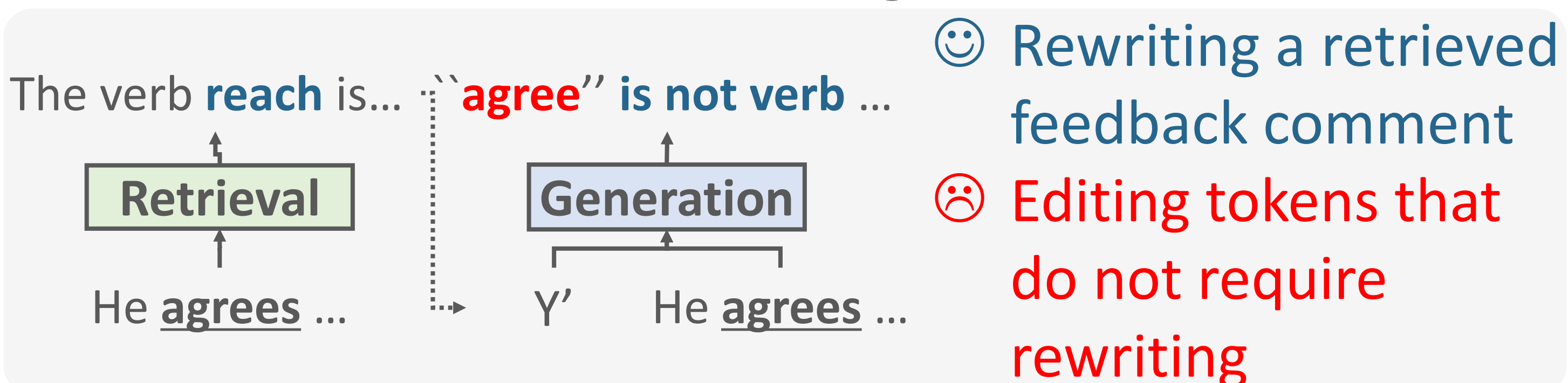
### Retrieval-based [1]: Retrieving a comment from data pool



### Simple generation [2]: Generating a comment from input



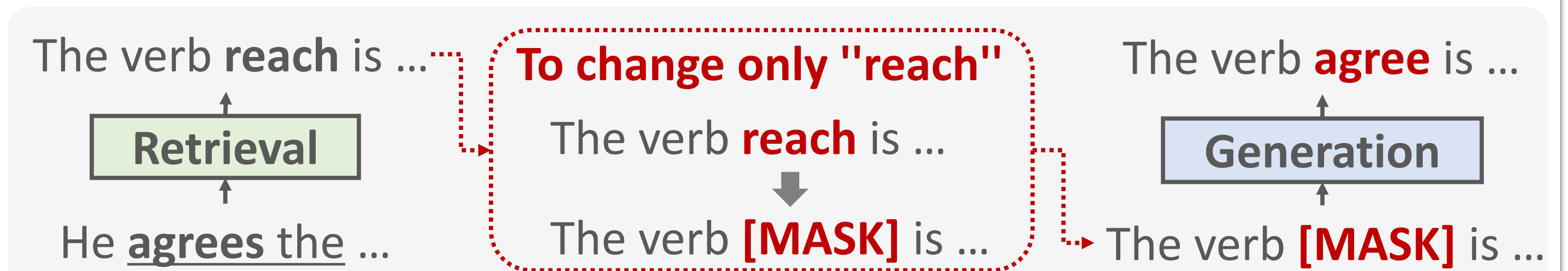
### Retrieve-and-edit [3]: Combining these two methods



## Proposed Method

### Key idea: Expanding retrieve-and-edit method

- Replacing tokens to be edited with mask tokens

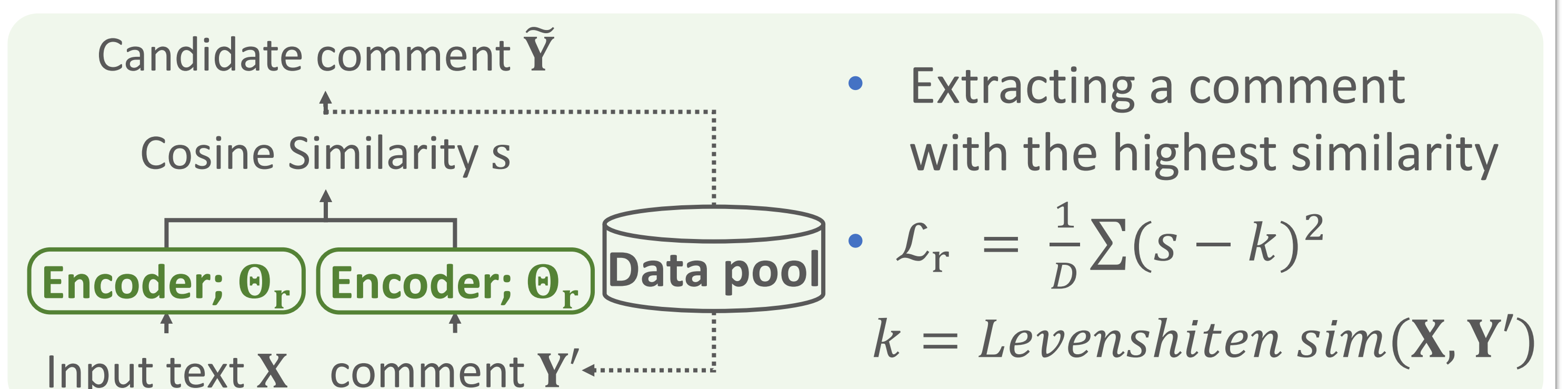


- Preventing over-editing by specifying the tokens to be edited

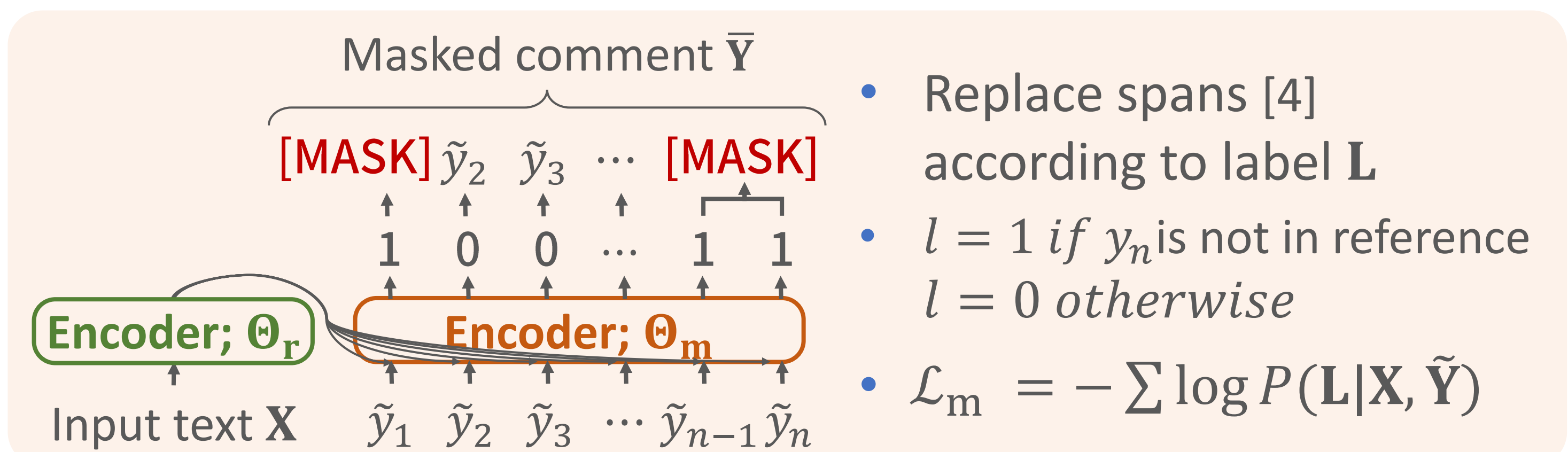
### Retrieval, Masking, and Generation

- Three modules are cascaded to output a comment

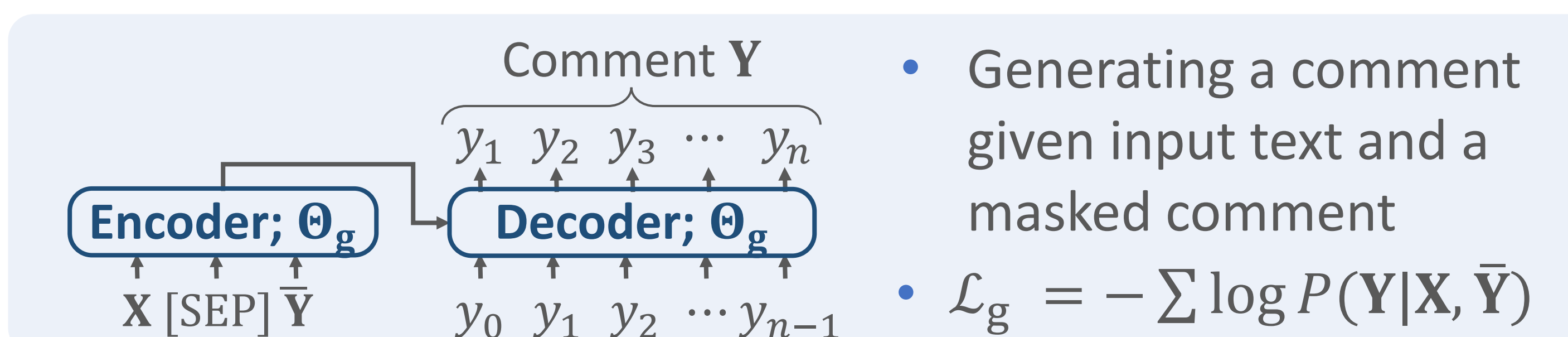
#### 1. Retrieval module: Retrieving a candidate comment



#### 2. Masking module: Binary classification of tokens to be edited



#### 3. Generation module: Predicting masked tokens



## Experiments

### Dataset: A set of input text, correction positions, and feedback comment provided by Generation Challenge 2022

- $\mathcal{D}_{ret}$ : created by calculating the Levenshtein similarity of the two extracted comment
- $\mathcal{D}_{mask}$ : created using pairs of reference and extracted comment for same input text
- $\mathcal{D}_{gen}$ : created by pairing input text and masked comment

### Setup: Comparison with base models using BERT and T5 from Hugging Face [5]

### Results: Proposed method outperformed conventional method using both automatic and manual evaluation

Method	BLEU	Manual
Retrieval	0.423	-
Simple generation	0.464	0.479
Retrieve-and-edit	0.482	0.502
Proposed	<b>0.494</b>	<b>0.517</b>
Oracle mask	0.539	-

### Example of proposed and retrieve-and-edit method (Input text: most of college students ...)

#### Retrieve-and-edit

A group of something follows [[most of]]. Use [[most]] as an [adjective] rather than a [noun] when simply referring to human beings in general.

[[Most of]] is followed by a [noun] or by a [determiner] such as 'the', ..., or a [pronoun]. Otherwise, [[most]] is placed just before the [noun] to be qualified as an [adjective] without requiring the [preposition] [[of]].

#### Proposed

A group of something [M] [[most of]]. Use [[most]] as an [adjective] rather than a [noun] when simply referring to [M] in general.

A group of something **specific** follows [[most of]]. Use [[most]] as an [adjective] rather than a [noun] when simply referring to **students** in general.

[1] R. Nagata. Toward a Task of Feedback Comment Generation for Writing Learning. EMNLP-IJCNLP, 2019.

[2] A. See et al. Get to the point: Summarization with Pointer-Generator Networks. ACL, pp. 1073-1083, 2017.

[3] T. B. Hashimoto et al. A retrieve-and-edit framework for predicting structured outputs. NeurIPS, 2018.

[4] C. Raffel et al. Exploring the Limits of Transfer Learning with a Unified Text-to-Text Transformer. JMLR, 2020.

[5] T. Wolf et al. Transformers: State-of-the-Art Natural Language Processing. EMNLP, 2020.