

# Explanatory Summarization with Discourse-Driven Planning

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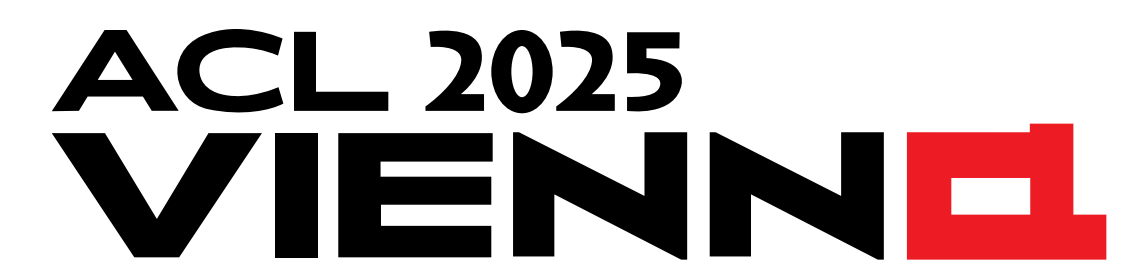
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## Introduction

### Lay Summarization Challenge:

- Scientific texts need **explanatory content** for accessibility
- Current methods **underrepresent** explanations in generated summaries

### Key Insights:

- Most models follow end-to-end approaches **without explicit explanation modeling**
- Plan-based models offer better **controllability** and reduce **hallucinations**

**The cerebellum utilizes proprioceptive feedback to fine-tune the timing of movements in a sequence based on previous actions.**

*q1: How does the cerebellum use feedback to adjust the timing of movements in a sequence?*

**Imagine the cerebellum as a coach who watches how you perform a move, then gives tips to improve the next one based on what was seen.**

Figure 1. An example of plan question

## Method

### Step 1: Explanatory Content Extraction

- Apply **DMRST** parser to identify explanatory EDUs from RST relations
- Focus on 4 key relations: *Background, Elaboration, Explanation, Comparison*
- Extract (explanation, target) EDU pairs from reference summaries

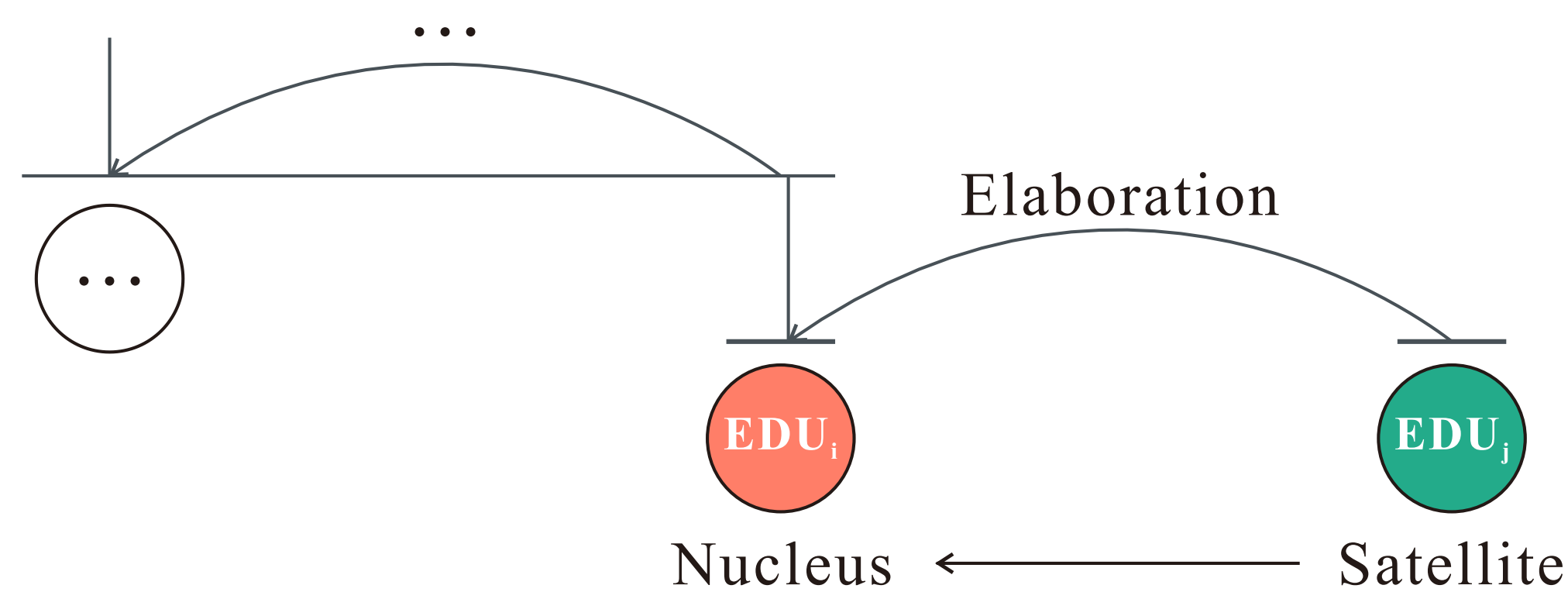


Figure 2. RST tree structure

### Step 2: Plan Generation

- Use **GPT-4o** to generate questions from target sentences + context
- Questions trigger explanatory content (based on QUD framework)
- Create ordered sequence of plan questions  $b = (q_1, q_2, \dots, q_n)$

#### Planning questions

q1: How does the cerebellum use feedback to adjust the timing of movements in a sequence?  
 q2: How does the cerebellum use feedback from one blink to trigger the next in a sequence?  
 q3: How can a blink in one eye trigger a blink in the other eye?

#### Processed summary

[The cerebellum utilizes ... previous actions.]<sup>t1</sup> [Imagine the cerebellum ... based on what was seen.]<sup>e1</sup> But how exactly does it achieve this? [To investigate, we ... to trigger the next.]<sup>t2</sup> [As expected, after ... chain of movements.]<sup>e2</sup> Control ... previous actions. [Building on this, we trained ... earlier blinks in the sequence.]<sup>t3</sup> [We further found ... these movements.]<sup>e3</sup> This raises the possibility ... should explore.

Target EDU Explanatory EDU

Figure 3. Plan generation pipeline

## Method

### Step 3: Two Model Variants

- Plan-Output** (End-to-End): Train  $P(b, s|x)$  to generate plan  $b$  + summary  $s$  jointly based on input document  $x$
- Plan-Input** (Pipeline): **PG Module**  $P(b|x)$  generates plan  $b$ , **SG Module**  $P(s|x, b)$  generates summary  $s$

## Main Results

- Plan-Input** achieves **SOTA performance** across all metrics
- More explanations**: ExpRatio 17.68% vs. 13.61% (Mistral<sub>FT</sub>)
- Better factual consistency**: VeriScore 0.71 vs. 0.56 (Mistral<sub>FT</sub>)
- Higher readability**: D-SARI 37.18 vs. 30.11 (Mistral<sub>FT</sub>)

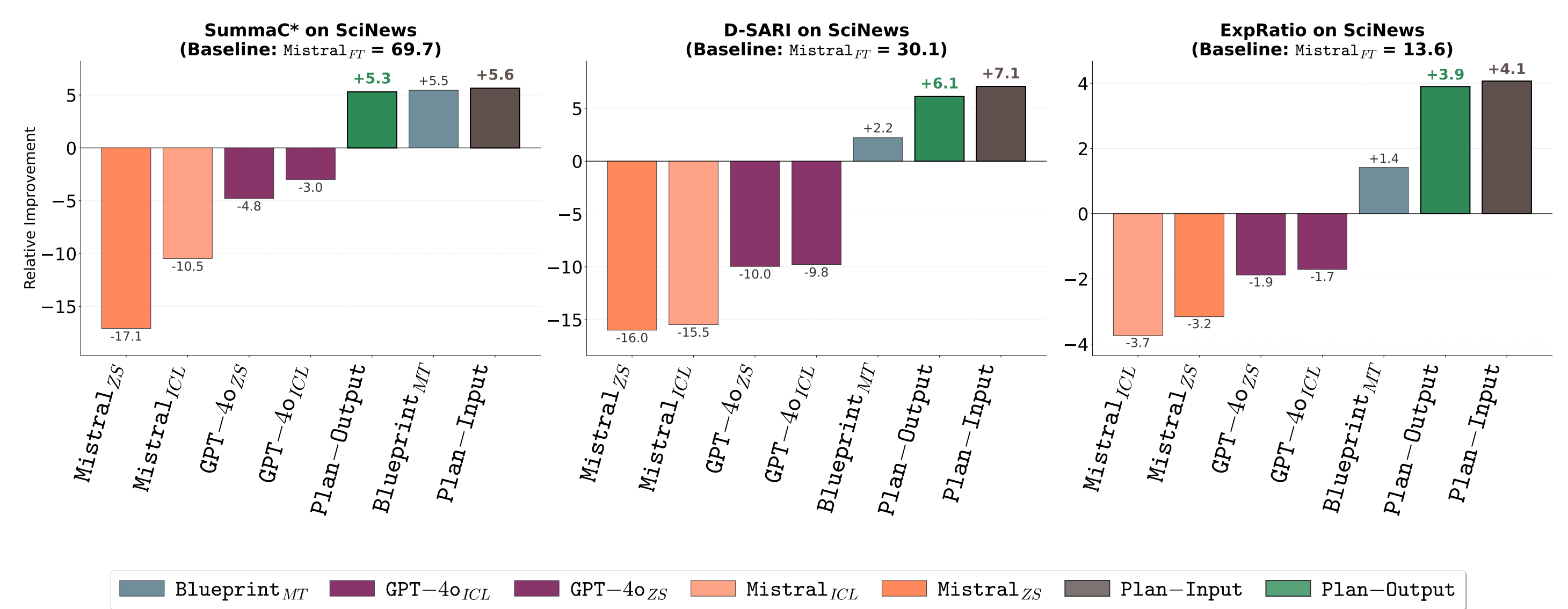


Figure 4. Model performance comparison across different metrics

**Human Evaluation:** Humans remain superior, but **Plan-Input** outperforms all baselines, achieving near human-level **accessibility** and substantial improvements in **explanation quality**.

## Controllability of Explanatory Content

- Our models can **control explanation types** by modifying plans
- Deleting specific RST relation questions reduces the corresponding explanations in the output

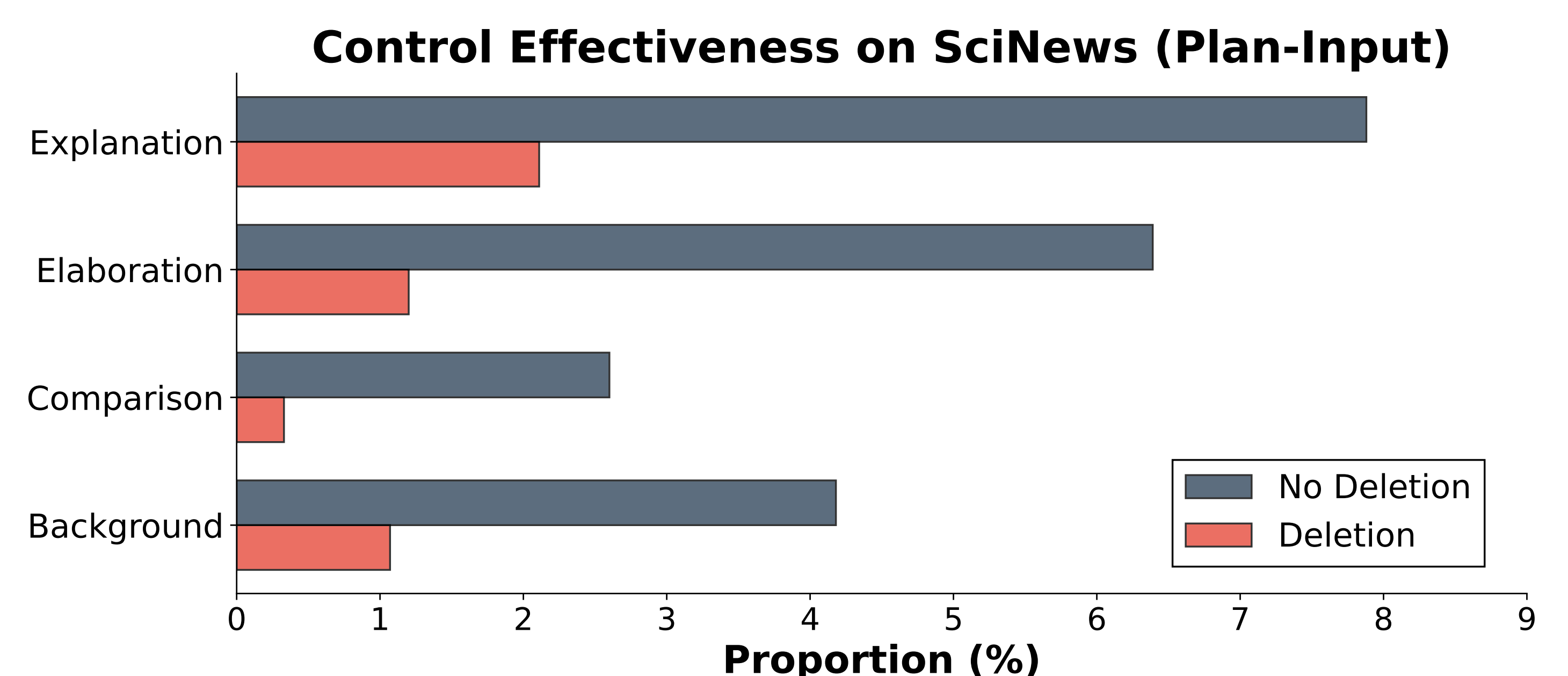


Figure 5. Control effectiveness across different explanation types

## Conclusion

- Introduced **explanatory summarization** task for controlled lay summary generation
- Developed **discourse-driven planning** using RST + QUD frameworks
- Proposed two model variants: **Plan-Input** and **Plan-Output**
- Achieved **SOTA performance** on 3 datasets with significant improvements

### Project Info



[dongqi.me/projects/ExpSum](https://dongqi.me/projects/ExpSum)