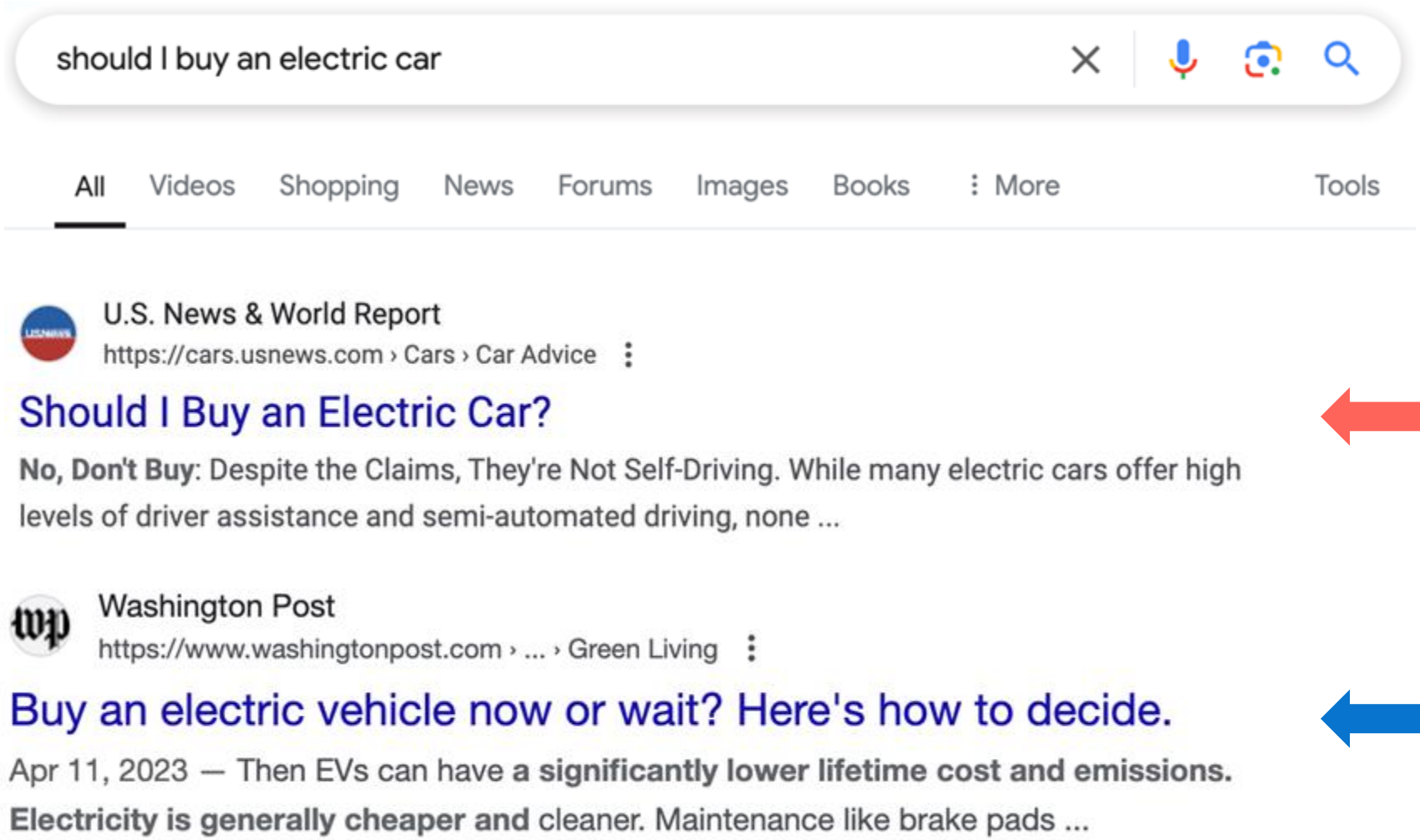
MoDS: Moderating a Mixture of Document Speakers to Summarize Debatable Queries in Document Collections

Nishant Balepur, Alexa Siu, Nedim Lipka, Franck Dernoncourt, Tong Sun,

Jordan Boyd-Graber, Puneet Mathur

Adobe

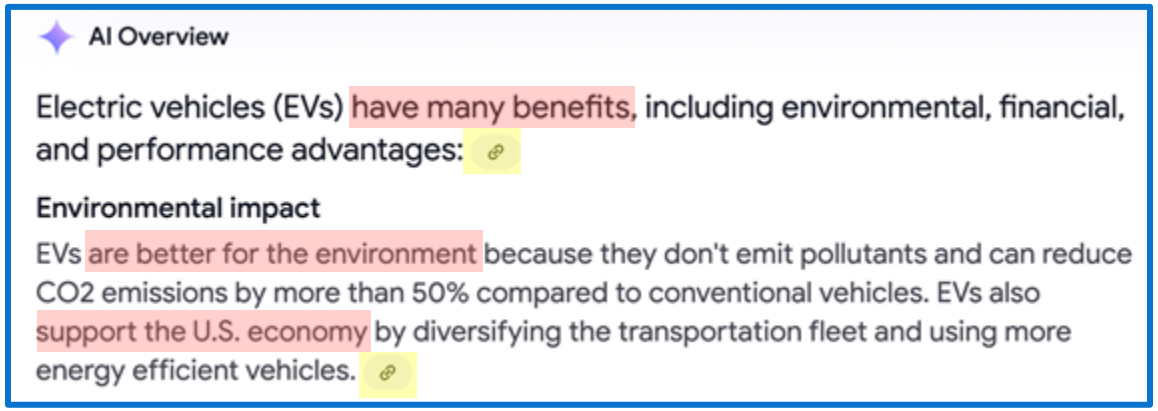
We often want answers to debatable queries



No, you shouldn't…

Yes, you should!

Can we summarize these documents to answer the query?



Google's Gemini

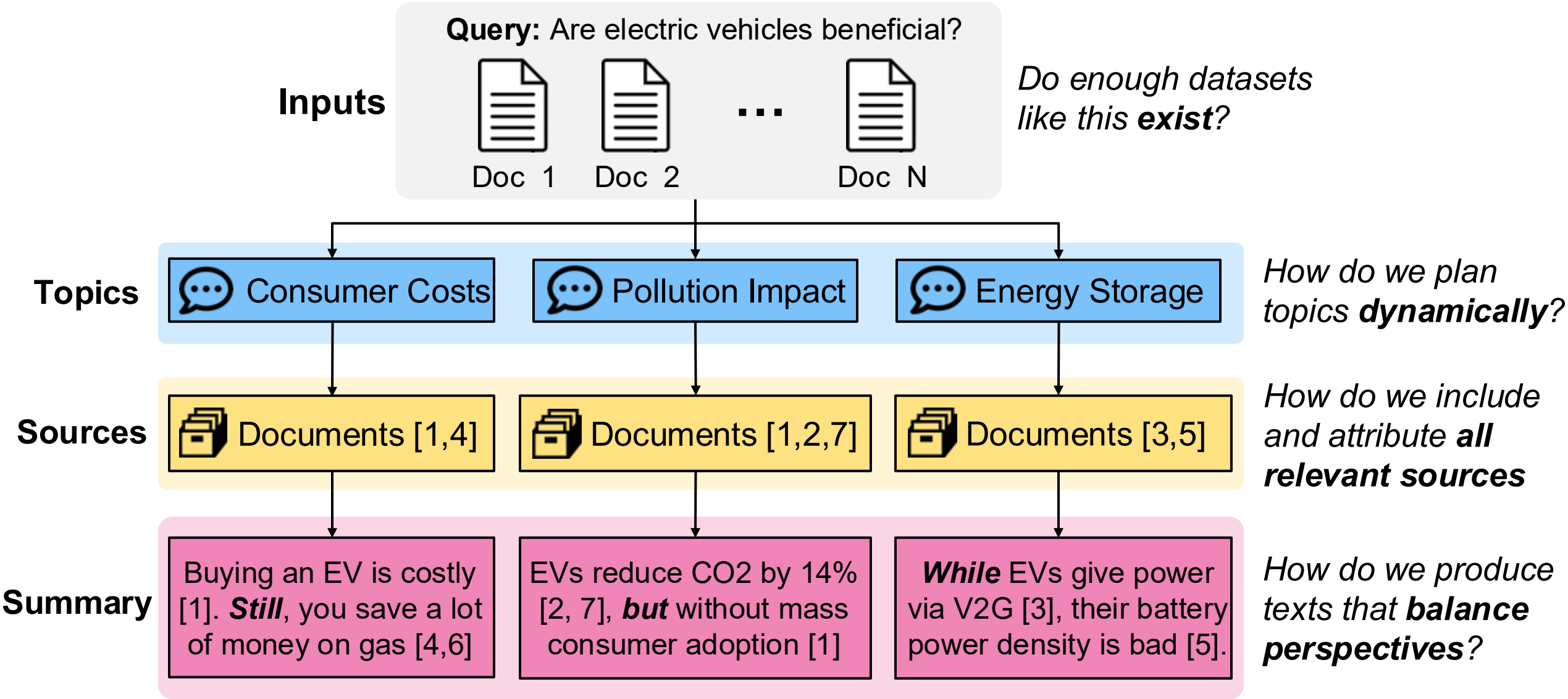
When asked to summarize:

> *Are electric vehicles beneficial?*

broken down into topics, models:

- ✗ do not balance support and refute perspectives
- ✗ do not use perspectives from all input documents

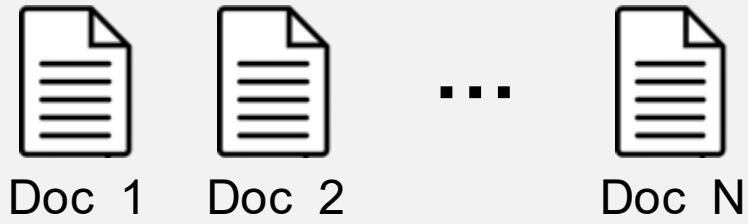
A New Task: Debatable Query-Focused Summarization



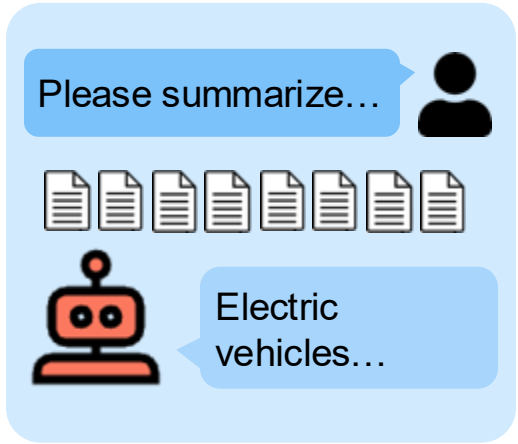
Existing approaches are insufficient

Input Data

Query: Are electric vehicles beneficial?

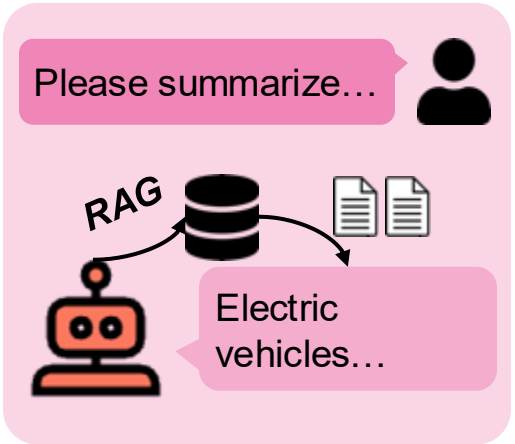


1) Prompt over all docs



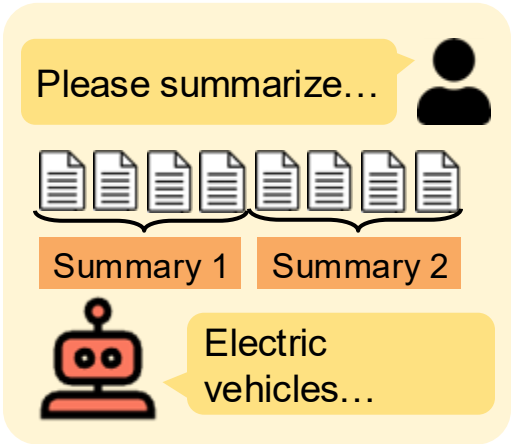
- Fails to cover documents in the middle of prompts
- Doesn't treat docs equally!

2) Retrieve + Generate



- Uses the same generic query for each document
- Misses perspectives specific to each document's content

3) Hierarchical Merging



- Intermediate summaries are unstructured + hard to balance

Solving these issues with MoDS: A Mixture of Document Speakers

To fairly treat documents…

Are electric cars beneficial?

Doc 1 Doc 2 … Doc N

MoDS: ***M****ixture* ***o****f* ***D****ocument* ***S****peakers*

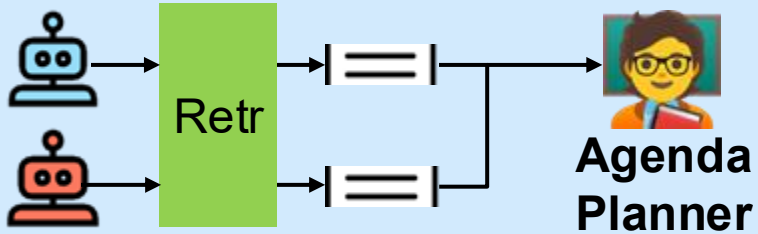
1 Agenda Planning

2 Speaker Selection

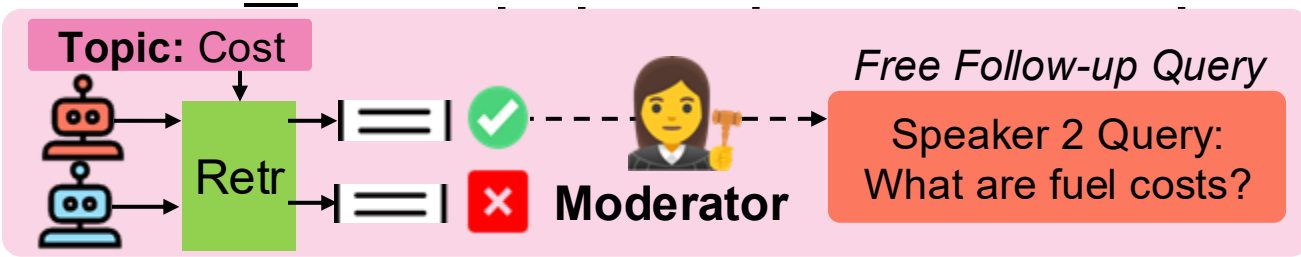
3 Speaker Discussion

3-Step Multi-Agent ***Panel Discussion***

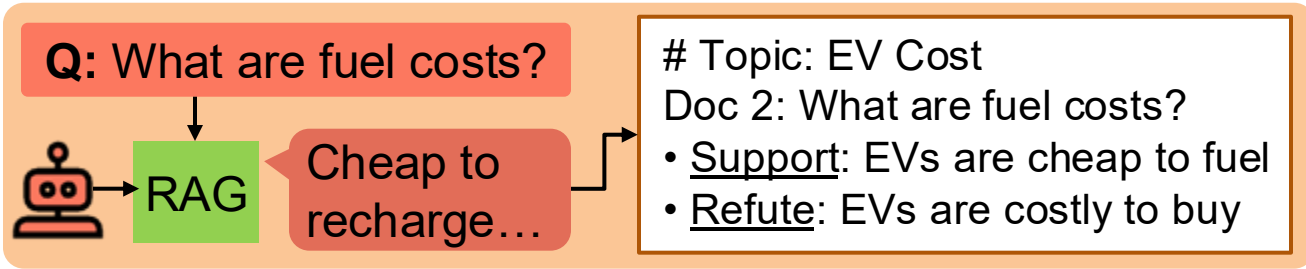
To plan discussion points… create a **topic agenda**



To cover all docs…



For structure and balance



Solving these issues with MoDS: A Mixture of Document Speakers

Outline

Debate Question: Are electric vehicles beneficial?

Neatly Organizes:

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Debate Question: Are electric vehicles beneficial?

1. EVs as Energy Storage

Neatly Organizes:

- Topics

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Debate Question: Are electric vehicles beneficial?

1. EVs as Energy Storage

Doc 1:

Doc 7:

Neatly Organizes:

- Topics
- Documents

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Outline

Debate Question: Are electric vehicles beneficial?

1. EVs as Energy Storage

Doc 1:

Yes: EVs act as energy stores for power grids

Doc 7:

Yes: GM chose them for durability

Neatly Organizes:

- Topics
- Documents
- Yes Perspectives

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Debate Question: Are electric vehicles beneficial?

1. EVs as Energy Storage

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Yes: EVs act as energy stores for power grids

Doc 7:

Yes: GM chose them for durability
No: A kg store 0.4% energy vs. a kg of gas
No: 175-lbs are needed to go just 90 miles

Neatly Organizes:

- Topics
- Documents
- Yes and No Perspectives

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Outline

Debate Question: Are electric vehicles beneficial?

1. EVs as Energy Storage

Doc 1: How can EVS be used for power grids?

Yes: EVs act as energy stores for power grids

Doc 7: Why did GM choose lead-acid batteries?

Yes: GM chose them for durability
No: A kg store 0.4% energy vs. a kg of gas
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Neatly Organizes:

- Topics
- Documents
- Yes and No Perspectives
- Follow-up queries

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2. EV Affordability and Market

… [for all topics] …

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Final Summary

1. EVs as Energy Storage

EVs can serve as valuable energy storage units when idle, contributing to the stability of the power grid [1]. However, early EVs like the GM EV1 had technical limitations. GM used lead-acid batteries due to their reliability, but these batteries had poor energy density—requiring over 1,100 pounds to travel just 90 miles [7]. This limits their potential effectiveness as mobile energy solutions.

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Content plan for generating comprehensive, balanced summaries!

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A dataset to evaluate MoDS: DebateQFS

We curate a new dataset from **Debatepedia**[1], the “Wikipedia of debates”

High-quality debate queries

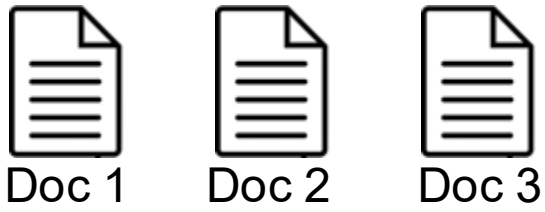
Expert-curated Pro/Con Sources

- 183 high-quality document collections
- 9.47 documents per collection
- 60/40 average support/refute split

[1] wiki.idebate.org/index.php/Welcome_to_Debatepedia!

Evaluating MoDS: Citation Metrics

How do you measure if this summary is useful?



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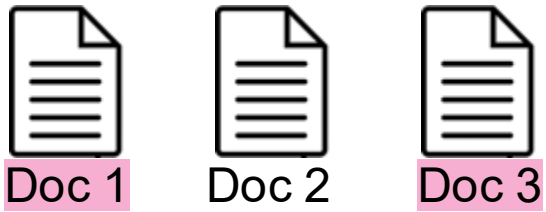

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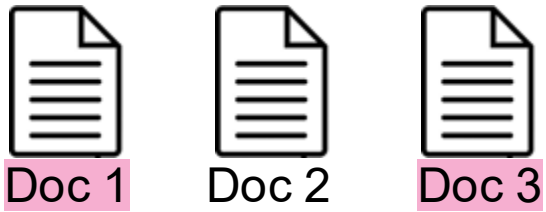

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Evaluating MoDS: Citation Metrics

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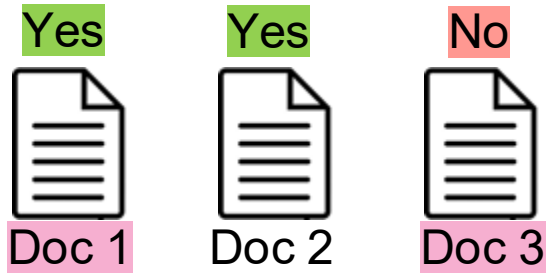

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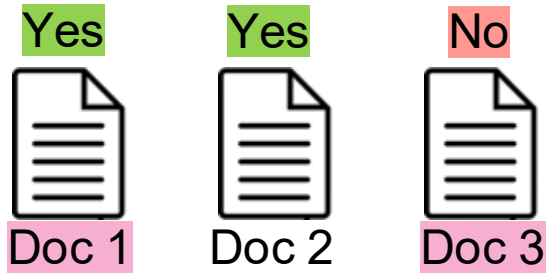

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Evaluating MoDS: Citation Metrics

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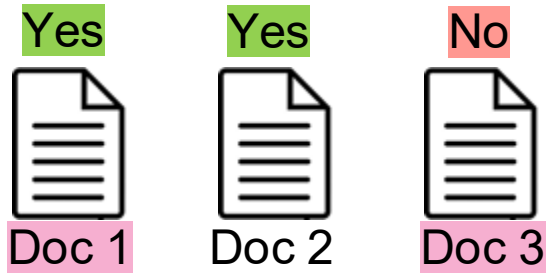

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*We also verify citations are accurate to avoid cheating

MoDS excels at summarizing debatable queries

MoDS has the best:

- **Document Coverage**: Includes perspectives from more documents
- **Fairness**: Balances "support" and "refute" perspectives
- **Faithfulness**: Reflects the perspectives of the input documents

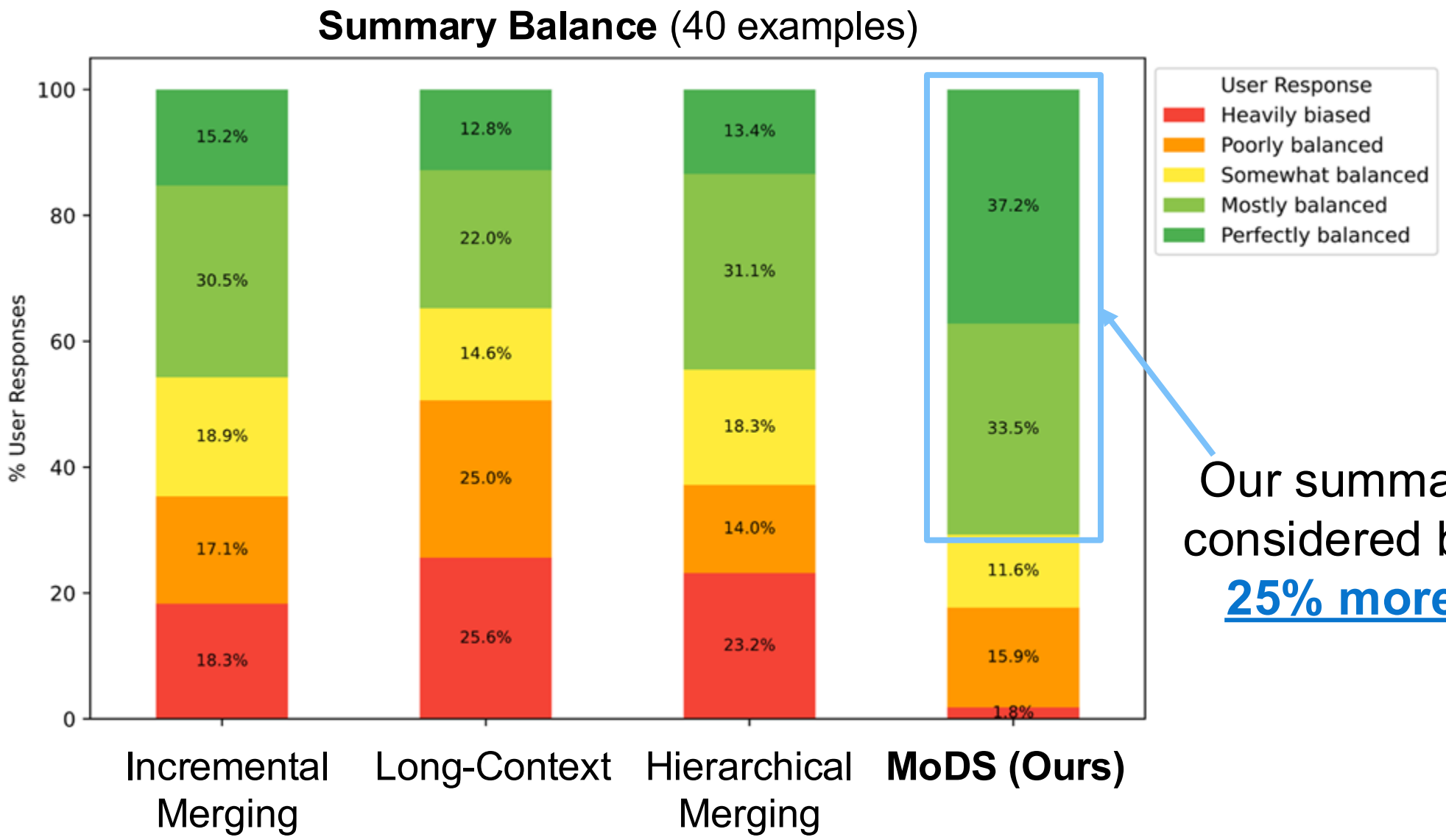
Overall Summary

# Top.	Model	DC (↑)	Fair (↓)	Faithful (↓)
3	MoDS-*Topic* (**Ours**)	**0.8724***	**0.0701***	**0.0235***
	MoDS-*All* (**Ours**)	0.8457*	0.0786*	0.0273*
	Long-Context	0.5877	0.2094	0.1790
	RAG-*All*	0.6125	0.1544	0.1040
	RAG-*Doc*	0.7171	0.1180	0.0664
	Hierarchical	0.7868	0.0907	0.0374
	Incremental-*All*	0.5566	0.2579	0.2089
	Incremental-*Topic*	0.6152	0.2415	0.1970
	Cluster	0.7102	0.1106	0.0725
	RAG+Cluster	0.6811	0.1405	0.0894
5	MoDS-*Topic* (**Ours**)	**0.9137***	0.0651*	**0.0208***
	MoDS-*All* (**Ours**)	0.8847*	**0.0640***	0.0236*
	Long-Context	0.6686	0.1724	0.1392
	RAG-*All*	0.6721	0.1423	0.0912
	RAG-*Doc*	0.7765	0.1053	0.0618
	Hierarchical	0.8565	0.0761*	0.0239*
	Incremental-*All*	0.6122	0.2000	0.1629
	Incremental-*Topic*	0.6767	0.1659	0.1198
	Cluster	0.8098	0.1116	0.0624
	RAG+Cluster	0.7811	0.1233	0.0738

DebateQFS Coverage + Balance (best in **bold**, second-best underlined)

We surpass SOTA by **38-59%** in topic paragraph coverage and balance!

And humans agree!



Our summaries are considered balanced **25% more often**

Qualitative Comparison

Query: Should all public transport be free?
Discussion Topic: Economics

MoDS (Ours)

Eliminating public transport fares can lead to increased ridership, more efficient use of existing capacity, and savings in fare collection costs, potentially improving quality of life and accessibility for low-income groups [1][2][3][5][6][9]. However, fare-free systems may face sustainability challenges due to increased operational costs, dependency on public funding, and potential service quality degradation due to higher demand and limited resources [7][12][13][14].

Long-Context

Eliminating public transport fares without improving services is not cost-effective for increasing patronage [13]. Free public transport primarily aids the already well-served and may not justify the financial cost, as seen in Hasselt's experience [13].

Our Model…

Summary + Takeaways

In this paper, we have:

- Tackled the unexplored task of summarizing debatable queries => DQFS
- Collected a new, high-quality dataset => DebateQFS
- Designed and thoroughly evaluated a multi-agent panel discussion framework => MoDS
    - **One LLM Speaker per document** => all perspectives are *treated equally*
    - **Moderator-tailored queries** => cater to relevant docs to *find all perspectives*
    - **Outline planning** => *better balance perspectives* in the final summary

Check out our paper!

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Is saying “Thank You” the best way to conclude a presentation?

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