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AMERICANO: Argument Generation with Discourse-Driven Decomposition and Agent Interaction



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Background & Motivations

- Argumentation is a fundamental form of opinion-based communication.

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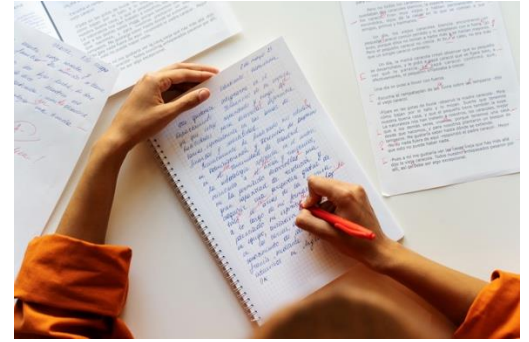
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- It plays a crucial role in shaping critical decisions in everyday life.



Political Debate



Decision Making



Essay Writing

Background & Motivations

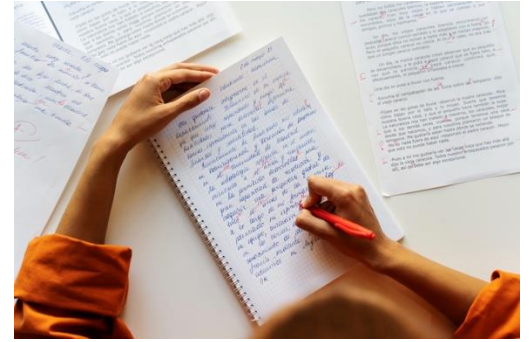
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Political Debate



Decision Making



Essay Writing

- In this paper, we study **counter-argument generation**.

Background & Motivations

- Constructing high-quality arguments is challenging
 - Rigorous Reasoning → Persuasion
 - Deliberate Discourse Structures → Coherence

Background & Motivations

- Constructing high-quality arguments is challenging

Generate a counterargument to refute the proposition: People shouldn't change gender

Background & Motivations

- Constructing high-quality arguments is challenging

Generate a counterargument to refute the proposition: People shouldn't change gender



Counterargument Generation

Individuals should not be prohibited from changing their gender, as it is a personal choice that ought to be respected and constitutes a fundamental aspect of one's identity.

Denying someone the right to undergo a gender transition infringes upon their basic human rights, as it disregards their autonomy and deprives them of their freedom to make decisions about their own body and identity. Research has demonstrated that the positive effects of gender transition have significantly increased in recent years, due to advancements in surgical techniques and enhanced social support.

Although some may argue that changing one's gender is an act of rebellion and contravenes traditional values and norms, this argument does not negate the essential right of individuals to determine how they express themselves and live their lives as they deem fit.

In conclusion, this is a fundamental human right that must be acknowledged and protected.

Argument Discourse Components

Background & Motivations

- Constructing high-quality arguments is challenging

Generate a counterargument to refute the proposition: People shouldn't change gender



Counterargument Generation

Argument Discourse Components

① A claim serving as the main statement

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↓ *Counterargument Generation*

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Argument Discourse Components

② A rigorous reasoning to support the claim.

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Argument Discourse Components

③ An optional concession responding with potential rebuttals.

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Counterargument Generation

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Argument Discourse Components

④ A conclusion

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↓ *Counterargument Generation*

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Argument Discourse Components

Maintain
overall
coherence

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Token-level LLMs: lack explicit planning capabilities, making it difficult to decompose and achieve the complex goal of generating good arguments

Background & Motivations

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- Autoregressive LMs cannot track back and revise the previously generated text

Background & Motivations

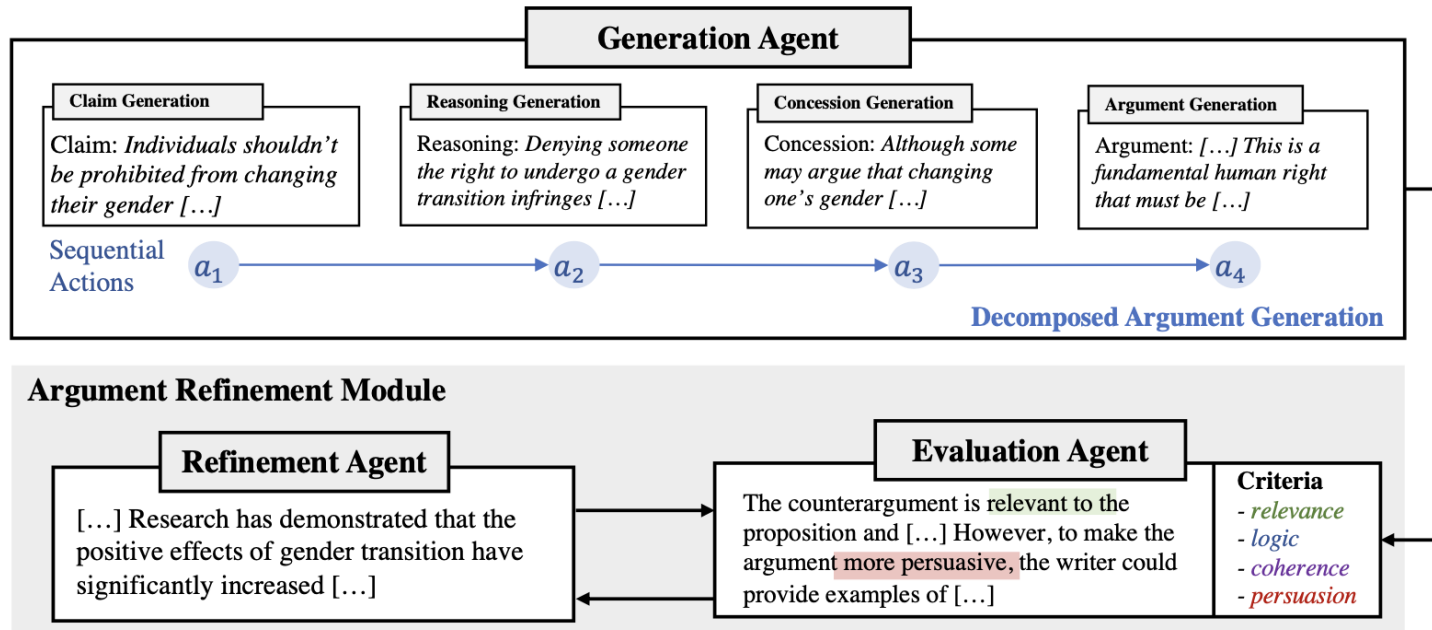
- Constructing high-quality arguments is challenging
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↳ Discourse-Driven Decomposition Approach
- Autoregressive LMs cannot track back and revise the previously generated text

↳ Argument Refinement Module with Agent Interaction

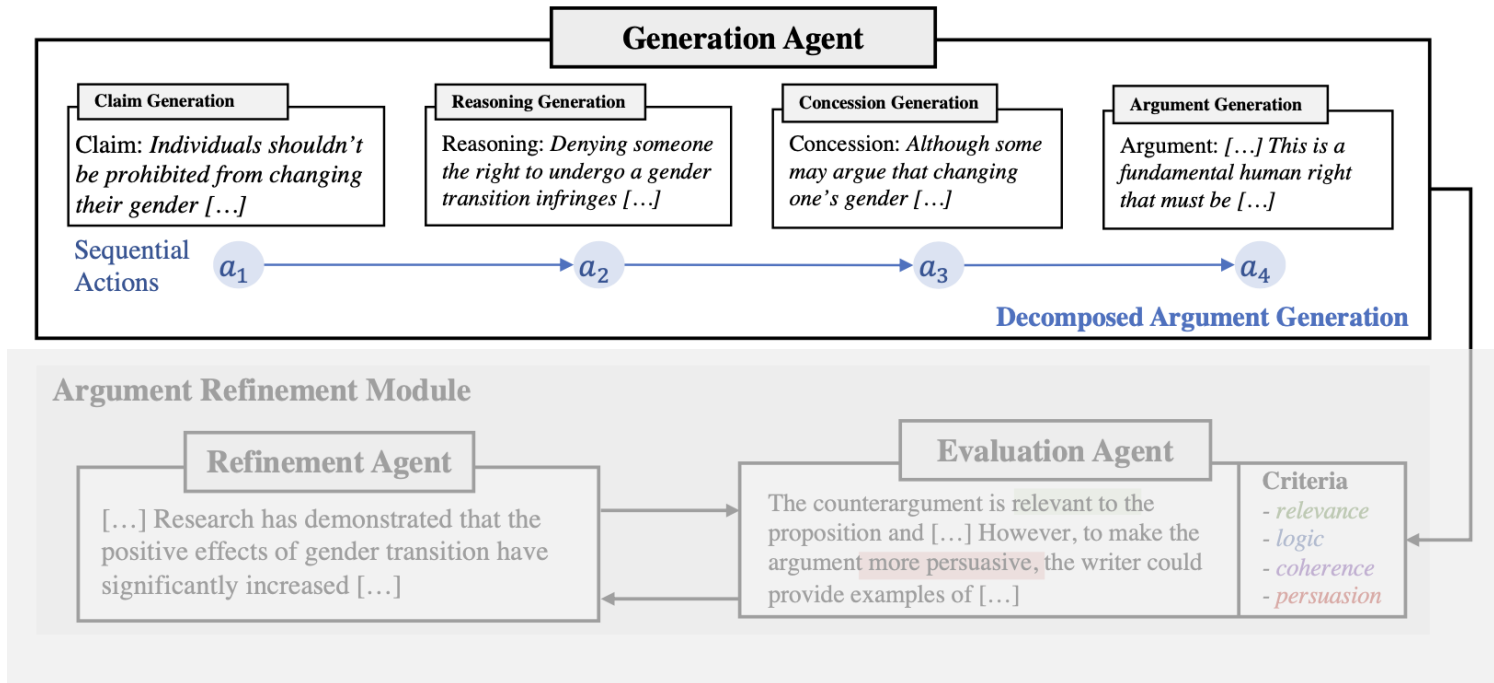
Method

- Discourse-Driven Decomposition and Agent Interaction



Method

- Discourse-Driven Decomposition



Method

- Discourse-Driven Decomposition

Generate a counterargument to refute the proposition: People shouldn't change gender



Claim Generation

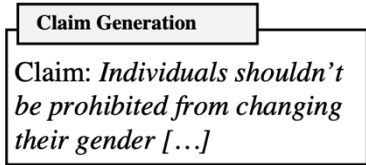
Claim: *Individuals shouldn't be prohibited from changing their gender [...]*

Generate multiple claims and rerank to select the best one

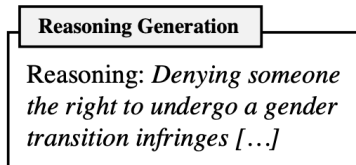
Method

- Discourse-Driven Decomposition

Generate a counterargument to refute the proposition: People shouldn't change gender



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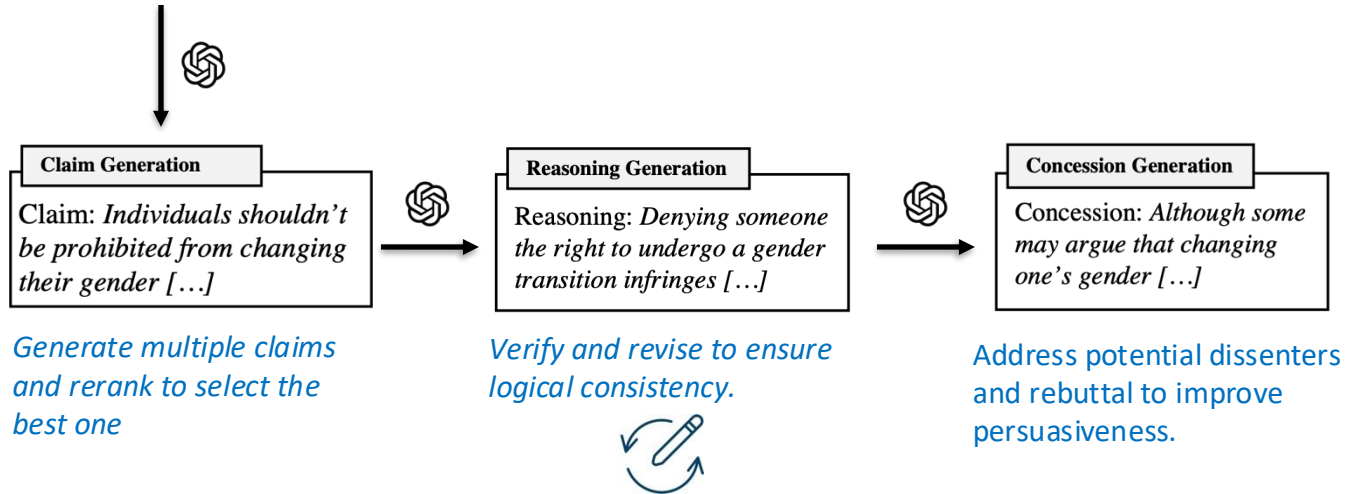
Verify and revise to ensure logical consistency.



Method

- Discourse-Driven Decomposition

Generate a counterargument to refute the proposition: People shouldn't change gender



Method

- Discourse-Driven Decomposition

Generate a counterargument to refute the proposition: People shouldn't change gender



Claim Generation

Claim: *Individuals shouldn't be prohibited from changing their gender [...]*

Generate multiple claims and rerank to select the best one



Reasoning Generation

Reasoning: *Denying someone the right to undergo a gender transition infringes [...]*

Verify and revise to ensure logical consistency.



Concession Generation

Concession: *Although some may argue that changing one's gender [...]*

Address potential dissenters and rebuttal to improve persuasiveness.

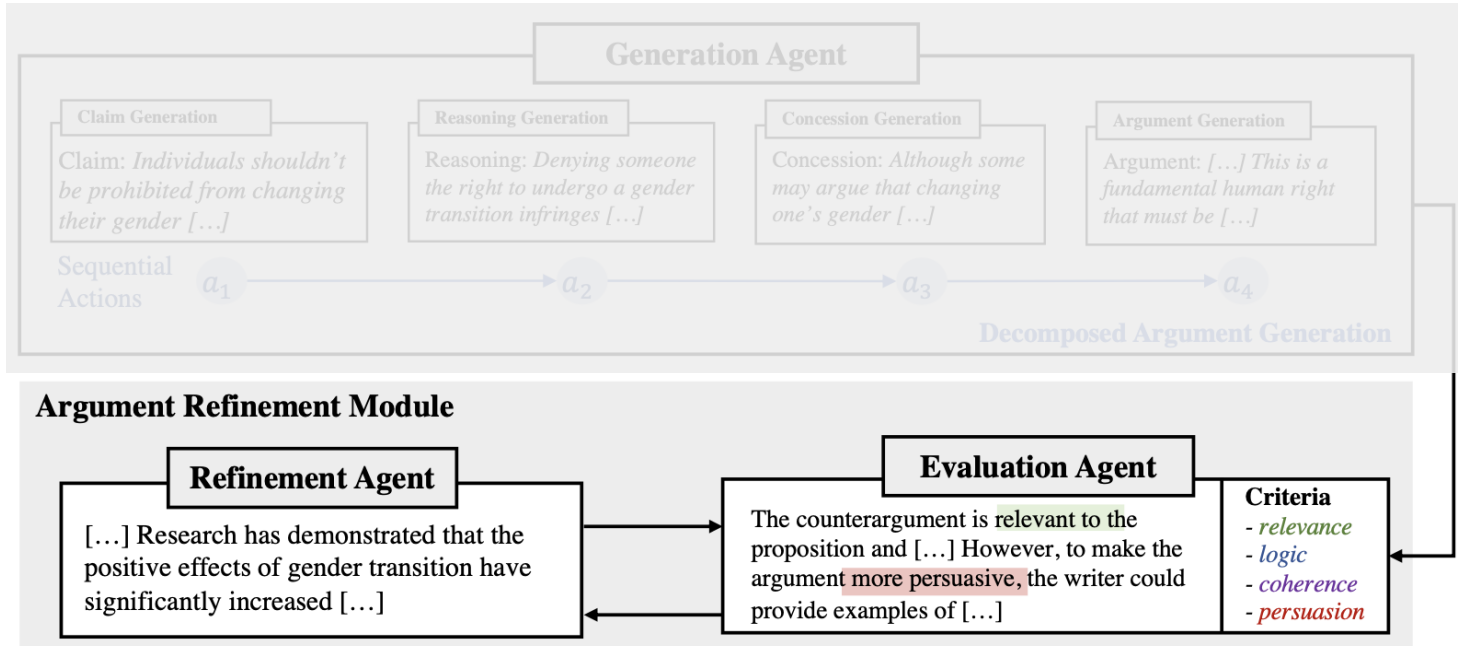


Argument Generation

Argument: *[...] This is a fundamental human right that must be [...]*

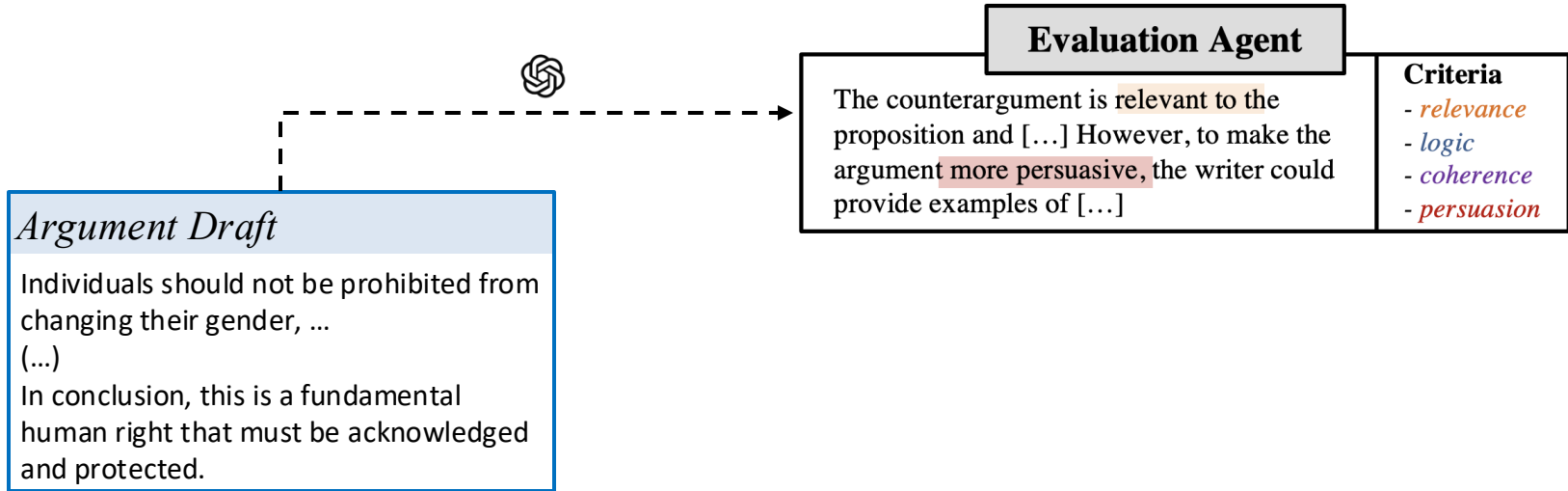
Method

- Argument Refinement with Agent Interaction



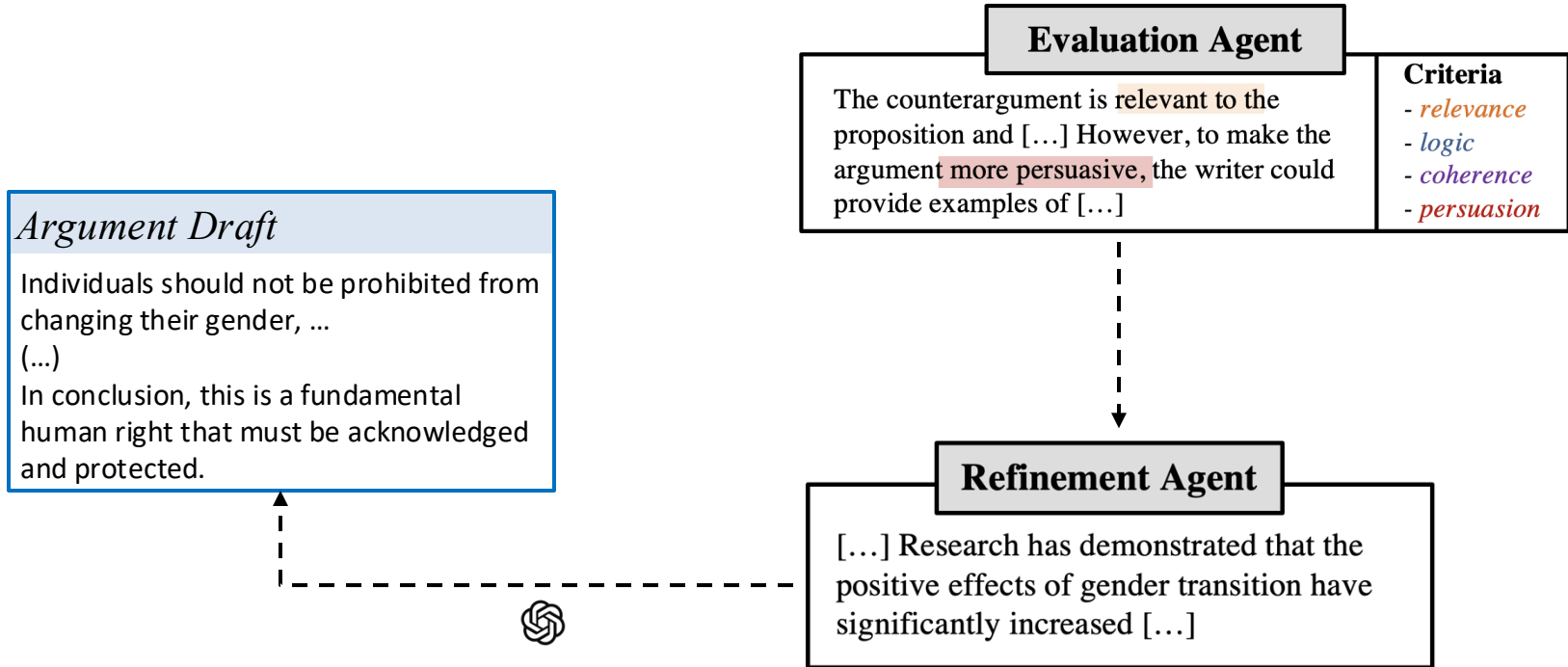
Method

- Argument Refinement with Agent Interaction



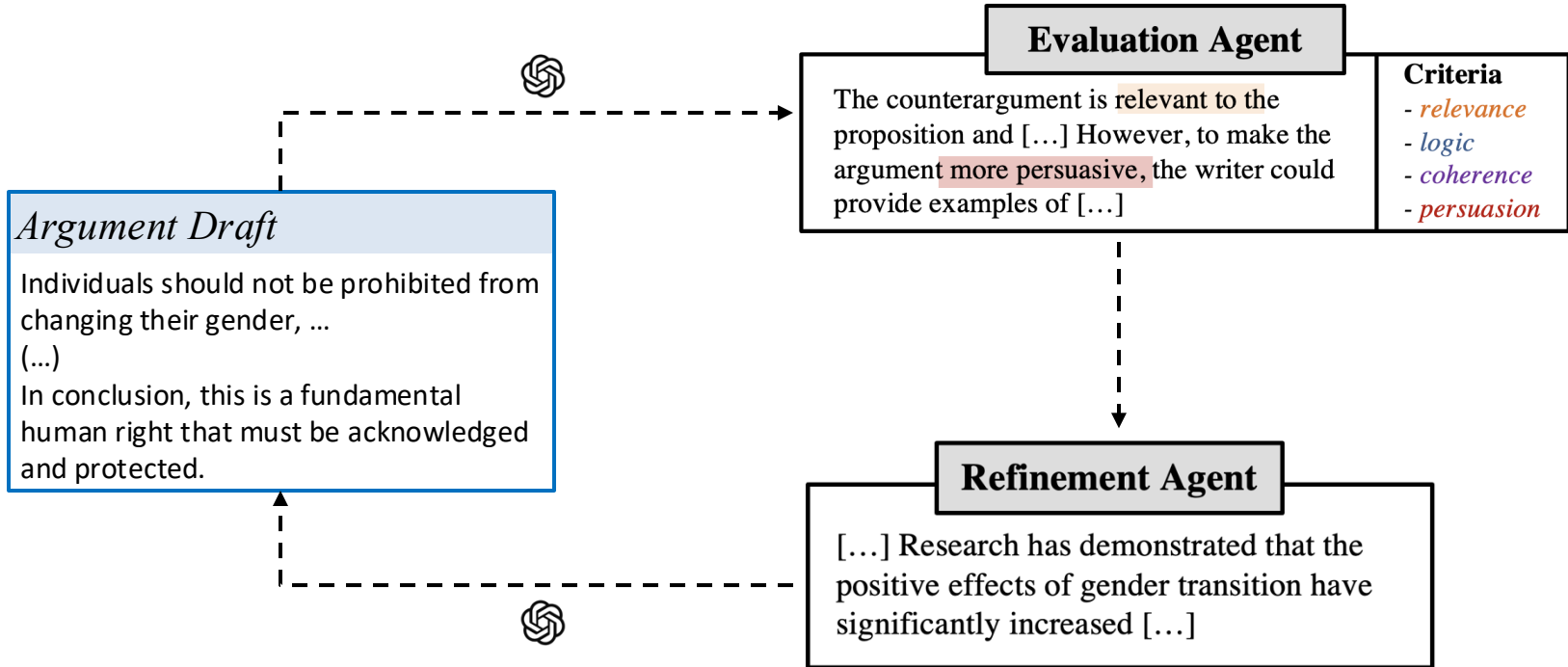
Method

- Argument Refinement with Agent Interaction



Method

- Argument Refinement with Agent Interaction



Experiments - Dataset

- **Task:** Counter-argument Generation

- Input: A proposition on controversial topics
- Output: An argument that tries to refute the proposition

- 50 Propositions sampled from Reddit/CMV



r/changemyview

- I think suicide should be a human right
- The US should strictly enforce border security to prevent illegal entry
- Starting a cult should not be protected as free speech
- The majority of the public are too apathetic / uneducated to vote rationally. Democracy is no longer the solution to effective governance.
- Both conservative and liberal economies can work very well, and the devil is in the details.
- The minimum wage should be directly attached to housing costs with low consideration of other factors.
- There is no defensible reason to prefer children of your own genetic material to adopting them.
- Bartenders should be able to refuse liquor service to pregnant women.
- Democracy, as it stands today, is an insufficient form of government and we need to find a replacement
- The U. S. should establish a system whereby other countries can be admitted to the union.
- Employees should not always be blamed for ignoring / inaction on a case of sexual harassment within their company / institution

...

Experiments - Baselines

- **Baselines:**
 - E2E: End-to-end Generation by directly prompting an LLM
 - Plan-CoT: First generates a chain of content plan, and then produce an argument
 - Ours w/o the Refinement Module
- **Implementations:**
 - All methods are implemented by prompting an LLM in a zero-shot manner
 - Base LLM: GPT-3.5

Experiments - Evaluations

- **Automatic Evaluations:** by GPT4

- Persuasion
- Coherence

- **Human Evaluations** (Hua et al., 2019, 2021):

- Appropriateness
 - Content Richness
 - Overall Quality
 - Validity: *whether an output is a strong argument (independently)*
- } Ranking-based metric

Task Instruction

You are a lecturer of the writing class. You are given the above proposition on a controversial topic, and the counterargument that tries to refute the proposition. You need to carefully read the proposition and the counterargument, and evaluate the counterargument based on the criteria:

.....

Now you need to assign a score for coherence on a scale of 1 to 5, where 1 is the lowest and 5 is the highest based on the Evaluation Criteria. Note, you should be very strict when giving the score.



Criteria of coherence

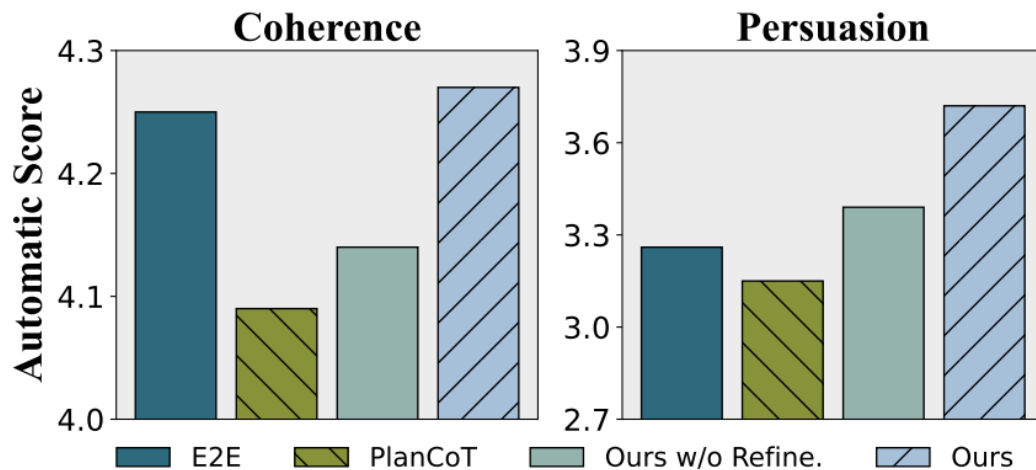
- Clarity
- Relevance
- Logical consistency
- Validity of reasoning

Criteria of persuasion

- Language and rhetoric
- Addressing opposing viewpoints
- Credibility
- Overall effectiveness

Experiments - Results

- Automatic Results



Experiments - Results

- Human Evaluation Results

Method	Appropriateness (↑)	Content Richness (↑)	Overall Quality (↑)	% Validity (↑)
E2E	1.81 / 6.7%	1.54 / 0.0%	1.78 / 4.4%	45.00%
PlanCoT	2.00 / 14.4%	1.74 / 6.7%	2.99 / 10.0%	53.33%
Ours _{w/o Refine}	3.00 / 34.4%	3.16 / 32.2%	3.03 / 28.9%	91.67%
Ours	3.12 / 44.4%	3.44* / 61.1%	3.31* / 56.7%	86.67%

*Scores computed
based on the relative
ranking position*

*Frequency being
ranked as top*

Experiments - Results

- Human Evaluation Results

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- The refinement module can reorganize and reform the draft to achieve a better coherence and readability

- During the refinement process, the model tends to add more detailed examples to support the claim, enhancing content richness and overall persuasion

Experiments - Results

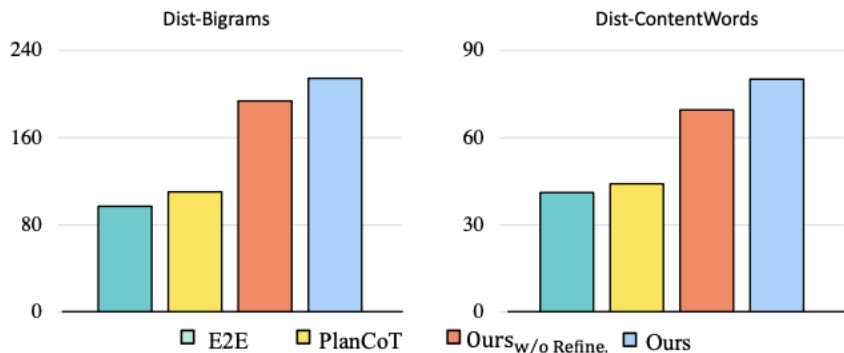
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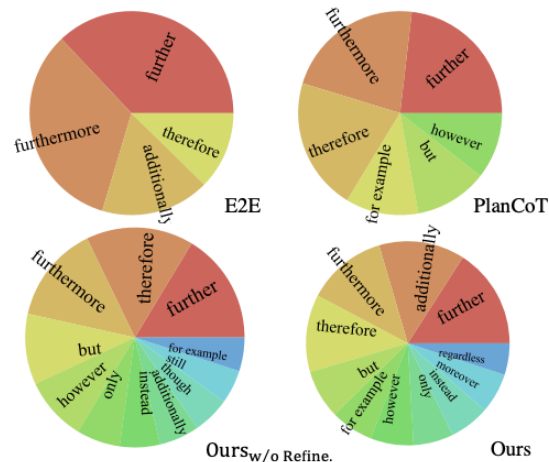
The refinement sometimes may introduce **redundancies** and diminish overall **readability**, thus leading to a reduced validity.

Experiments - Analysis

- Diversity



Our model produces outputs with more distinct bigrams and content words



More Frequent discourse markers are observed in our outputs.

Experiments – Sample Output

Proposition: The fact that voting isn't mandatory is a good thing.

Claim: Voting should be mandatory because it is a civic duty that ensures that the people's voices are heard and that their opinions are represented in government.

Reasoning: [...] ①Mandatory voting is a way of ensuring that all citizens are engaged in the electoral process and that their voices are taken into consideration when decisions are being made. ②It also helps to reduce the influence of special interests and ensures that the government truly reflects the will of the people. ③Furthermore, mandatory voting can help to reduce the influence of money in politics by ensuring that all citizens are represented and can participate in the democratic process. [...]

Concession: While it is true that mandatory voting can ensure that the voices of all citizens are heard, it is important to consider how to make the process accessible and fair for those who are unable to vote due to physical or financial limitations.

Counterargument: The fact that voting isn't mandatory is not a good thing. ①Mandatory voting should be implemented because it is a fundamental part of democracy and is an essential way to ensure that citizens are engaged in the electoral process and their voices are taken into consideration when decisions are made. ②By requiring citizens to vote, it can help to reduce the influence of money in politics, as more people are participating in the democratic process and their opinions are being represented. ③Additionally, mandatory voting can help to ensure that the government truly reflects the will of the people, as all citizens have an equal say in the political process.

However, it is important to consider how to make the process accessible and fair for those who are unable to vote due to physical or financial limitations. For example, measures such as providing transportation to and from polling stations, offering absentee ballots, and introducing flexible voting hours can help to make the process easier and more accessible for those who have difficulty voting in person. Additionally, lawmakers should focus on creating laws that promote fairness and accessibility for all citizens, regardless of their socio-economic status.

Overall, mandatory voting is a way to guarantee that all citizens have a voice in the political process and to ensure that the government is truly representative of the people's wishes. By implementing measures that make the voting process easier and more accessible for all citizens, mandatory voting can help ensure that everyone is given an equal chance to participate and have their voices heard

Conclusion

- We study the challenging argument generation task leveraging recent LLMs.
- We propose a discourse-driven decomposition framework with a self-refinement module.
- Our method generates better argument than directly prompting and chain of thoughts.

Thank You!

- Code and Data: <https://github.com/Derekkk/LLM4ArgGen>
- Contact: zhe-derek.hu@connect.polyu.hk