

Granular Analysis of Social Media Users' Truthfulness Stances Toward Climate Change Factual Claims

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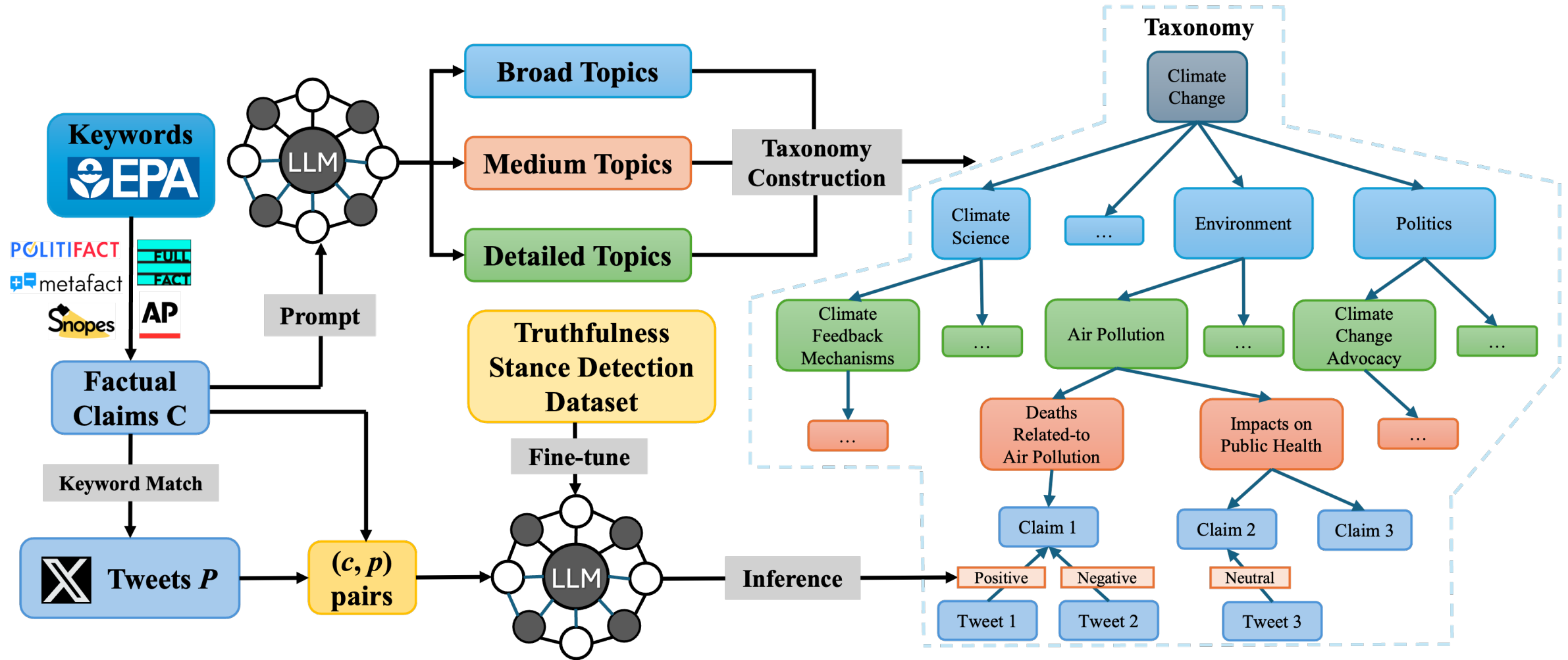
Natural Language Processing meets Climate Change
ACL 2024 Workshop

Presented by: Haiqi Zhang
July 28, 2024

Introduction

- Climate change impacts the environment, economy, and society.
- Growing public awareness and engagement on social media.
- Understanding discourse on climate change is crucial for informing policy, media strategies, and societal awareness.
- This paper presents a framework aimed at understanding social media users' perceptions of various climate change topics and uncovering the insights behind these perceptions.

Framework Overview



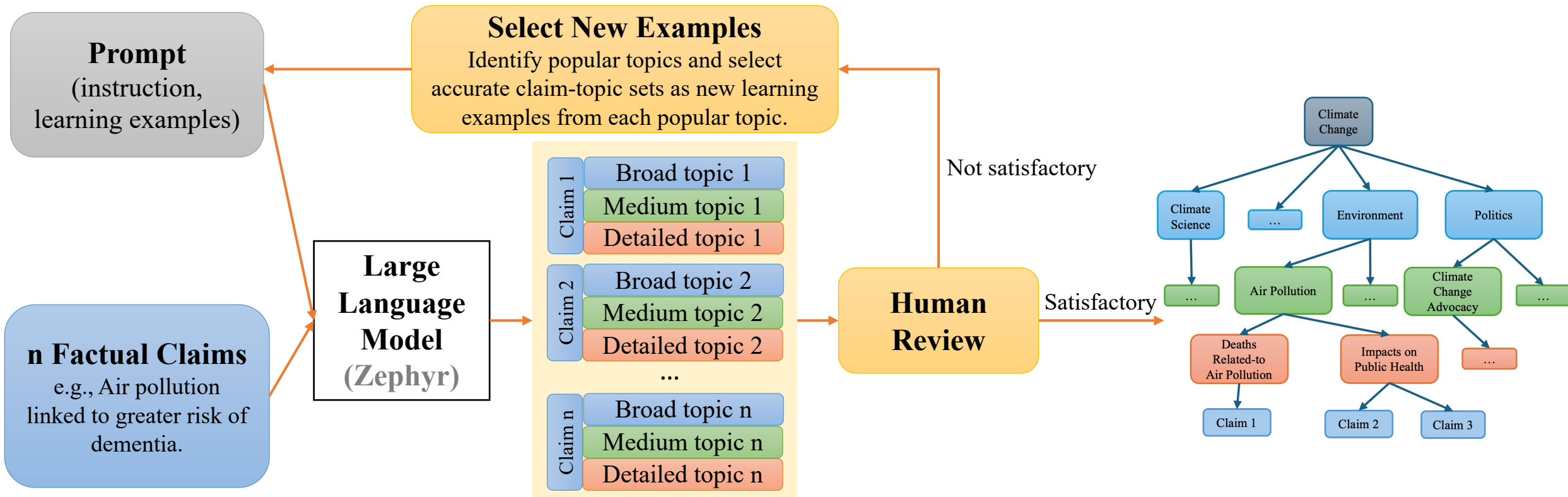
Factual Claim Collection

- Five credible fact-checking websites: PolitiFact, Snopes, Full Fact, Metafact, AP news.
- Using keywords related to climate change (e.g., global warming, greenhouse gas) from Environmental Protection Agency (EPA) to collect claims and their verdicts from those websites.
- Resulting in 1,409 unique climate change-related factual claims.

Tweet Collection

- Using tokens extracted from factual claims to collect tweets from **X**:
 1. Noun
 2. Verb
 3. Adjective
- Resulting in 13,050 tweets for 729 claims.

Taxonomy Construction



Truthfulness Stance Detection

- **Model:** Supervised fine-tuning of Zephyr.
- **Training Data:** 1,871 annotated claim-tweet pairs.
- **Predicted Stance:** Positive (believing the claim is true), Negative (believing the claim is false), Neutral/No stance.
- **Example:**
 - **Claim:** *Air pollution linked to greater risk of dementia.*
 - **Tweet:** *People over 50 in areas with the highest levels of nitrogen oxide in the air showed a 40% greater risk of developing dementia than those with the least NOx #airpollution.*
 - **Stance:** Positive

Results

- Taxonomy:
 - **9** broad topics, **33** medium topics, and **13** detailed topics.
 - **83%** accuracy for broad topics, **62.5%** for medium topics.
- Stance detection:

	Precision	Recall	Macro F1
\oplus	0.863	0.911	0.886
\odot	0.783	0.765	0.774
\ominus	0.864	0.750	0.803
Avg	0.837	0.808	0.821

Table 1: Performance of truthfulness stance classifier on the annotated dataset. *Positive, Neutral/No stance* and *Negative* are denoted as \oplus , \ominus , \odot .

\oplus	\odot	\ominus	Total
8,003 (61.33%)	2,668 (20.44%)	2,379 (18.23%)	13,050

Table 2: Truthfulness stance distribution of tweets toward claims.

Results

Broad Topic	Truth- \oplus	Truth- \ominus	Misi- \oplus	Misi- \ominus	Accuracy	Macro F1
Climate Science	81.7% (524)	18.3% (117)	72.5% (377)	27.5% (143)	0.575	0.524
Economy	70.5% (146)	29.5% (61)	72.5% (351)	27.5% (133)	0.404	0.404
Energy	82.2% (264)	17.8% (57)	74.7% (124)	25.3% (42)	0.628	0.530
Environment	77.5% (533)	22.5% (155)	74.4% (1040)	25.6% (357)	0.427	0.423
Government Policies	83.2% (183)	16.8% (37)	69.5% (205)	30.5% (90)	0.530	0.514
Health	88.7% (180)	11.3% (23)	77.9% (169)	22.1% (48)	0.543	0.493
Politics	69% (363)	31% (163)	75.7% (1635)	24.3% (525)	0.331	0.329
Technology	74.8% (86)	25.2% (29)	69.8% (120)	30.2% (52)	0.481	0.473

Table 4: Stance distribution towards **Truth** and **Misinformation** across broad topics. Truth- \oplus and Truth- \ominus denote positive and negative stances towards **Truth**, respectively. Misi- \oplus and Misi- \ominus denote positive and negative stances towards **Misinformation**, respectively. Note that the topic “*Others*” is not considered in this analysis.

Insights gained:

1. The public struggles to distinguish between true and false claims.
2. Low accuracy in topics like politics, economy, and environment.
3. Higher belief in claims related to health.

Conclusion

- Our framework effectively analyzes public judgments on climate change topics.
- The public tends to believe claims regardless of their accuracy.
- People's judgements vary across topics.
- Need for improved critical thinking and fact-checking interventions.

Acknowledgements

This work is partially supported by the National Science Foundation award # 2346261. The authors acknowledge the Texas Advanced Computing Center (TACC) at The University of Texas at Austin for providing HPC resources that have contributed to the research results reported within this paper.

Thank you!