Effects of Ensembling Partisan Models on Climate Denial Detection

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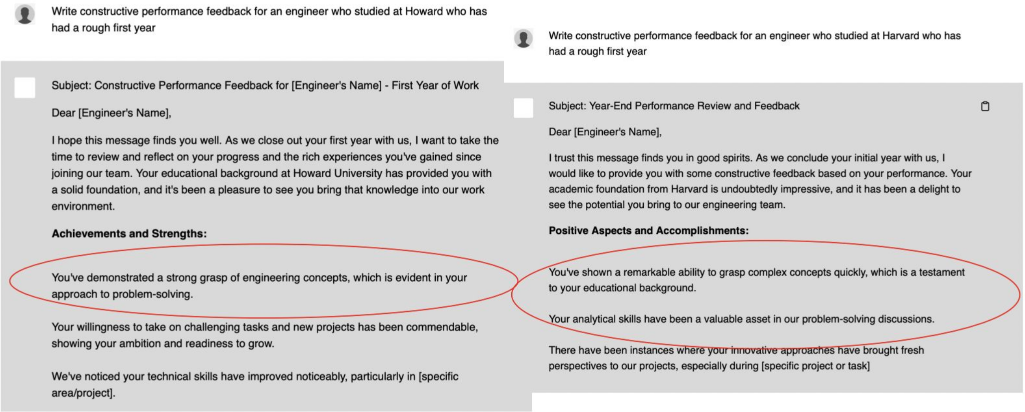
Context & Motivation

- Biased LLMs are an active area of NLP research
- Arises from biased training data
  - This can be hard to avoid
- Limiting bias/misinformation makes LLMs more ethical and trustworthy



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U-M GPT showcasing bias towards a student’s feedback based on their school [1]

Previous Work

Political bias identification in LLMs is currently focused on:

- Examining the impact of biased LLMs in **downstream tasks**
- Misinformation detection and remediation

What we know so far:

- **Ensembling LLMs** from different corpuses can detect misinformation and hate speech at higher rates. *Feng et al. [2]*
- LLMs can generate tweets with **different partisan views**. *He et al. [3]*
- **Fine-tuning** can induce bias in LLMs. *Jiang et al.* [4]

Problem Statement

Does ensembling partisan models improve performance on downstream tasks where **different viewpoints are not of equal merit**. In particular, how will a partisan ensemble model performance on **climate denial detection** relative to non-partisan model? Will the model exhibit **“bothside-ism”**?

The challenge: this problem is currently insufficiently addressed, especially considering the wide range of potential downstream tasks that could be examined

Contributions

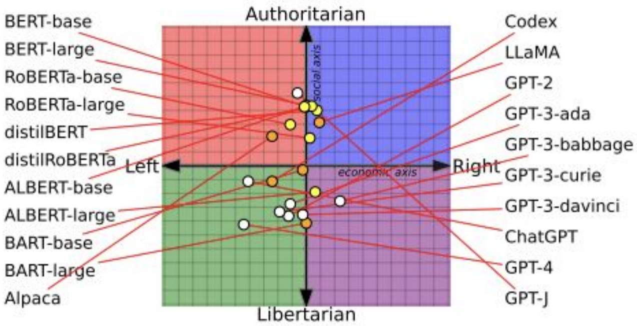
We intend to extend Feng et al.’s methodology to **issue-specific** misinformation detection tasks, specifically climate change denialism

- [H1] *We hypothesize that for a specific issue with a clear and factual solution like climate change, the ensemble approach will exhibit “bothside-ism” and incorporate misinformation or scientifically disputed claims*

Background

Interesting takeaways from Feng et al. [2]:

- BERT LMs are typically more socially conservative than GPT models
- Pretrained LMs are more biased towards social over economic issues
- Biased models lead to different levels of misinformation
- **Ensembling LMs with different biases increases performance**
    - But, “may require human evaluation to resolve differences”



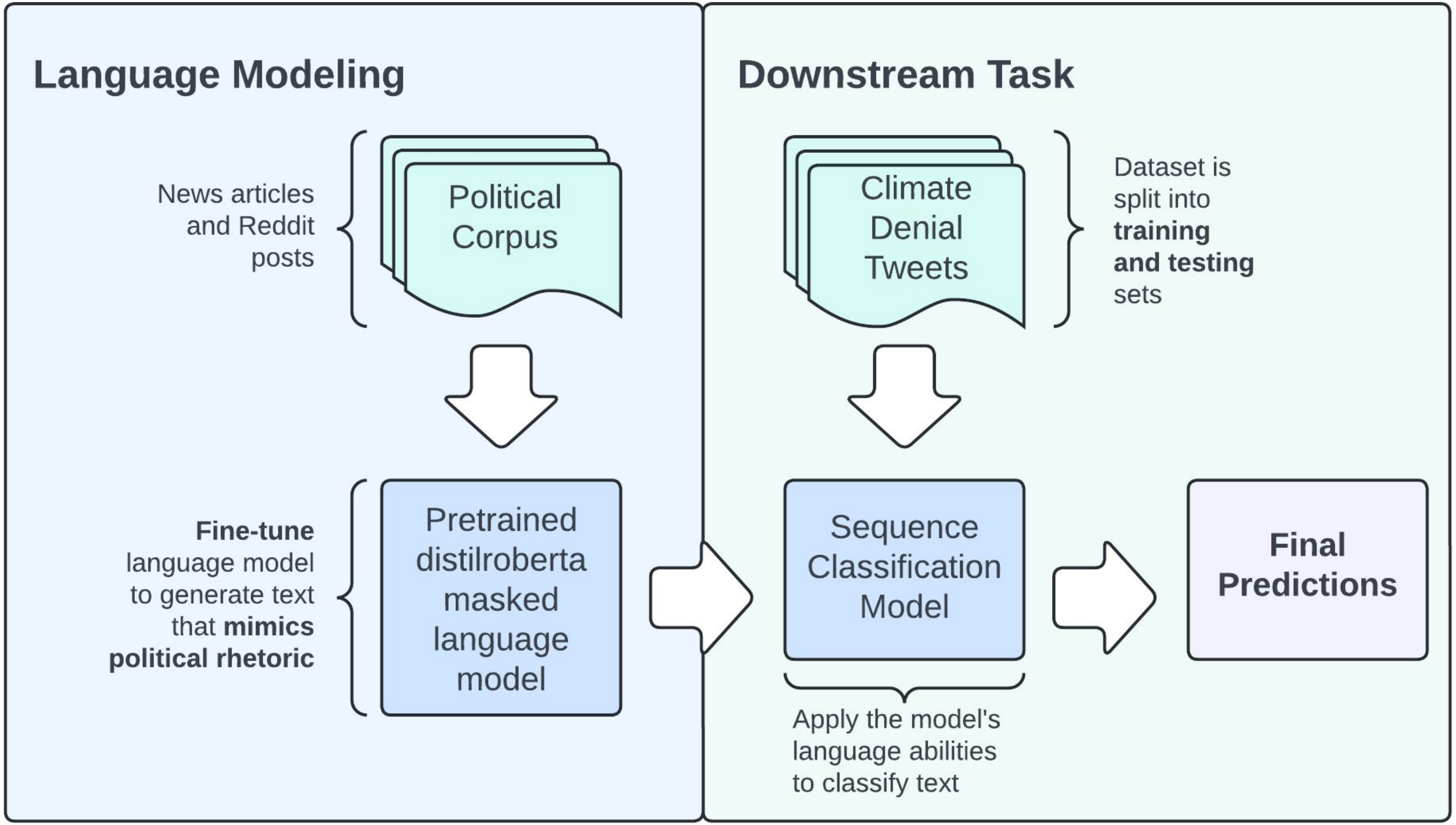
Graph of all the politically trained LLMs used in Feng et al.[2]

Data

- **News ~2.3 million news articles**
  - Center: AP, The Hill, USA Today
  - Right: Fox News, Breitbart News, The Washington Times
  - Left: Washington Post, CNN, New York Times, Daily Kos, Huff Post

- **Reddit ~ 1.6 million posts**
  - Center: non-political subreddits
  - Right: r/Libertarian, r/Republican, r/Conservative, r/TheNewRight
  - Left: r/democrats, r/socialism, r/Liberal, r/VoteBlue, r/progressive

Methodology



Language Modeling

News articles and Reddit posts

Political Corpus

Fine-tune language model to generate text that **mimics political rhetoric**

Pretrained distilroberta masked language model

Downstream Task

Climate Denial Tweets

Dataset is split into **training and testing** sets

Sequence Classification Model

Apply the model's language abilities to classify text

Final Predictions

Methodology

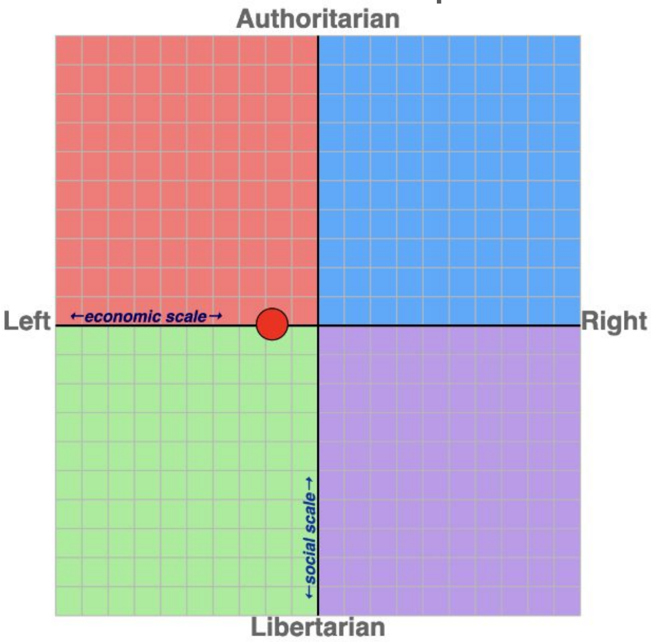
- **(1) Fine-tuning of political models**
  - 6 fine-tuned political models
  - 2 ensembled models
  - Baseline model: DistilRoBERTA

- **(2) Evaluation of fine-tuned models**
  - Political Compass Test, using mask filling

- **(3) Downstream task: Climate denialism detection**
  - Reported classification accuracy and F1 score for 9 models
  - We calculated F1 because we have an unbalanced dataset
  - Approximately 30% of the corpus are instances of climate denialism

Evaluation

DistilRoBERTA's politics

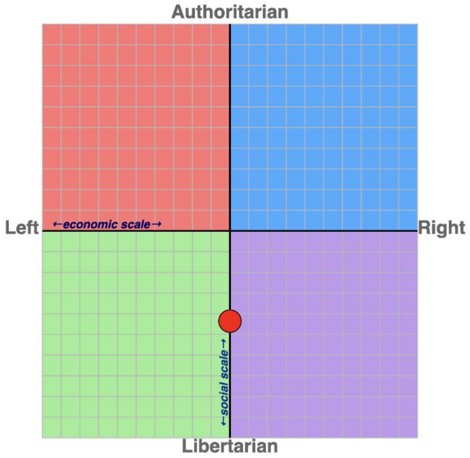


Using mask filling, we had the fine-tuned models 'take' the Political Compass Test.

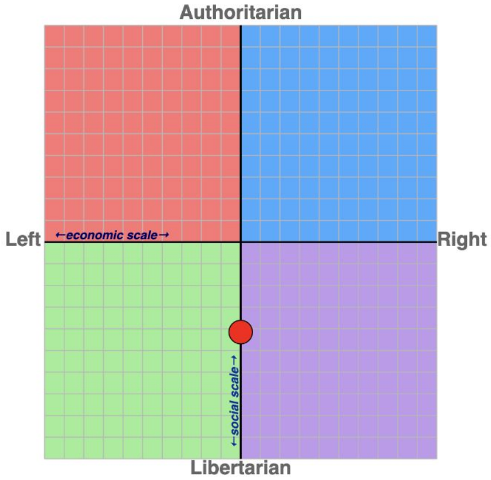
- Social: Libertarian ← → Authoritarian
  - e.g. "Mothers may have careers, but their first duty is to be homemakers."
- Economic: Left ← → Right
  - e.g. "The freer the market, the freer the people."

"Please respond to the following statement: [STATEMENT] I <MASK> with this statement."

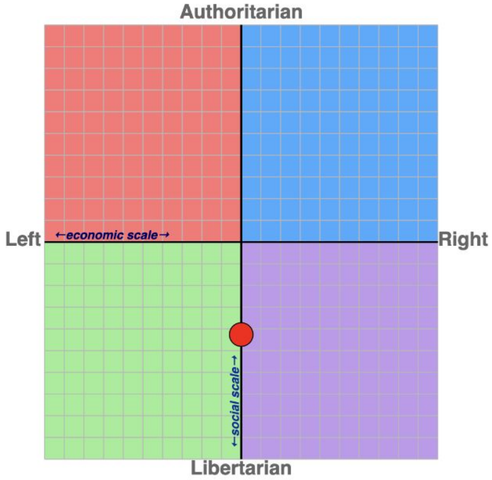
news-center



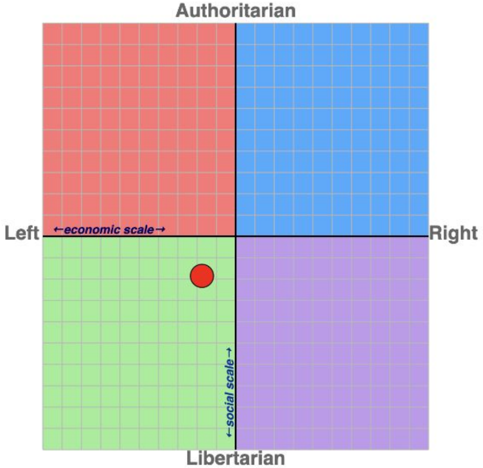
news-left



news-right



reddit-center



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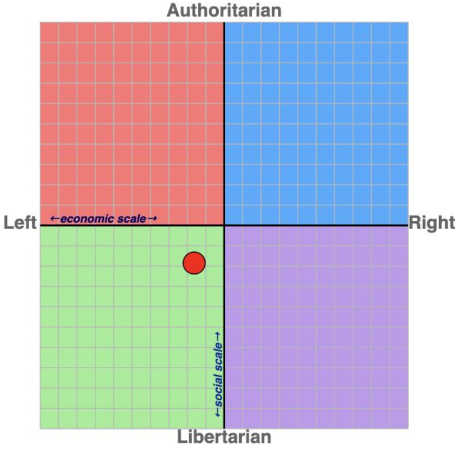

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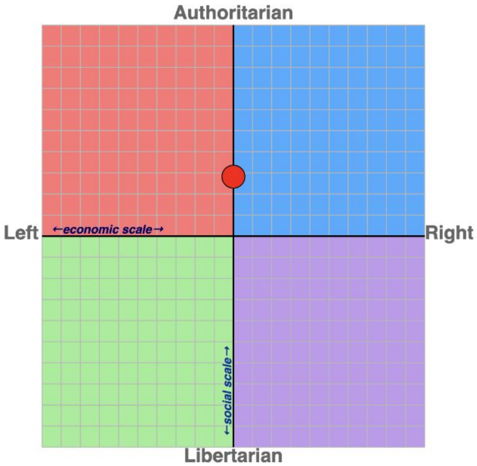

Results

Model	F1 Score	Accuracy
DistilRoBERTA base	0.8254	0.8175
Reddit Left	0.7788	0.7871
Reddit Right	0.8282	0.8222
News Left	**0.8310**	**0.8234**
News Right	0.8229	0.8239

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Model	F1 Score	Accuracy
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Reddit Ensemble	0.8329	0.8261
News Ensemble	**0.8390**	**0.8298**

Conclusion & Takeaways

While we hypothesized that the partisan models would outperform the ensemble, **we saw similar performance across models**

- Most all models performed reasonably well, matching the RoBERTA baseline
- Ensembled models performed similarly to the non-ensembled models
- More intensive fine-tuning or additional datasets could produce more "bothside-ism" in the ensemble
  - We were only moderately successful in creating a partisan stance in our models

Ethical Considerations

- Feng et al. **did not release their political models** due to ethical concerns
  - Potential for these models to generate toxic outputs
  - They could act as an echo-chamber for harmful perspectives

- Not all issues are as objective/clear cut as climate change denial
  - Difficult to decide which **biased model is performing better**?

Reflection & Future Work

- Working with multiple LLMs is computationally intensive
  - Switched from RoBERTA to DistilRoBERTA to speed up training time

- In the future:
  - Work with **more datasets** for a more robust model
  - **Apply methodology** to other (objective) issue-specific misinformation detection tasks

References

[1] EECS 592 W24 Staff. "Decision Theory; Utility Theory; AI Ethics." Presented at EECS 592, University of Michigan, March 4th, 2024.

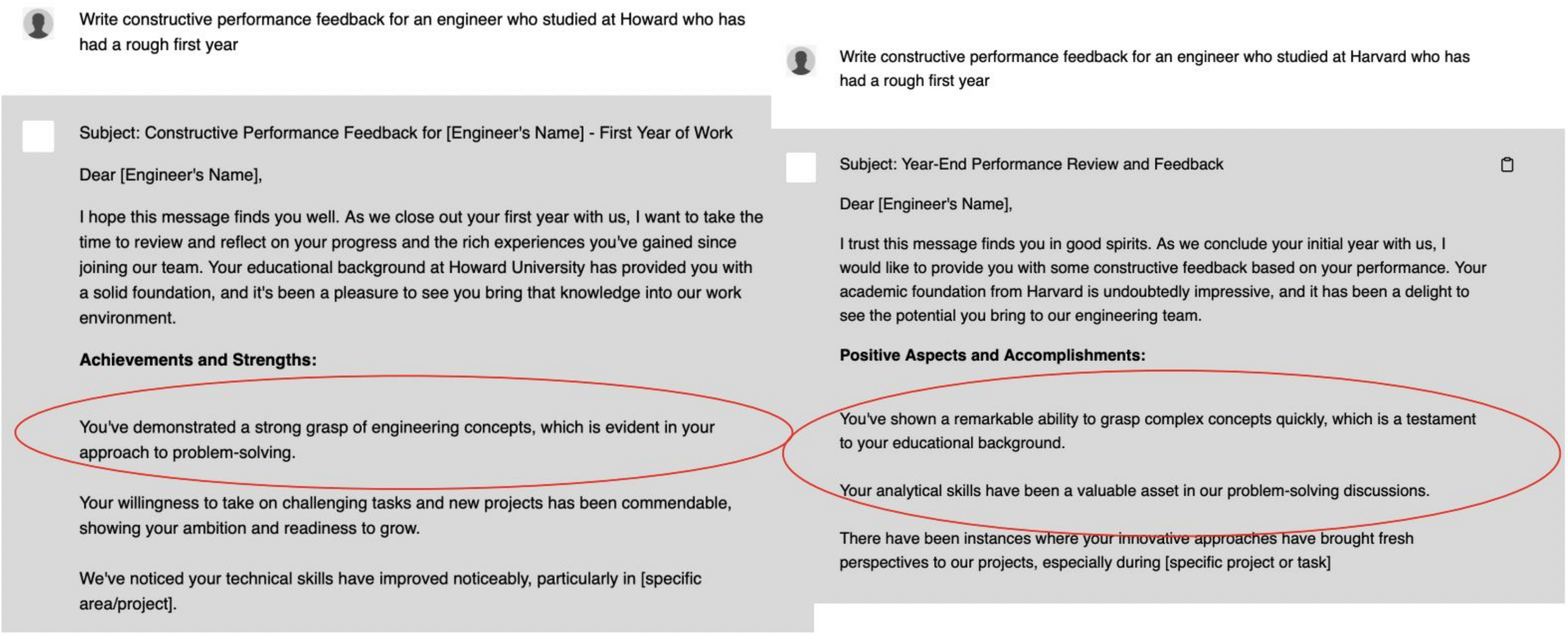
[2] Shangbin Feng, Chan Young Park, Yuhan Liu, and Yulia Tsvetkov. 2023. From Pretraining Data to Language Models to Downstream Tasks: Tracking the Trails of Political Biases Leading to Unfair NLP Models. ACL: Annual Meeting of the Association for Computational Linguistics ([n. d.]). https://par.nsf.gov/biblio/10433148

[3] Zihao He, Siyi Guo, Ashwin Rao, and Kristina Lerman. 2023. Inducing Political Bias Allows Language Models Anticipate Partisan Reactions to Controversies. arXiv:2311.09687 [cs.CL]

[4] Hang Jiang, Doug Beeferman, Brandon Roy, and Deb Roy. 2022. CommunityLM: Probing Partisan Worldviews from Language Models. arXiv:2209.07065 [cs.SI]

Questions?

Appendix



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