Polarization: A Multi-Dimensional Approach

Measuring polarization diachronically by annotating political ideology over time

Katherine Atwell[1] and Malihe Alikhani[1]
in collaboration with Barea Sinno[2], Bernardo Oviedo[3], and Junyi Jessy Li[4]

[1]Computer Science Dept, University of Pittsburgh, [2]Political Science, Rutgers University, [3]Computer Science, University of Texas at Austin, [4]Linguistics, University of Texas at Austin

Introduction

- With the rise of social media and polarized events such as COVID-19 and the 2020 election, misinformation has been extremely rampant.
- Hate speech is thought to co-occur with, and even fall under the umbrella of, misinformation[1]
- By identifying sources of polarization, we can more easily mitigate the spread of misinformation[2], so getting a comprehensive measure of polarization over time is important.
- We do this by capturing the **ideology** of the specific content discussed within an article along three different dimensions in order to get a more fine-grained measure of polarization across articles spanning a 30-year period.

Data

- Collected data from: Chicago Tribune (CT), Wall Street Journal (WSJ), Christian Science Monitor (CSM), the New York Times (NYT), and Time Magazine (TM)
- Collected articles based on the **federal budget**
- 721 total paragraphs in articles spanning from 1947 to 1974

Annotation

- Annotated ideology at the paragraph level according to the following dimensions: **fiscal, social,** and **foreign**
- After annotations were conducted separately, annotators **adjudicated** data wherever there was disagreement

Examples

Socially and economically liberal
Secretary of Defense Robert S. threw his full support today behind the Administration's drive against poverty. Citing figures showing that, about a third of the nation's youths fail either mental or physical examinations given by, the Selective Service, Mr. Mc-Namara said : "It is the youth that we can expect to be the most immediate beneficiaries of the war on poverty."

Socially and economically conservative
The antipoverty program, the Republicans insisted, would undercut the authority of the Cabinet members by making Sargent Shriver a "poverty czar." "I don't see how you can lie down and be a doormat for this kind of operation, "Representative Peter Frelinghuysen Jr., Republican of New Jersey, commented.
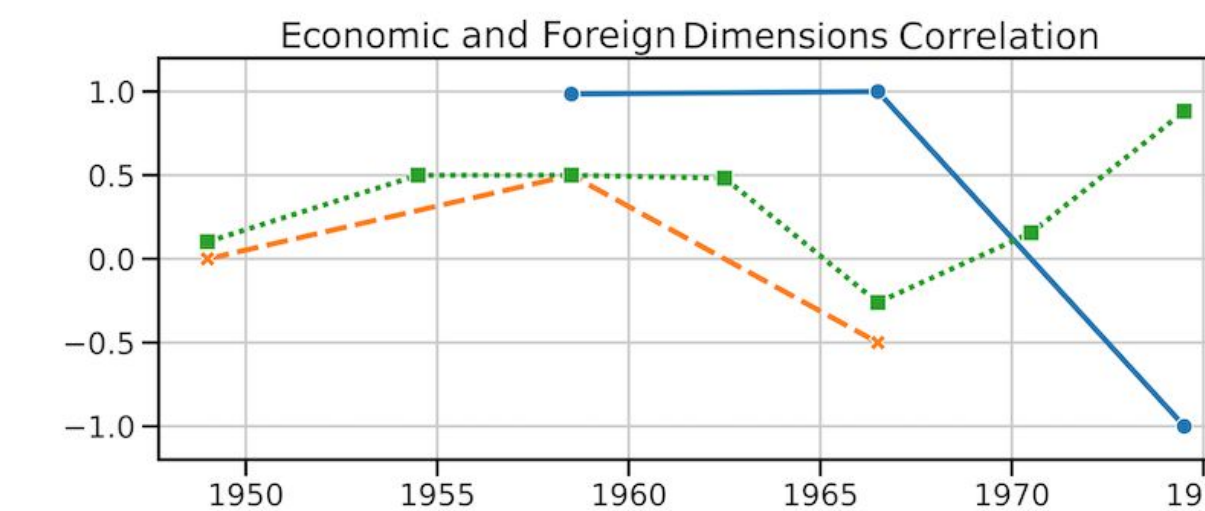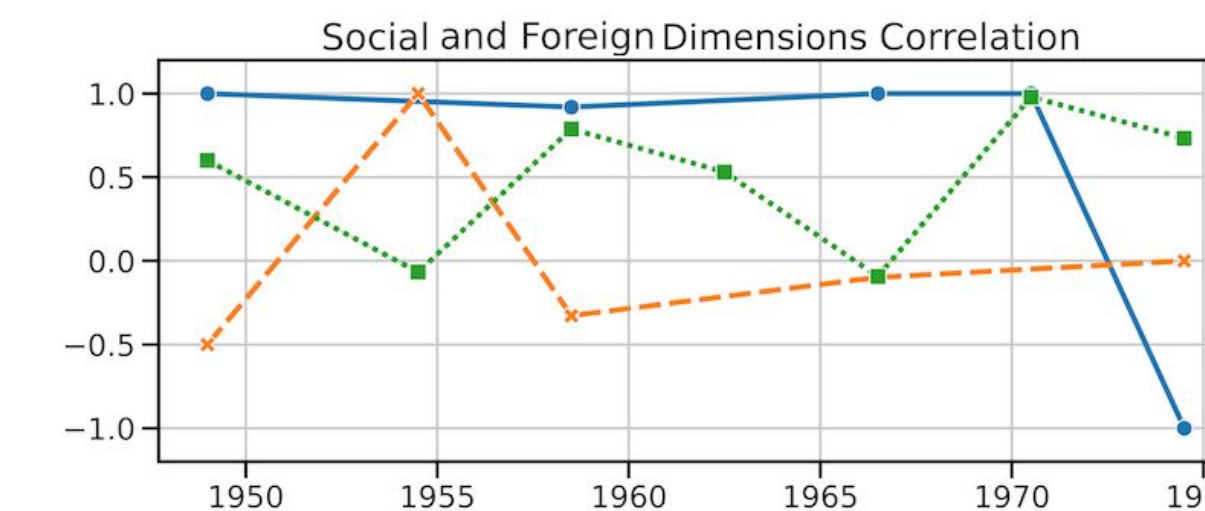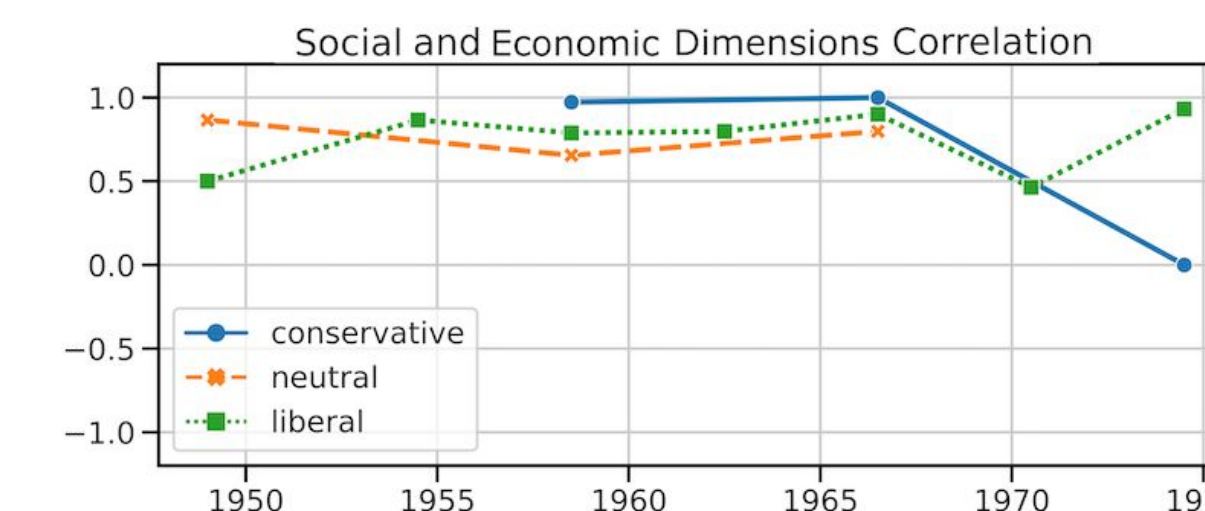
Our data indicates an **elevated level of polarization in conservative media** between 1957 and 1967
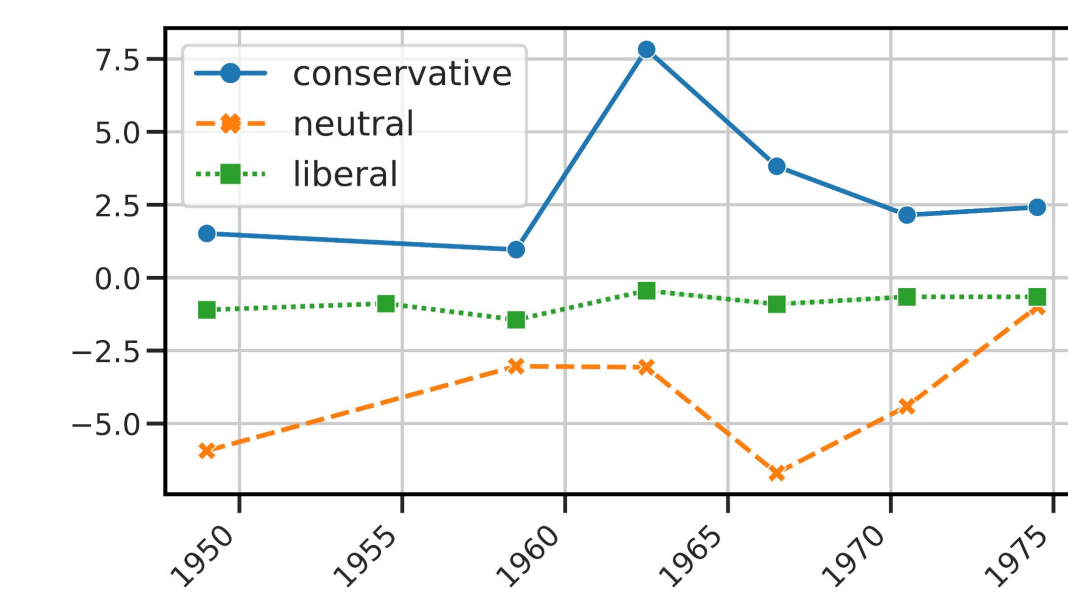
The evolution of the sorting measure, aggregating conservative/neutral/liberal outlets
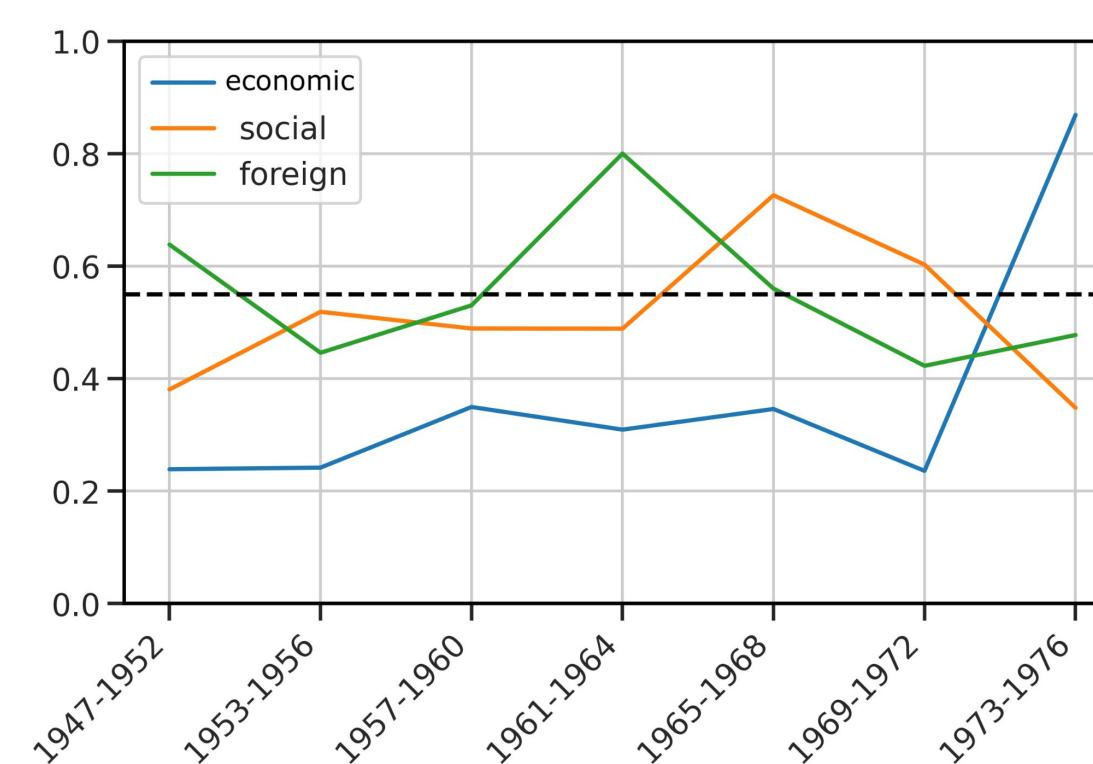
The evolution of the ideological divergence measure stratified by dimension

The evolution of the issue constraint measure, stratified by pairs of dimension

The highest average F1 score was **.55**, making it clear that this is a very challenging task.

	Econ	Social	Foreign	Average
Majority	0.30	0.23	0.25	0.26
BiLSTM	0.44	0.37	0.33	0.38
BERT no-ft	0.46	0.31	0.53	0.44
+pre-training	0.42	0.32	0.46	0.40
BERT ft	**0.64**	**0.50**	**0.52**	**0.55**
+pre-training	0.56	0.47	0.46	0.49
-focal loss	0.61	**0.50**	0.50	0.54

Macro F1 scores of the models averaged across 10 runs.

Models

Recurrent Neural Network: 2-layer bidirectional LSTM, with sequence length and hidden size of 256, and 100D GloVe embeddings.

Pre-trained language models: We used a BERT base model from HuggingFace and trained two versions, with and without fine-tuning. For more details about the model architecture, see our paper (QR code below).

Results

- In order for polarization to be indicated in the media, three measures must be increasing simultaneously: the **sorting measure**, **issue constraint**, and **ideological divergence**.
- We find that the most noteworthy period, based on the results of these graphs, is 1957-1967, where there is an elevated level of polarization in conservative media.
- In 1957, Congress flipped Democrat, and in 1961, all three branches of government became Democrat. This held true until 1969, when the presidency flipped Republican.
- Conservative media being especially polarized during this time therefore makes sense.

Future Work

In the future, we wish to study the following:
- Affective polarization, or the level of negative emotion felt between members of differing political parties towards the opposite party.[3]
- Ideological polarization in tweets: we wish to create a similar labelling schema and apply it to social media data in order to measure the opinions of the masses.

References

1. Wu, L., Morstatter, F., Carley, K. M., & Liu, H. (2019). Misinformation in social media: definition, manipulation, and detection. ACM SIGKDD Explorations Newsletter, 21(2), 80-90.
2. Vicario, M. D., Quattrociocchi, W., Scala, A., & Zollo, F. (2019). Polarization and fake news: Early warning of potential misinformation targets. ACM Transactions on the Web (TWEB), 13(2), 1-22.
3. Iyengar, S., Sood, G., & Lelkes, Y. (2012). Affect, not ideology: a social identity perspective on polariza[tion]. Public opinion quarterly, 76(3), 405-431.

2021 GLOBAL SUMMIT ERADICATE HATE | Seeds of Hope from the Tree of Life.

COLLABORATORY AGAINST HATE | RESEARCH AND ACTION CENTER

University of Pittsburgh