

Evaluating the Ability of Computationally Extracted Narrative Maps to Encode Media Framing

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Contents



Introduction

Data Set

Methods

**Results &
Discussion**

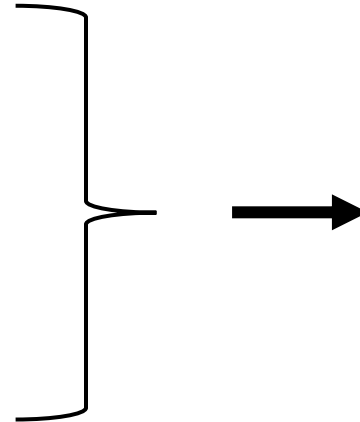
Conclusions



Data Set



Starting Point



*Understand the underlying stories
and the overall narrative*

As the world vies for vaccines, Cuba's making its own

AP AP NEWS
U.S. News World News Politics Sports Entertainment Business Technology Health Science Oddities Lifestyle Photography Videos
Cuban cooks overcome shortages with ingenuity on Facebook
By ANDREA RODR

REUTERS
World Business Legal Markets Breakingviews Technology
4 minute read · April 14, 2021 1:58 PM EDT · Last Updated 2 years ago
Analysis: Cuban Communists under pressure to accelerate economic reforms
By Marc Frank

Miami Herald
Part of the McClatchy Media Network
Havana goes back into lockdown after record number of COVID-19 cases in Cuba

Timeline

January 14, 2021 - Havana goes back into lockdown after record number of **COVID-19** cases in Cuba

March 03, 2021 - As the world vies for **vaccines**, Cuba's making its own

April 08, 2021 - Cuban cooks take to Facebook to share ingenious culinary creations in wake of **food shortage** due to COVID-19 pandemic

April 27, 2021 - Cubans Turn to Herbs in the Face of **Medicine Shortages**

May 31, 2021 - Cuba and the **US** return to **the era of confrontation**

June 11, 2021 - Cuba temporarily suspends cash deposits in dollars, cites **embargo** hurdles

June 18, 2021 - Cuba decided to make its own **COVID-19 vaccines**. Now it needs syringes

June 23, 2021 - US votes against UN resolution condemning **US embargo** on Cuba

July 3, 2021 - Cuba is facing its worst **shortage of food** since the 1990s

July 7, 2021 - Cuba facing **worst health crisis** of the pandemic

• • •

January 14, 2021 - Havana goes back into lockdown after record number of **COVID-19** cases in Cuba

Medicine Shortage and Healthcare Crisis

March 03, 2021 - As the world vies for **vaccines**, Cuba's making its own

April 27, 2021 - Cubans Turn to Herbs in the Face of **Medicine Shortages**

June 18, 2021 - Cuba decided to make its own **COVID-19 vaccines**. Now it needs syringes

July 7, 2021 - Cuba facing **worst health crisis** of the pandemic

Food Shortages

April 08, 2021 - Cuban cooks take to Facebook to share ingenious culinary creations in wake of **food shortage** due to COVID-19 pandemic

July 3, 2021 - Cuba is facing its worst **shortage of food** since the 1990s

Regime Change and Economic Reforms

April 14, 2021 - Analysis: Cuban Communists under pressure to accelerate **economic reforms**

April 17, 2021 - As Cuba turns **page on Castro era**, **economic reform** gains urgency

April 19, 2021 - What's next for Cuba and the United States after **Raul Castro's retirement**

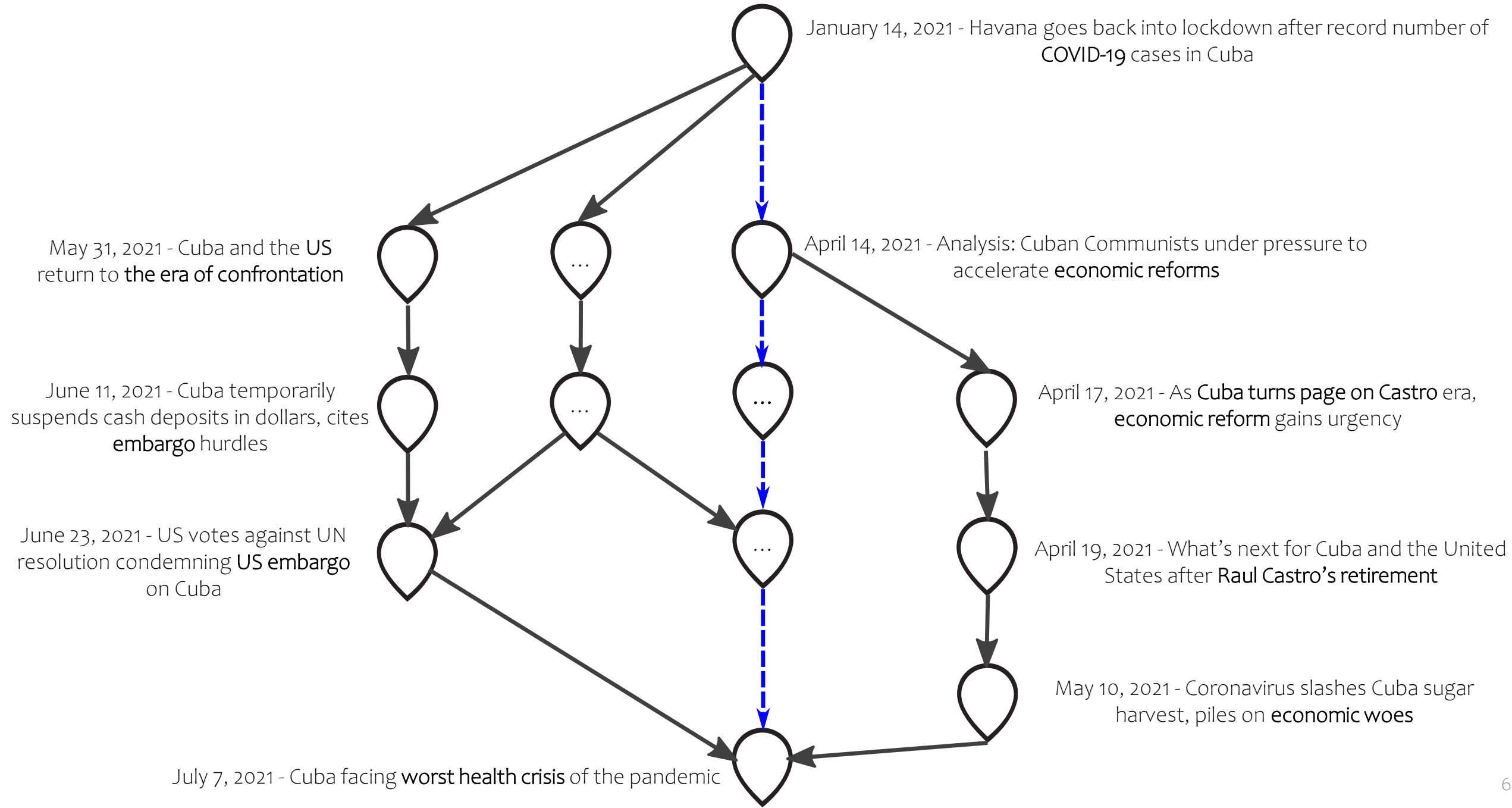
May 10, 2021 - Coronavirus slashes Cuba sugar harvest, piles on **economic woes**

US Relations and Embargo

May 31, 2021 - Cuba and the **US** return to **the era of confrontation**

June 11, 2021 - Cuba temporarily suspends cash deposits in dollars, cites **embargo** hurdles

June 23, 2021 - US votes against UN resolution condemning **US embargo** on Cuba



Motivation: Media Framing



Media Framing

- “The **angle** or **perspective** from which a news story is told.”
- Subtle yet potent mechanism in shaping narratives.
- Media framing works through:
 - Word Choice
 - Selection and Emphasis
 - Visual Imagery



Fox News v. Fox News Latino
How do they frame the same story for two different audiences?

In Rare Move, University Grants \$22K Scholarship To Undocumented Student

© Elizabeth Lawler / PolitiFact August 26, 2014 / Fox News Latino

mediamatters.org

Research Questions

How do computational narrative maps enhance our comprehension of media framing in news narratives ?

- **RQ1:** Does the narrative maps extraction algorithm properly capture the framing distribution of the data set?
- **RQ2:** Does the narrative maps extraction algorithm produce a representation with consistent framing?

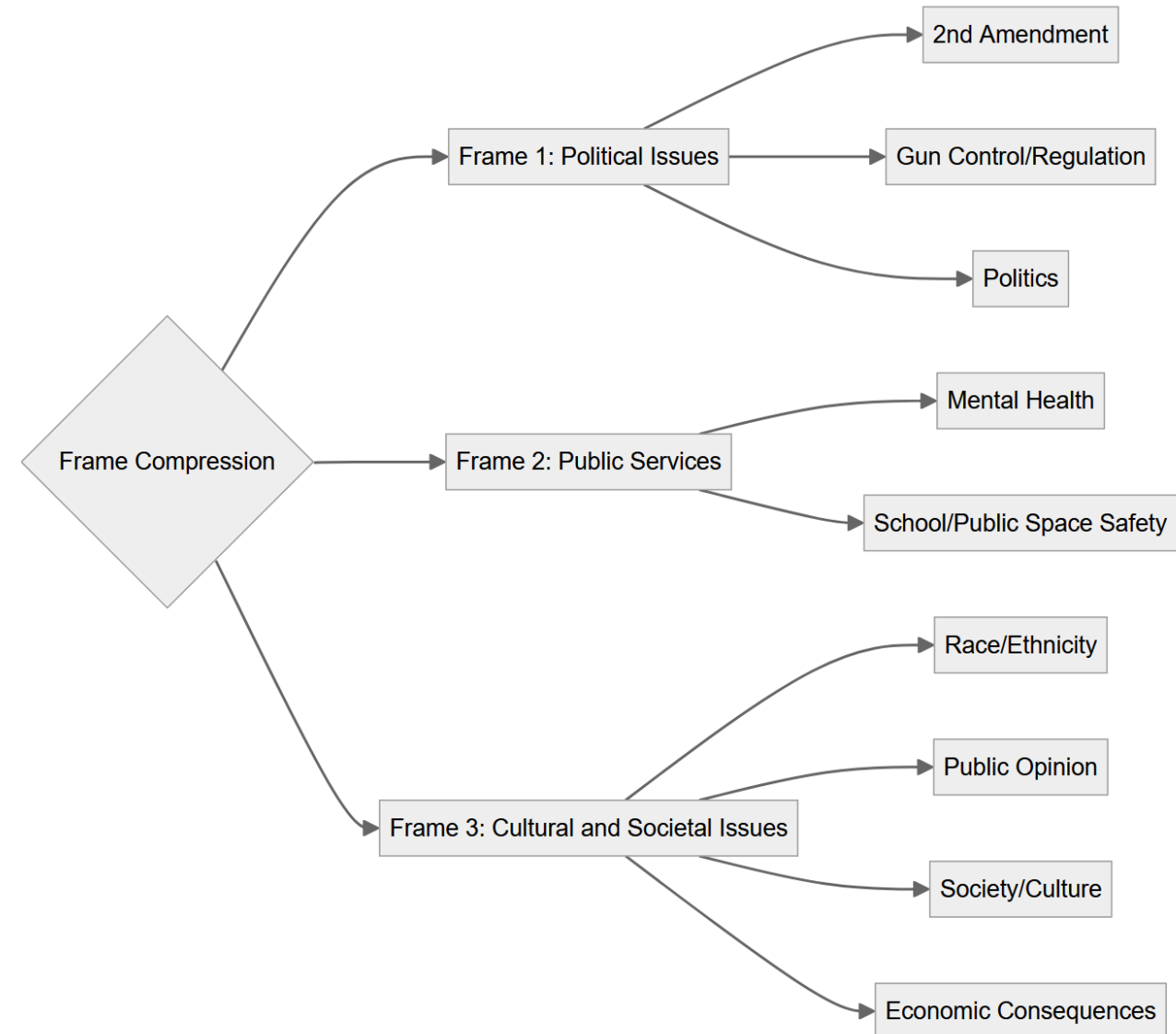
Data Set: Gun Violence Frame Corpus

- **Content:** Articles that discuss gun violence in the United States.
- **Data Set Size:** 1300 news articles written in English.
- **Frame Labels**

ID: Frame Label [Reference]	Freq.	Example Headline
1: 2nd Amendment [18]	38	"Breaking down the 27 words of the Second Amendment"
2: Gun Control/Regulation [18]	215	"How gun background checks work"
3: Politics [19]	373	"Romney open to new gun measures"
4: Mental Health [20]	65	"Florida shooter a troubled loner with white supremacist ties"
5: School/Public Space Safety [21]	137	7 ways to help prevent school shootings
6: Race/Ethnicity [22]	114	"Lawyers call US gun charges for Mexican man 'vindictive'"
7: Public Opinion [23]	237	"Students call for action after Florida school mass shooting"
8: Society/Culture [24]	41	"White House weighs video game link to gun violence"
9: Economic Consequences [23]	80	"Calstrs to engage with assault-weapon sellers first, divest last"

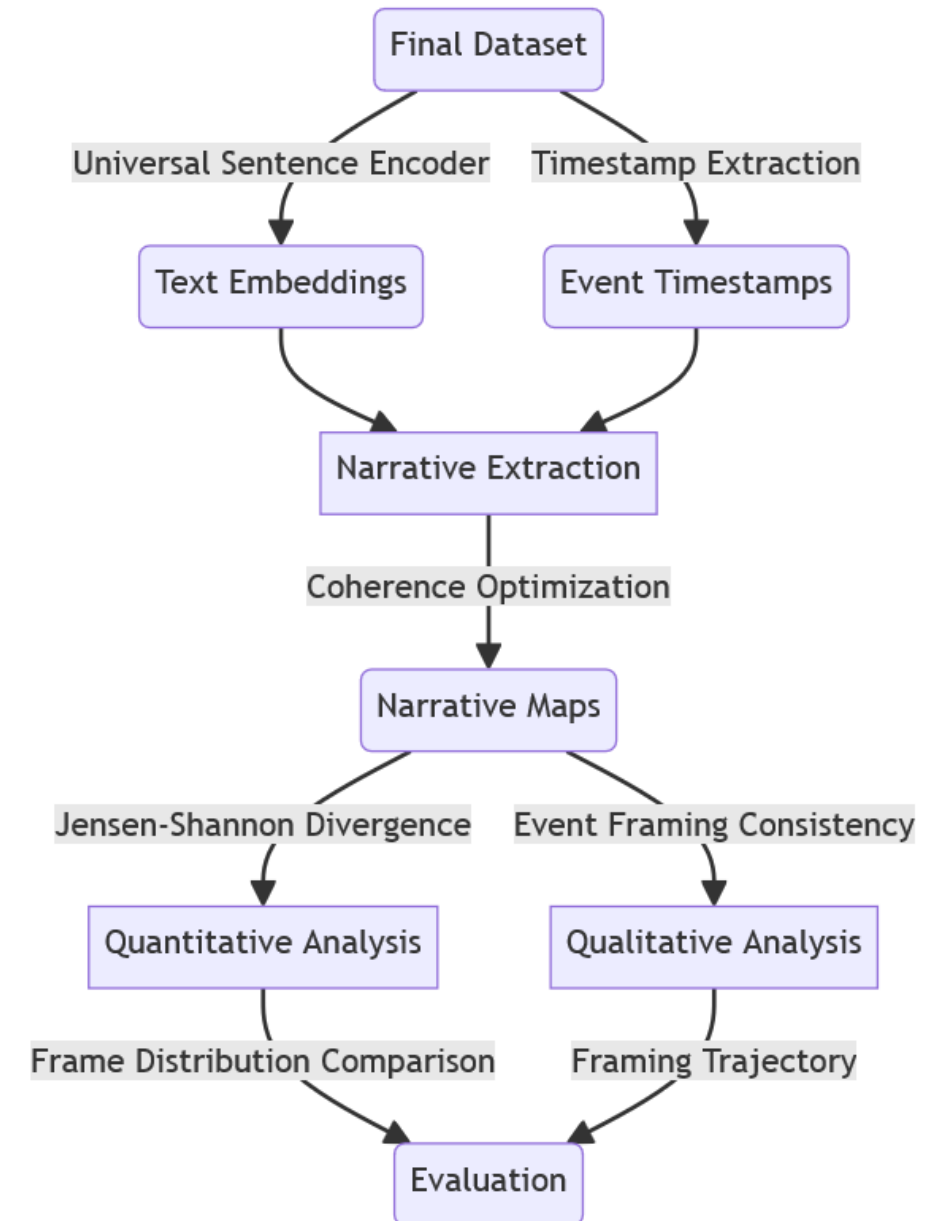
Processing the Data Set

- Original data set: 9 frames
- Compressed into 3 higher-level frames.
- Reduces complexity for smaller data subset
- Maintains essence of original framing structure



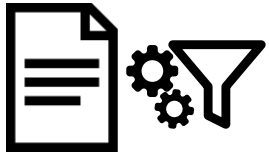
Methodology Overview

- **Quantitative analysis:**
 - Using the Jensen-Shannon divergence we assess the framing distribution similarity.
- **Qualitative analysis:**
 - Analyzing framing consistency within maps.

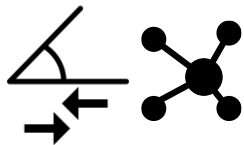


Extraction Algorithm

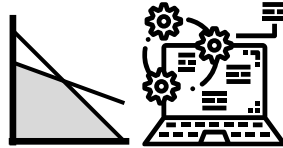
Extract and Preprocess



Compute Coherence



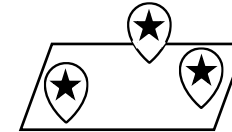
Solve Linear Program



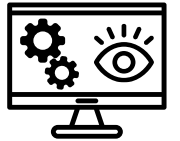
Extract Main Route



Extract Representative Landmarks



Generate Final Visualization



- Deep Learning
- Clustering
- Graph Theory
- Linear Optimization

Angular Similarity Table

sim	1	2	3	...
1	1.0	0.45	0.15	
2	0.45	1.0	0.67	
3	0.15	0.67	1.0	
⋮				⋮

Clustering Probability Vectors

index	probability_vectors	
1	[0.86, 0.05, 0.01, ..., 0.02]	$\Sigma=1$
2	[0.18, 0.00, 0.20, ..., 0.51]	$\Sigma=1$
3	[0.01, 0.00, 0.99, ..., 0.00]	$\Sigma=1$
⋮	⋮	

UMAP + HDBSCAN

$$\begin{aligned} \max \quad & \text{minedge} && \text{Coherence} \\ \text{s.t.} \quad & \text{minedge} \leq 1 - \text{next-node}_{i,j} + \text{similarity}(d_i, d_j) \quad \forall_{i,j} \end{aligned}$$

$$\begin{aligned} \text{node-active}_s = 1 & \quad \text{next-node}_{i,j} \leq 1 - \text{node-active}_k \quad \forall_{i < k < j} \\ \text{node-active}_t = 1 & \quad \text{next-node}_{i,j} = 0 \quad \forall_{i \geq j} \end{aligned}$$

$$\sum_i \text{node-active}_i = K$$

$$\sum_{i,j} \text{next-node}_{i,j} = K - 1$$

$$\sum_i \text{next-node}_{i,j} = \text{node-active}_j \quad \forall_{j \neq s}$$

$$\sum_j \text{next-node}_{i,j} = \text{node-active}_i \quad \forall_{i \neq t} \quad \text{Chain Constraints}$$

$$\text{cluster-active}_k = \sum_{i,j} \text{node-next}_{i,j} \cdot \text{membership}(d_i, d_j, k) \quad \forall_k$$

$$\sum_k \text{cluster-active}_k \geq \text{num-cluster} \cdot \text{mincover} \quad \text{Clustering}$$

Resulting Maps

- Generated 9 maps for all combinations of starting and ending frames.
- Map sizes:
 - **Mean:** 19.7 nodes
 - **Median:** 21 nodes
 - **Standard deviation:** 3.15 nodes
- Similar map sizes, but different events based on starting and ending frames.
- Framing distributions of maps are similar despite differences in size and content.

Map Size	End: Frame 1	End: Frame 2	End: Frame 3
Start: Frame 1	24	21	19
Start: Frame 2	16	17	22
Start: Frame 3	22	22	15

Quantitative Analysis

- Narrative extraction algorithm captures similar framing distribution to full data set.
- Extracted narrative maps provide insights into framing dynamics of news narrative
- **Average J-S Divergence: 0.0218**

J-S Divergence	End: Frame 1	End: Frame 2	End: Frame 3	<i>Average</i>
Start: Frame 1	0.0764	0.0009	0.0050	0.0274
Start: Frame 2	0.0270	0.0396	0.0172	0.0280
Start: Frame 3	0.0069	0.0171	0.0063	0.0101
<i>Average</i>	0.0368	0.0192	0.0095	0.0218

Qualitative Analysis

Analyzed map with **Frame 2** endpoints

- Public Services Issues.
- Framing **should** remain consistent.

Inconsistencies in event framing throughout the narrative

- Shift from public service frames to others.
- Abrupt framing shifts between connected events.



Frame 1: Political Issues



Frame 2: Public Services



Frame 3: Cultural and Societal Issues



01/11/2018 - Inoperable handgun found at Waukegan alternative school (2)



01/18/2018 - Cremated remains of Las Vegas mass shooter to be kept in safe deposit box, brother says (3)



02/07/2018 - 7 ways to help prevent school shootings (2)



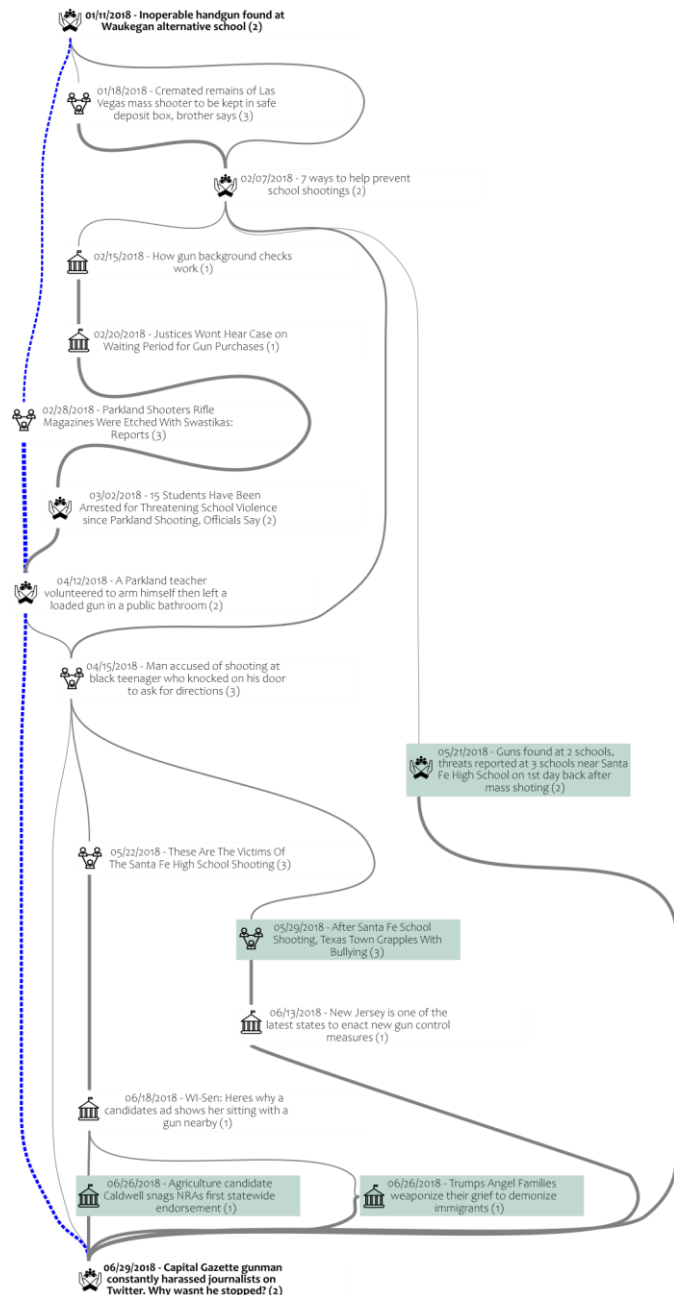
02/15/2018 - How gun background checks work (1)



02/20/2018 - Justices Won't Hear Case on Waiting Period for Gun Purchases (1)

Qualitative Analysis

- Algorithm focuses on content similarities rather than coherent framing.
- Framing inconsistencies undermine narrative coherence and interpretation.
- **Challenge:** Maintaining consistent framing across entire narrative.



Implications

Need for greater attention to framing in narrative extraction.

Current techniques **insufficient** for fully coherent narrative representations.

Prioritize novel approaches for consistent framing across narrative chains.

Potential benefits and pitfalls of computational narrative extraction for media framing.

High-level framing distribution insights.

Caution when interpreting specific structure and connections.



Conclusions

Research Questions

1. Does the algorithm accurately capture framing distributions?
2. Does it produce narratives with consistent framing?

Main Findings

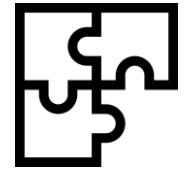
- Algorithm captures framing distribution of the data set.
- Limitations in achieving consistent framing within individual maps.



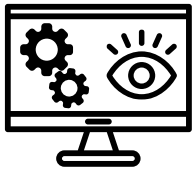
Future work



Developing consistent methods.



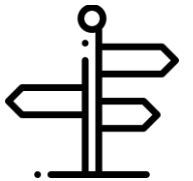
Incorporating framing into extraction process.



Interactive tools to analyze framing in narratives.



Cross-lingual and cross-cultural framing analysis.



Domains beyond news narratives.

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