



Creating Signed Networks of News Events

From Targets to Constructing Signed Networks for News Analysis

**BTP
Presentation**



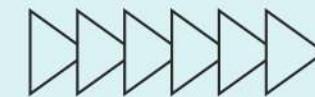
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Overview

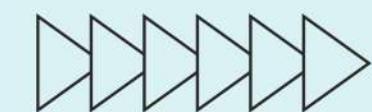
- Introduction
- Problem Statement
- Objectives
- Methodology
- Key Insights
- Challenges
- Future Work
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- Reference

Introduction



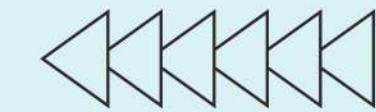
- Social media platforms have gained huge popularity
- Millions of users share opinions daily on events & policies
- Extracting these opinions manually is highly challenging





What do we face?

- Large volume of unstructured user-generated data
- Opinions are mixed, implicit, and scattered across posts
- Difficult to identify key entities, sentiments, and relationships



What is Stance Detection?



- Stance detection determines whether a target is for, against, or neutral toward a specific event or entity.
- Unlike general sentiment analysis, it is target-specific.



What is Stance Detection?



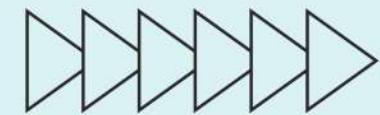
Example:

- Text: “The government’s policy is effective.”
 - Target: Government
 - Stance: For

- Text: “It is a good day to stand in long queues.”
 - Target: long queues
 - Stance: Against



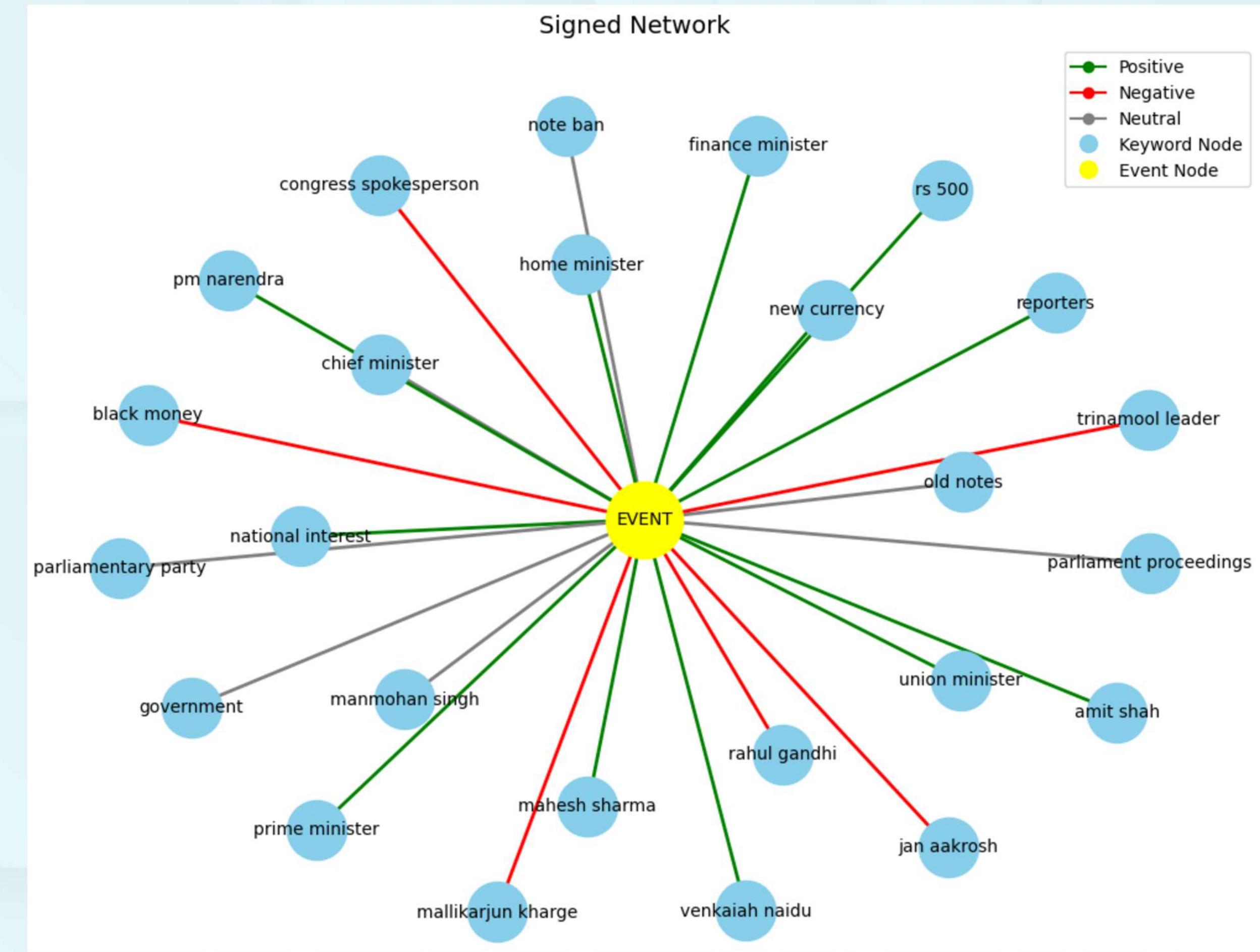
Why a Signed Network?



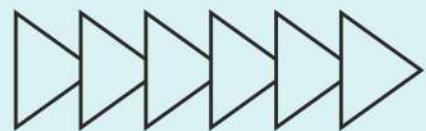
- A signed network represents targets as nodes and their relationships as edges.
- Edge signs indicate:
 - Positive (+) → Targets are often mentioned together in supportive context
 - Negative (−) → Targets are often mentioned in opposition or conflict
 - Neutral → Mentioned without support or opposition.
- This network helps in aggregating polarity across targets to determine stances more accurately.



Relation between Demonetization event and targets



Problem Statement



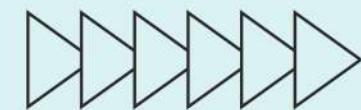
Given a news event and its corresponding news articles,
Create a signed network where nodes represent the targets and edges represent
polarity relation between those targets with respect to the news event.

For representation, we can say that-

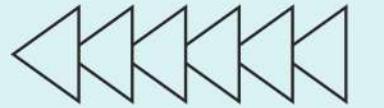
- N = News Event
- $T=\{t_1, t_2, \dots, t_n\}$ = Targets
- $P(t_i, N) \in \{-1, 0, +1\}$ = Sentiment polarity of target t_i , w.r.t event N



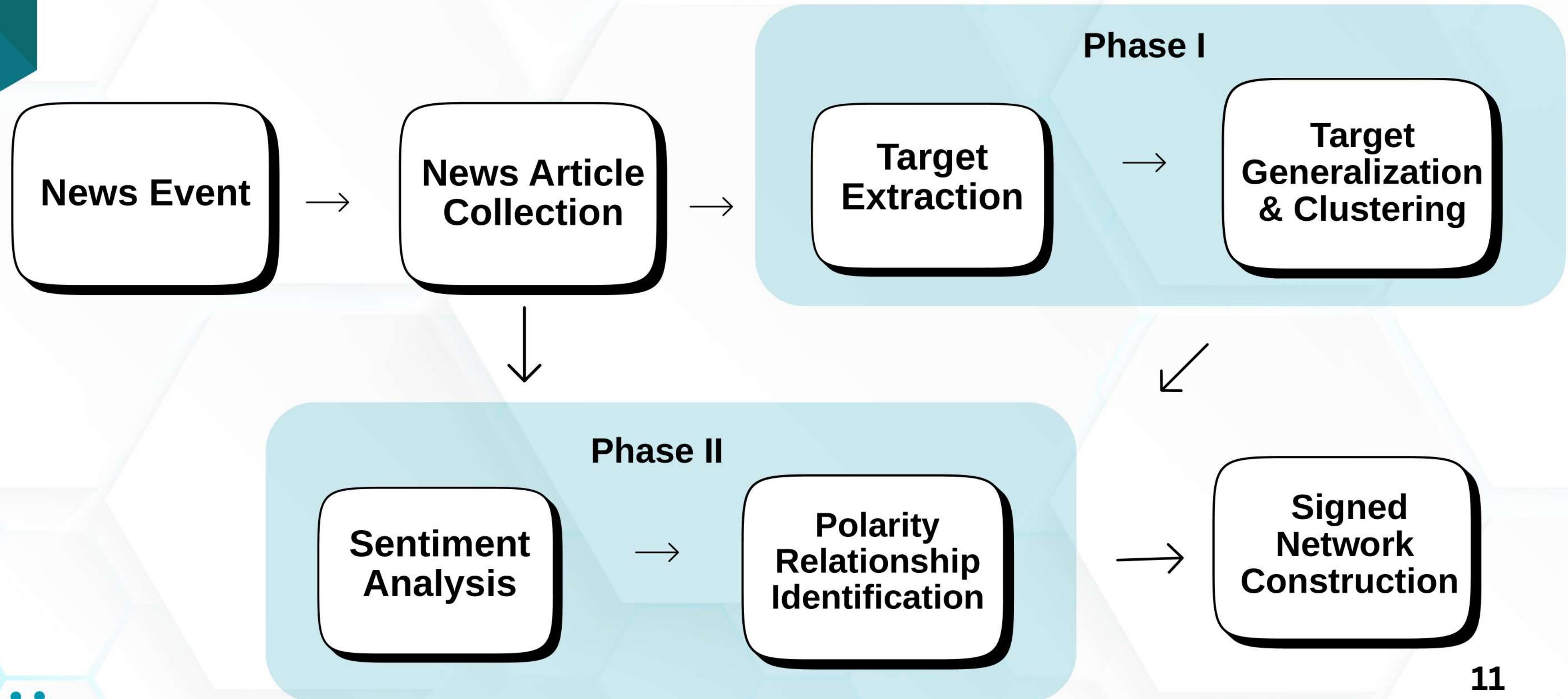
Objectives



- Identify target with respect to the news event.
- Identify polarity relationships of targets toward events.
- Build a signed network representing targets and their positive/negative relationships to the news event.



Proposed Methodology



Dataset Details

Event ID	Event Name	Year	Description	No. of Articles
N1	Indian Banknote Demonetisation	2016	PM Modi announced demonetisation of ₹500 & ₹1,000 notes to curb counterfeit currency, sparking nationwide debate.	86
N2	Catalan Independence	2017	Catalonia Parliament declared independence from Spain, leading to international debate and discussions.	47
N3	Harvey Weinstein Allegations	2017	Around 80 women accused Harvey Weinstein of sexual abuse, leading to major social and media debates.	34
N4	Smith-Warner Ball-Tampering Scandal	2018	Virat Kohli and others commented on the Australian cricket ball-tampering scandal involving Steve Smith, David Warner, and Cameron Bancroft, causing intense public & media debate.	48

https://en.wikipedia.org/wiki/2016_Indian_banknote_demonetisation

https://en.wikipedia.org/wiki/Harvey_Weinstein_sexual_abuse_cases

https://en.wikipedia.org/wiki/Catalan_independence_movement

https://en.wikipedia.org/wiki/2018_Australian_ball-tampering_scandal

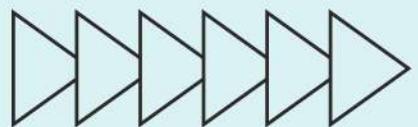
Phase I: Target Extraction



- Preprocessing:
 - Remove verbs; keep nouns and proper nouns.
 - Flatten paragraphs, clean unwanted symbols/lines.
 - Output: List of targets with scores.



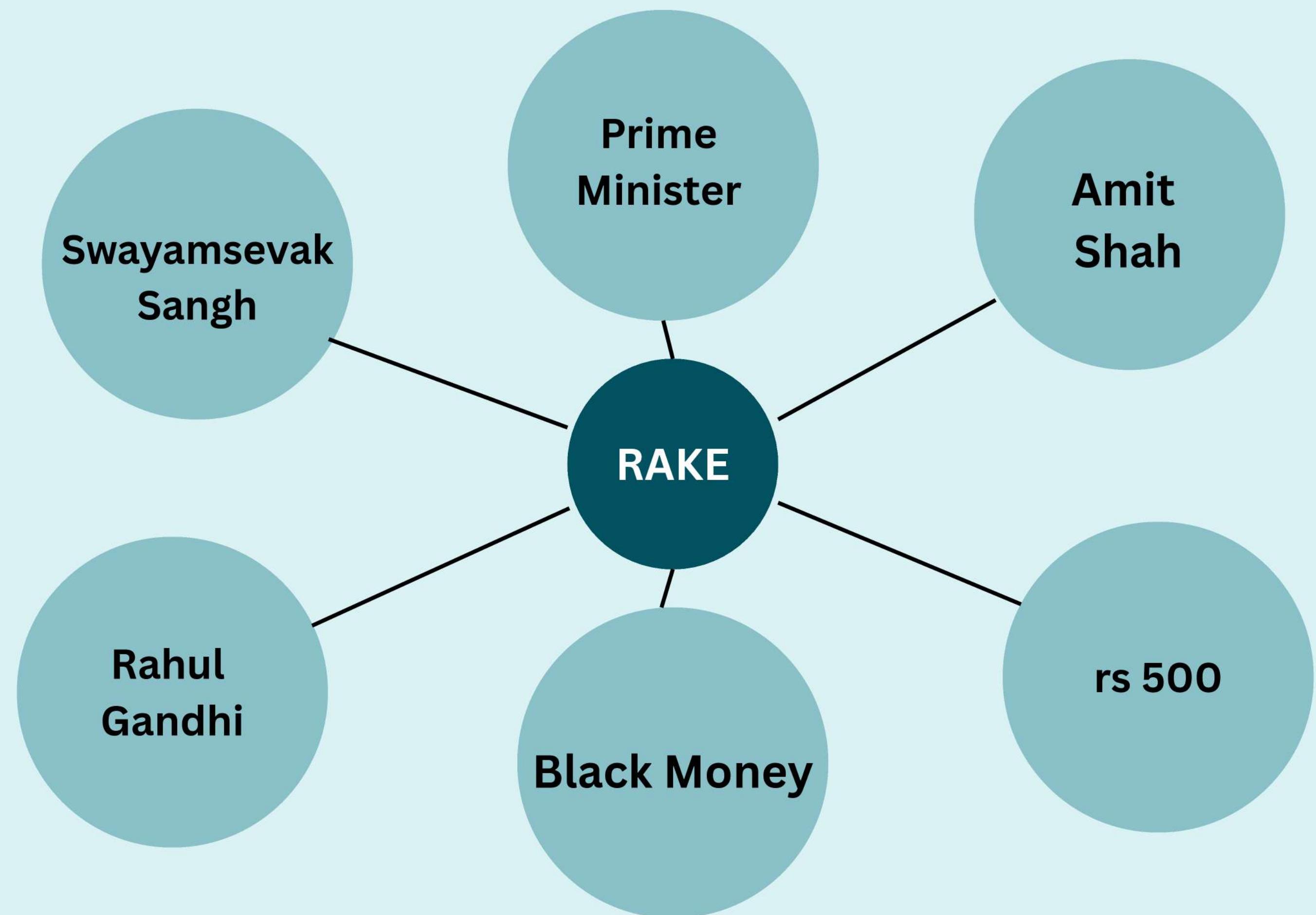
Phase I: Target Extraction



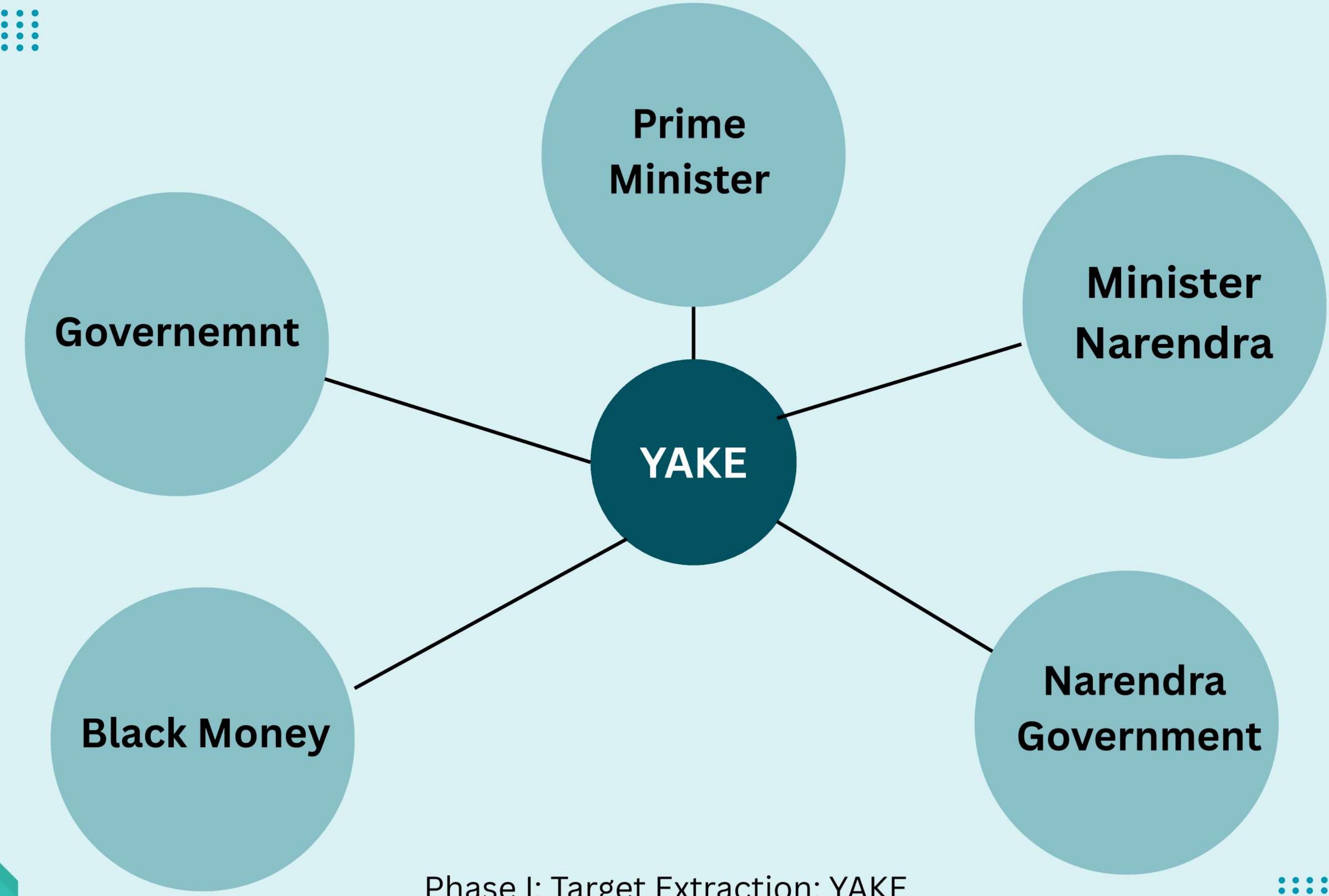
- **Methods Used:**

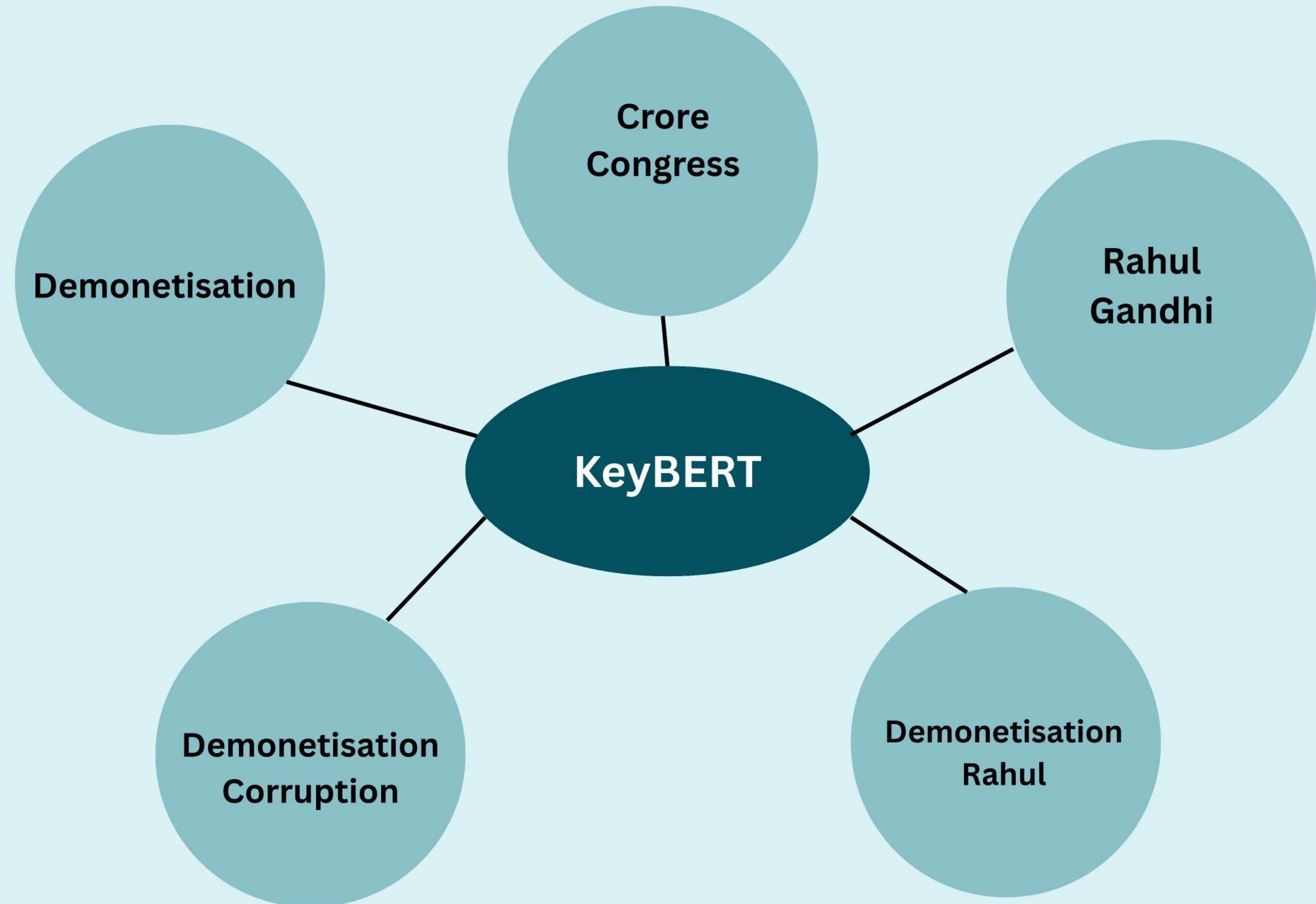
- **RAKE (Rapid Automatic Keyword Extraction)**
 - Extracts keywords by analyzing word co-occurrence and frequency in a document.
 - Reference: Rose et al., 2010
- **YAKE (Yet Another Keyword Extractor)**
 - Lightweight, unsupervised; considers statistical features like casing, position, frequency.
 - Reference: Campos et al., 2020
- **KeyBERT**
 - Embedding-based approach; finds keywords semantically closest to document embedding using BERT.
 - Reference: Gutiérrez et al., 2020





Phase I: Target Extraction: RAKE





Phase I: Target Extraction: KeyBERT

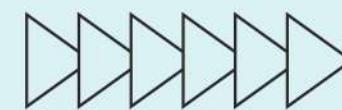
Phase I: Target Extraction

Dataset	Model	Number of Targets found
Demonetisation	RAKE	100
	YAKE	8
	KeyBERT	96
Ball Tampering	RAKE	98
	YAKE	5
	KeyBERT	93

Phase I: Target Extraction

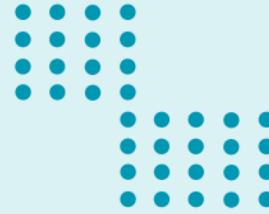
Dataset	Model	Number of Targets found
Harvey Weinstein	RAKE	100
	YAKE	9
	KeyBERT	99
Catalan Independence	RAKE	98
	YAKE	6
	KeyBERT	93

Phase I: Target Generalization & Mapping



- Convert keywords to embeddings using SentenceTransformer.
- Perform hierarchical clustering based on cosine distance.
- Identify representative keyword for each cluster.
- Map original keywords to generalized representatives.



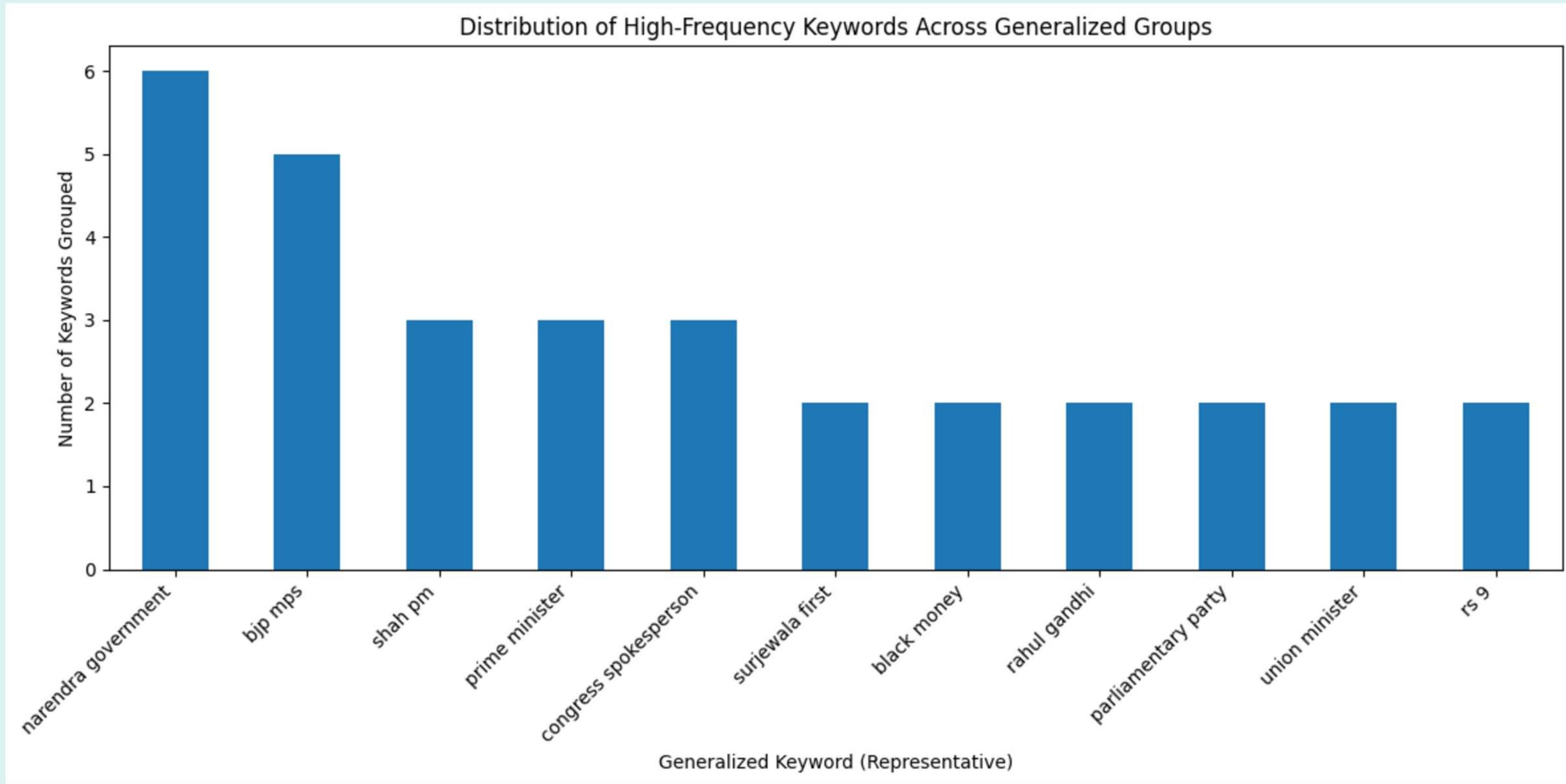


Phase I: Target Generalization and Clustering

Generalized Target	Targets Extracted
Narendra government	Minister Narendra, Narendra, Narendra Government, Narendra Modi, PM Narendra, Prime Minister Narendra
BJP MPS	BJP chief, BJP leader, BJP MPs, BJP President, BJP spokesperson
Congress Leader	Congress Leader, Congress Leaders, Congress Spokesperson
Demonetisation	Demonetisation, Demonetization

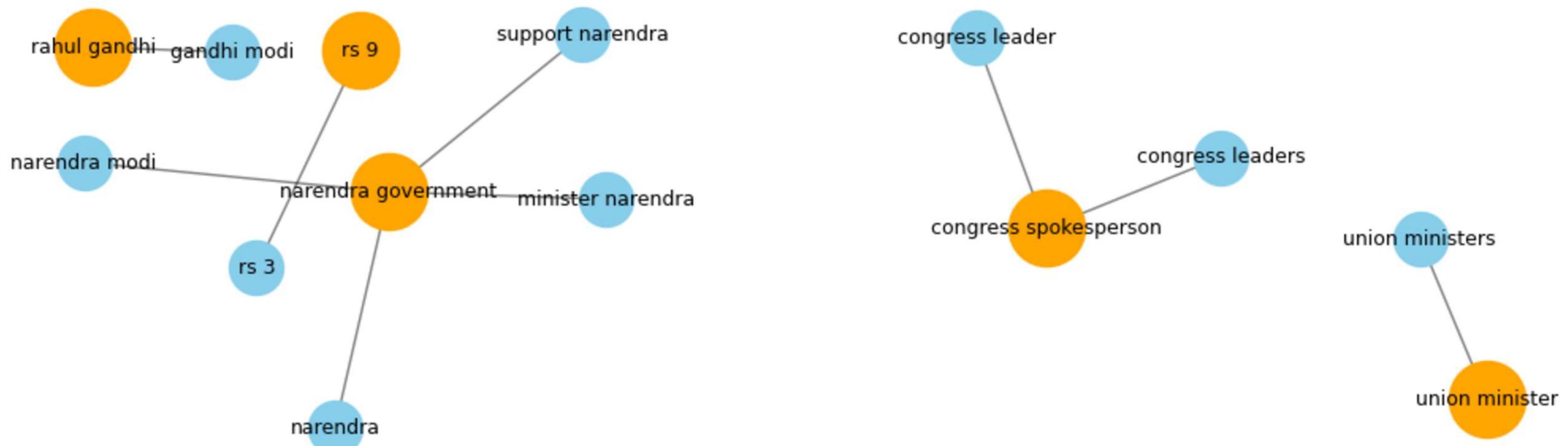


Results: Target Generalization Visualization

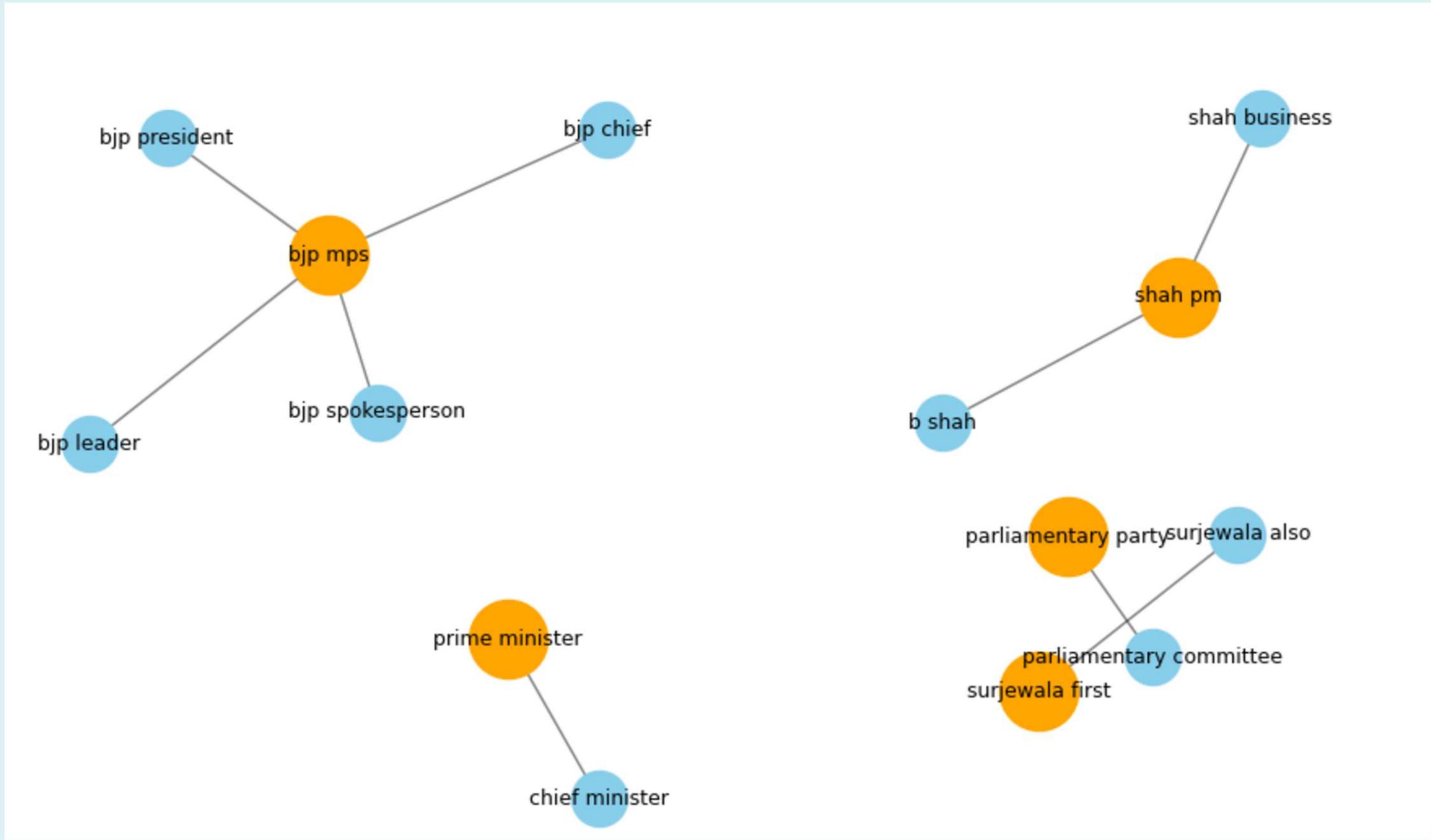


Results: Target Mapping Visualization

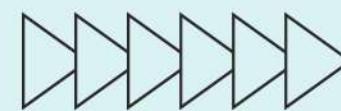
Keyword Generalization Mapping (High-Frequency Clusters)



Results: Target Mapping Visualization



Phase II: Polarity Identification



- Detects sentiment (positive, negative, neutral) for each target.
- Uses ELECTRA-based sentiment classifier (jbeno/electra-base-classifier-sentiment, google/electra-base-discriminator) and DeBERTa-based sentiment classifier (microsoft/deberta-base, microsoft/deberta-v3-base)
- Efficient and accurate for sentence-level news sentiment.
- Output: Sentences with sentiment labels.
- Refs:
 - Clark et al., ELECTRA, 2020
 - Hugging Face Model Hub



Sentiment Analysis Performed

Multiple Dataset:

Dataset	Setup	Accuracy	Precision	Recall	F1-Score
Demonetisation	No Training	0.5038	0.5018	0.5038	0.4794
	Stratified	0.6094	0.3713	0.6094	0.4615
	Oversample	0.6562	0.6424	0.6562	0.6441
Catalan Independence	No Training	0.5899	0.7518	0.5899	0.5964
	Stratified	0.5517	0.3044	0.5517	0.3923
	Oversampled	0.7586	0.7653	0.7586	0.7616
Ball Tampering	No Training	0.4291	0.4560	0.4291	0.3935
	Stratified	0.4400	0.6857	0.4400	0.3688
	Oversampled	0.4400	0.4359	0.4400	0.4330

Sentiment Analysis Performed

Cross Dataset:

Dataset	Model	Accuracy	Precision	Recall	F1-Score
Demonetisation	ELECTRA	0.4486	0.5281	0.4486	0.4612
	DeBERTa	0.4511	0.5794	0.4511	0.4714
Catalan Independence	ELECTRA	0.2880	0.1291	0.2880	0.1783
	DeBERTa	0.5346	0.7074	0.5346	0.5393
Ball Tampering	ELECTRA	0.4494	0.4756	0.4494	0.4477
	DeBERTa	0.5223	0.5310	0.5223	0.5034
Harvey Weinstein	ELECTRA	0.5390	0.5505	0.5390	0.5065
	DeBERTa	0.5373	0.5585	0.5373	0.5334

Sentence	Sentiment	Predicted
Weinstein approached her at a New York club in 2004 she told The New Yorker.	Negative	Neutral
But it remains to be seen how much supporting evidence prosecutors will be allowed to introduce in seeking to demonstrate a pattern of criminal behavior.	Neutral	Positive
The expansion of the inquiry first reported by The Wall Street Journal added to the legal risks facing Weinstein	Negative	Negative
Harvey Weinstein Will Be Charged With Rape in New York Officials said these on a report.	Negative	Neutral

Results: Sentiment Analysis of Harvey Weinstein

Sentence	Sentiment	Predicted
Nirupam was here on Friday to take part in the 'Sawal Satygrah' over demonetization being organised by the local unit of Congress.	Positive	Neutral
Now another new scheme under the name of 'black money holder welfare scheme' has been brought.	Positive	Neutral
Unlike Congress, our party believes in setting example for others as we can't expect from people what we can't do," he said.	Positive	Positive
He said blackmoney is a psychological disease which has to be changed and also requires cleansing of the corrupt income tax department.	Neutral	Negative

Results: Sentiment Analysis of Demonetization

Phase II: Polarity Identification

Sentence: Weinstein denies allegations of misconduct and of blacklisting the actresses.

Targets Identified: actress, weinstein
Polarity Identified: Negative

Sentence: It demonstrated to me that cricket fans are the true custodians of the values of the game.

Targets Identified: cricket
Polarity Identified: Positive

Phase II: Polarity Identification

Sentence: Currency crisis: Let people use old notes for necessities, says Supreme Court Dec 16, 2016, 01.

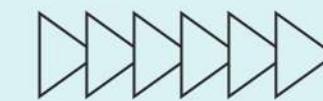
Targets Identified: old notes

Polarity Identified: Neutral

Sentence: Continuing his diatribe, Rahul said the PM thought about demonetisation "when he realised that super rich people, who had borrowed money from banks have not repaid it, leaving banks on the verge of closure.

Targets Identified: Rahul, PM
Polarity Identified : Negative

Signed Network Construction

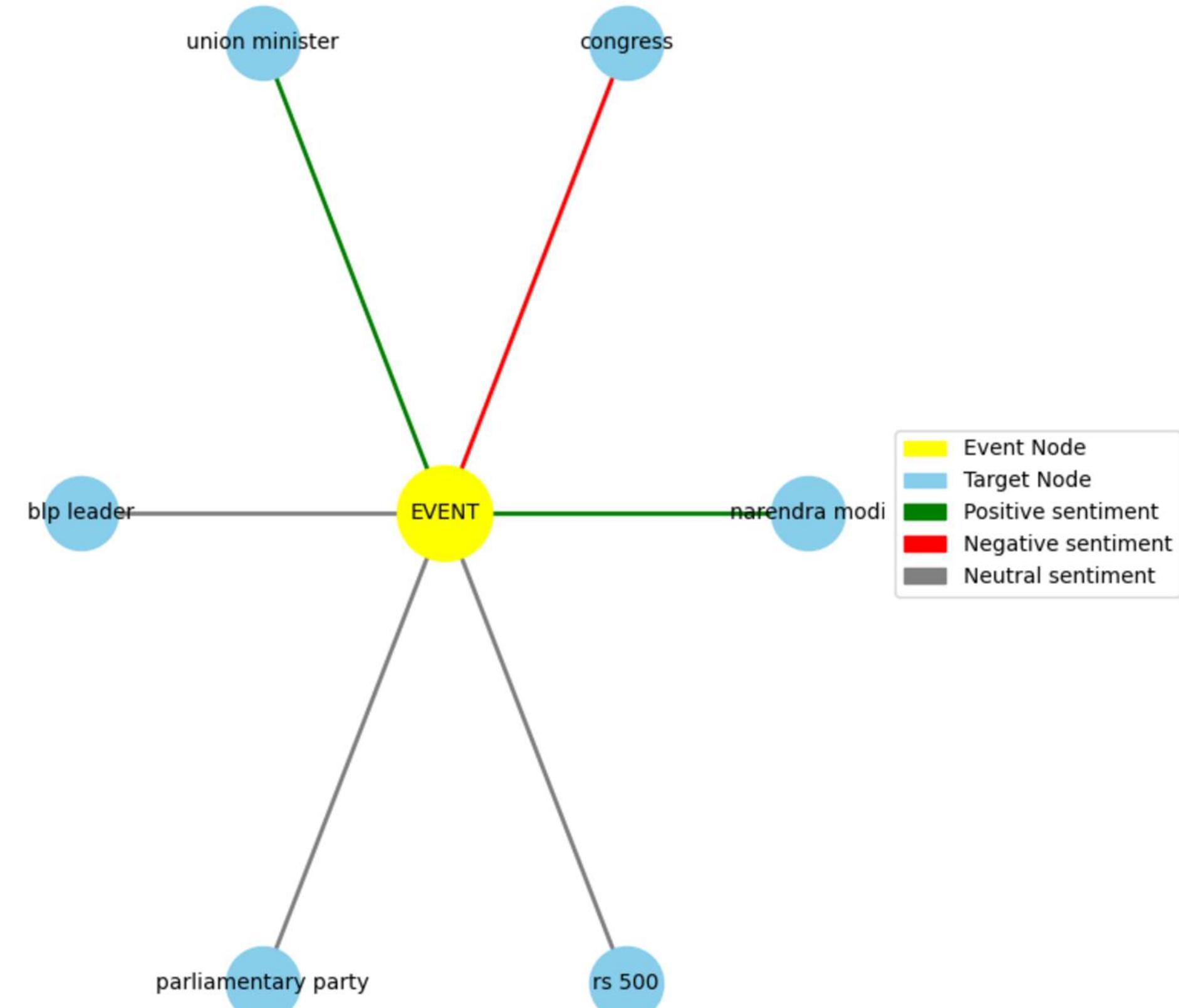


- Nodes represent the event and mapped targets.
- Edges show sentiment polarity: positive (+), negative (-), or neutral (0).
- Edge colors:
 - Green → Positive
 - Red → Negative
 - Gray → Neutral



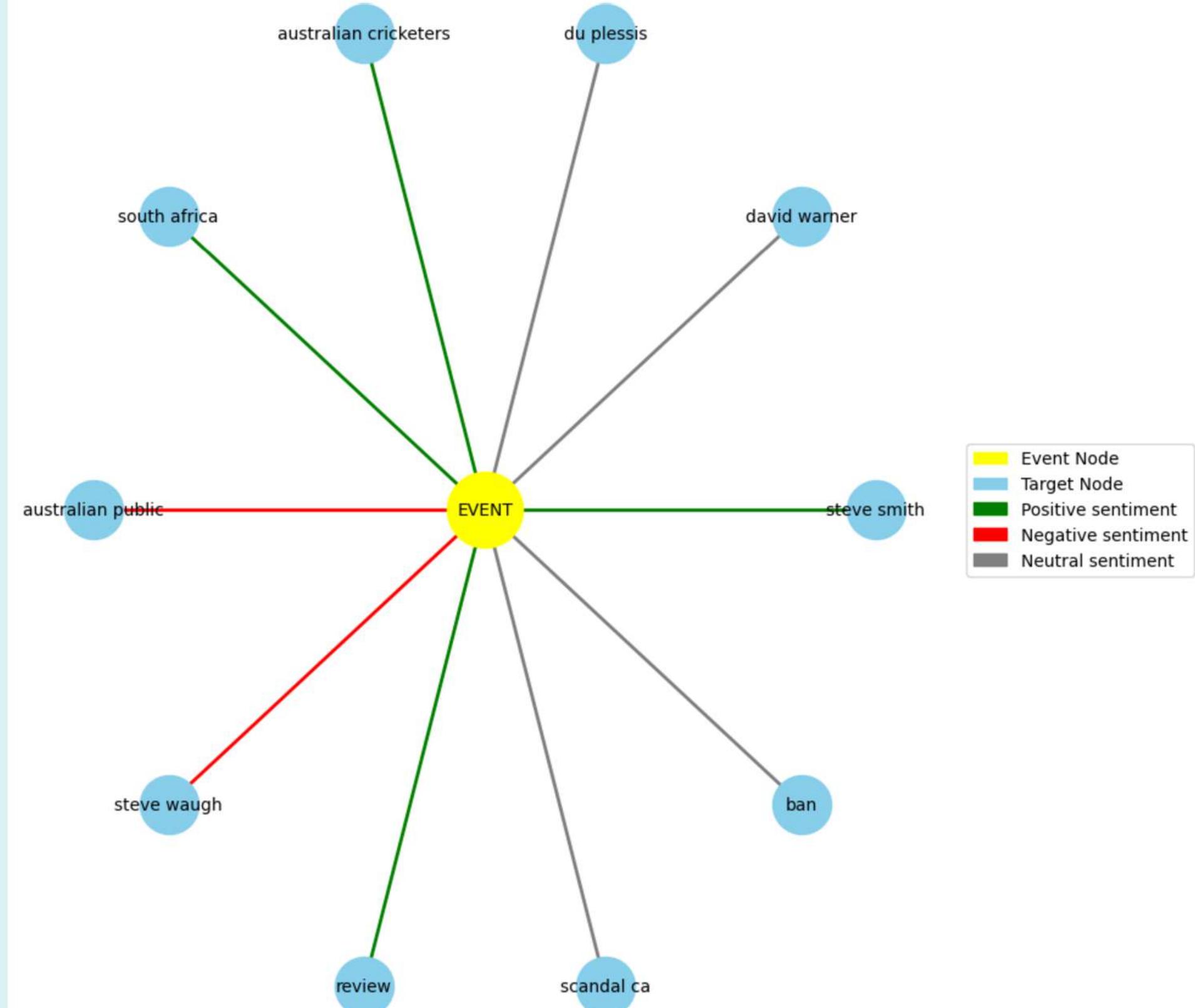
Results: Signed Network Visualization

Signed Network with Sentiment (Event-Target)



Results: Signed Network Visualization

Signed Network with Sentiment (Event - Target)



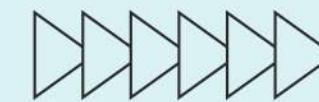
Result



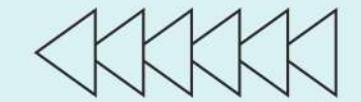
- Target Identification is done by multiple processes (Rake, Yake, KeyBert)
- Polarity identification is handled by signed network which shows relationships targets and event.



Tech Stack



- Libraries & Tools: NLTK, RAKE, YAKE, KeyBERT
- Pretrained Models: all-MiniLM-L6-v2, ELECTRA/DeBERTa
- Visualization: NetworkX, Matplotlib



Challenges Faced



- High variance in targets across events dataset.
- Polarity Identification depends on pretrained model accuracy.
- Network visualization may become dense for large datasets.



Conclusions

Successfully extracted and generalized targets from articles.

Combined statistical + semantic methods for robust target extraction.

Built a signed network connecting events and targets with sentiment.

Integrated sentiment analysis + clustering + graph visualization.

Future Work



- Integrate automated stance detection for targets.
- Signed Network based concepts for connection analysis.
- Interactive network dashboard for better exploration.
- Combine with temporal analysis for evolving events.



Reference



- R. Chakraborty, S. Bhandari, N. Chakraborty, and R. Das (2020). Eve2Sign: Creating Signed Networks of News Events
- Wu et al. (2021) – Multiple-Element Joint Detection for Aspect-Based Sentiment Analysis. Knowledge-Based Systems
- Hugging Face: ELECTRA model, DeBERTa Model
- RAKE, YAKE, KeyBERT libraries
- SentenceTransformer (MiniLM models)
- NLTK toolkit
- Datasets: Demonetization, Ball Tampering, Catalan, Harvey





**Thank
You**