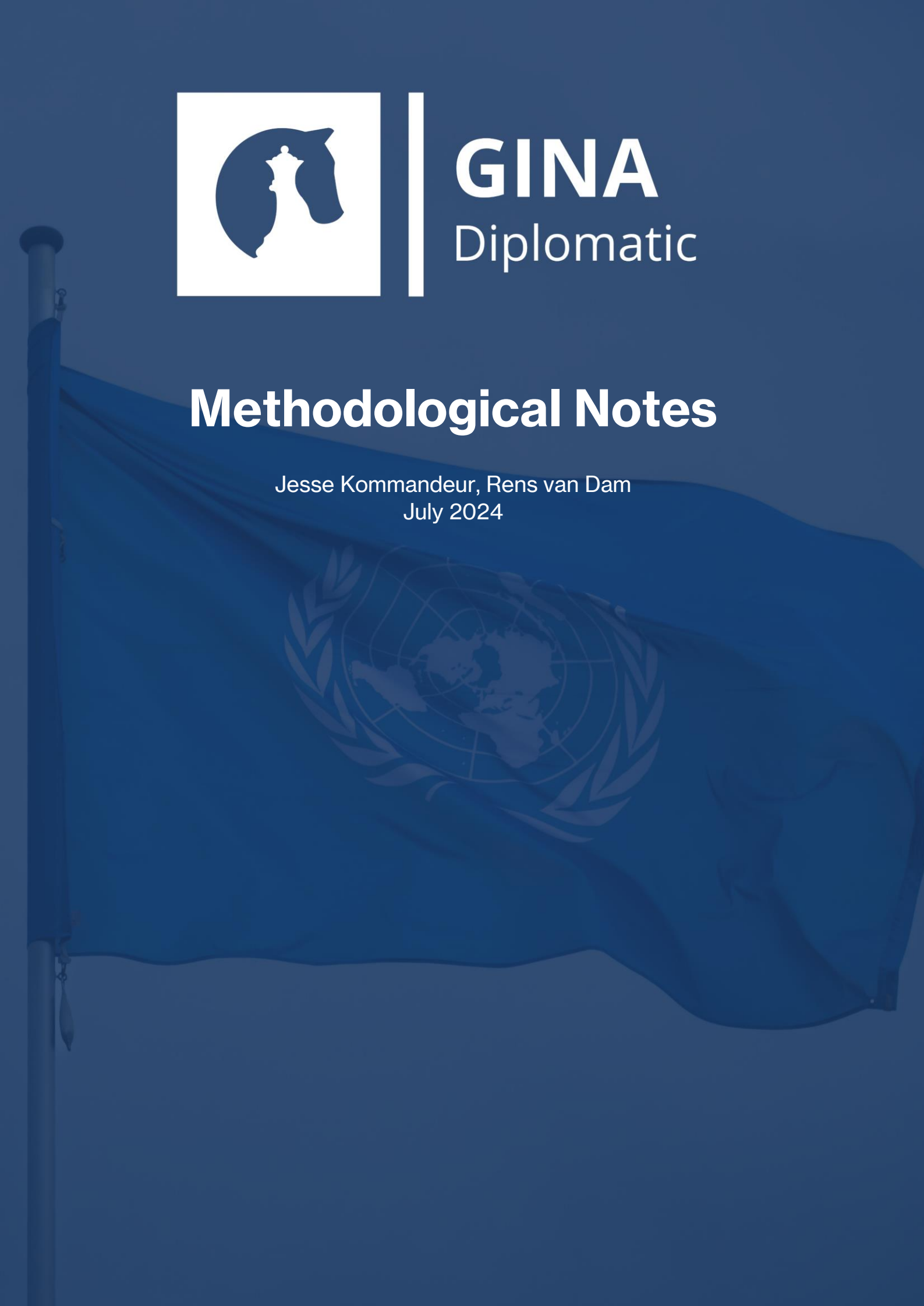

GINA Diplomatic

Methodological Notes

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This HCSS tool and methodological note have been constructed by the HCSS Datalab. The conclusions and recommendations presented in this tooling and report are the result of in-house independent research and development. Responsibility for the content rests with the authors and the authors alone.

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Key takeaways

The GINA Diplomatic tool tries to revolutionise the analysis of UN voting behaviours with the integration of indices and scores such as the Ideal Points Index and Voting Similarity Score. These tools allow for precise measurement of state-specific voting behaviours and alignments over time, offering insights into the evolving dynamics of global diplomacy. By quantifying the distance between states' voting positions and analysing dyadic voting similarities, these metrics provide a clear, numerical depiction of international relations and policy stances.

Using advanced natural language processing (NLP) techniques, the GINA Diplomatic tool assesses the sentiment and tone of diplomatic speeches delivered during the UN General Debate. The General Sentiment Score and State Sentiment Index are pivotal in this analysis, providing a quantified view of how states express their diplomatic positions. These tools not only measure the positive or negative sentiments conveyed but also help understand the broader geopolitical context by identifying the nature of diplomatic discourse by visualising the raw data.

The methodological notes outline a structured, three-tier approach to data analysis, which includes Index Level, Score Level, and Data Level. This methodology ensures that every piece of information, whether textual or numerical, is standardised and analysed with precision. The statistical models used are science based, allowing for robust evaluations and comparisons across different datasets and timeframes. This approach not only enhances the traceability and reliability of the findings but also sets a standard for future research in the field of international relations analytics. By incorporating various sources such as UN voting records and speech transcripts, GINA Diplomatic provides a rich dataset for ongoing and future geopolitical analysis.

1. Introduction

In an ever-evolving global landscape, the Hague Centre for Strategic Studies (HCSS) remains at the forefront of pioneering research into the intricacies of global, monadic, dyadic, and network relations within the geopolitical domain. Our Geopolitical Interactive Network Analysis (GINA) initiative aims to transcend the limitations of traditional, material-based analyses, shedding light on the nuanced tapestry of relational power dynamics that define our world.

This codebook serves as a cornerstone of our analytical framework, providing a categorisation of various data series. By examining the intertwined layers of voting and speech variables derived from UN data, we strive to construct both a comprehensive and quantitative overview of index and score variables. The codebook encapsulates our innovative approach to measurement, advocating for a dynamic methodology that reflects the geodynamics of international relations. By integrating considerations such as proxy actors, statistical rigour, and standardisation, we enhance the precision and depth of our analysis[1].

GINA Diplomatic is the inaugural installment of our series of interactive network analysis tools, which also includes *GINA Economic* (released July 2024), *GINA Military* (scheduled for August 2024), and *GINA Information* (scheduled for September 2024). These tools are slated for deployment later this year.

In the following sections, the reader will find a detailed description of our data series, variables, and estimation methodologies for GINA Diplomatic. Our measurements are structured into three distinct levels to enhance the precision and traceability of our analysis:

1. **Index Level:** We focus on the aggregation and normalisation of scores, facilitating comparative analysis across various datasets and temporal frames. This provides a standardised framework for interpreting raw scores within broader patterns and trends.
2. **Score Level:** Involves quantitative evaluations derived directly from our data, representing specific measurements or calculated values essential for constructing indices.
3. **Data Level:** We handle both textual and numerical information, collected from diverse sources.

This foundational work lays the groundwork for our open source suite of tools, each designed to bring a deeper understanding of their respective domains through network analysis techniques.

[1] This is the first version (Version 1.0) of GINA Diplomatic, and it is currently in its beta phase. Therefore proxy actors, statistical rigour, and standardisation have not been fully integrated in the analysis yet.

2. Voting Variables

2.1. Ideal Points Index

Category: Voting
Type: Numeric
Unit: Score
Source: Voeten et al. (2013) and UNVD

Description: A measure of voting behaviour of states in the United Nations General Assembly (UNGA). The ideal points are state and session specific numeric estimates for the voting behaviour. If states have a similar voting ideal point, their voting is similar and vice versa. We use the absolute distance between ideal points (for every session) to judge how a state's voting changes over time. The ideal point vector θ_{it}, for a state in a given year, is estimated using the statistical model below.

$$Z_{itv} = \beta_v \theta_{it} + \epsilon_{iv}$$

- Z_{itv} is the preferred vote of country *i* in a given year for a certain vote *v*.
- β_v is the 'discrimination parameter' for vote *v*.
- ϵ_{iv} is the random normal error term, N(0,1).

Each vote has three options: yea (Y=1), abstain (Y=2), or nay (Y=3). The observed choice variable Y_{itv}then is the observed vote, dependent on Z_{itv} and the cut-off points to get yea, abstain or nay, namely Y_{1v} and Y_{1v}. Hence we get:

$$Y_{itv} = 1 \quad if \quad Z_{itv} < Y_{1v}$$
$$Y_{itv} = 2 \quad if \quad Y_{1v} < Z_{itv} < Y_{1v}$$
$$Y_{itv} = 3 \quad if \quad Z_{itv} > Y_2$$

We can model the vote with the formula below, which is the probability that country *i* votes in year t in the vote *v* for *k*. This allows us to use our voting data to find the ideal points θ_{it}. For more details, see Bailey et al (2017).

$$\mathrm{P}(Y_{itv} = k) = \Phi(Y_{kv} - \beta_v \theta_{itv}) - \Phi\left(Y_{k-1,v} - \beta_v \theta_{itv}\right)$$

2.2. Voting Similarity score

Category: Voting
Type: Numeric
Unit: Score
Source: Voeten et al. (2013) and UNVD

Description: A measure of voting behaviour of states in the United Nations General Assembly (UNGA). The similarity score is a dyadic property, defined as the number of UNGA votes in which two states vote the same minus the number of times they vote differently, normalised. Voting the same happens when two states either both vote yea or nay or abstain; voting differently happens in all other cases. If a state is not present at a vote, it is not calculated. The Voting Similarity (S)-score can be calculated with the formula below.

$$VS - score(i,j) = \frac{similar\ votes(i,j) - different\ votes(i,j)}{similar\ votes(i,j) + different\ votes\ (i,j)}$$

2.3. Community score

Category: Voting
Type: Numeric
Unit: Score
Source: Newman (2011) and UNVD

Description: Community modularity measures the density of edges inside communities compared to edges between communities. High modularity indicates dense connections (blocks) within communities and sparse connections between them.

This measure finds communities in a graph G using the Clauset-Newman-Moore greedy modularity maximisation method. It begins with each node in its own community and iteratively joins communities to maximise modularity, stopping when no further increase is possible. Modularity is defined using the resolution parameter γ, which affects the size of the resulting communities. The function allows control over the community merging process with parameters like cutoff, enabling early termination or continuation beyond the modularity peak to achieve a desired number of communities. The modularity Q can be expressed as:

$$Q = \sum_{c \in C} \left[\frac{e_c}{m} - \left(\frac{k_c}{2m} \right) \right]^2$$

- C is the set of communities.
- e_c is the number of internal edges in community c.
- kc is the sum of the degrees of the nodes in c,
- and m is the total number of edges in the graph.

2.4. Centrality score

Category: Voting
Type: Numeric
Unit: Score
Source: Newman (2010) and UNVD

Description: The average degree centrality represents the average number of connections per node in the network. This measurement indicates how interconnected the typical node is within the network, reflecting the network's overall density and connectivity. The degree centrality for a node in a graph G is determined by the number of edges connected to the node. The function calculates the average centrality across all nodes in the graph. The centrality C can therefore be expressed as:

$$C = \frac{\sum degrees}{n}$$

- $\sum degrees$ is the sum of the degree of all nodes.
- n is the number of nodes in the network.

2.5. Voting data

Category: Voting
Type: Numeric
Unit: Data
Source: UNVD

Description: The United Nations General Assembly Voting Data (UNVD) comprises a dataset of roll-call votes during the General Debate from the inaugural session in 1946 (Session 1) through to 2022 (Session 77). Based on this voting data, we extracted votes from a given country regarding a specific resolution. Each of these resolutions has a resolution type that is part at maximum one of the following categories: economic, nuclear weapons, arms control and disarmament, human rights, colonialism, Israel Palestine conflict.

Based on a country's position regarding a specific resolution, they can either vote yea (agree), abstain (abstention), or nay (disagree). If a country did not participate in a voting, for example if the country did not exist at the time of voting, the voting contains an empty value. Ultimately, each unique vote is characterised as follows:

$$Vote\ (C, T, V, P)$$

- A is the country delivering the vote.
- T specifies the type of vote based on the categorisation.
- V indicates the vote, being either, yea, abstain, or nay.
- P indicates whether a country participated in voting.

3. Speeches variables

3.1. General sentiment score

Category: Speech
Type: Numeric
Unit: Index
Source: UNGDC

Description: This score measures the tone and use of language in diplomatic statements on a global level during public speeches of the UN general debate. It is based on the amount of positive mentions minus negative mentions divided by total mentions, including neutral. Further away from zero implies more negative or more positive overall sentiment. The General Sentiment Index (GSI) can be calculated with the formula below:

$$GSI = \frac{Number\ of\ Positive\ Mentions - Number\ of\ Negative\ Mentions}{Total\ mentions}$$

- Number of Positive Mentions is the count of all positive statements regarding other states.
- Number of Negative Mentions is the count of all negative statements regarding other states.
- Total Mentions includes all mentions (positive, negative, and neutral).

These sentiments are found by going through the speeches sentence by sentence and analysing the sentiment using a sentiment analysis NLP model by Cardiff NLP called Twitter-roBERTa-base. Next to that, we use a GPE (Geopolitical Entity) detection model by SpaCy that identifies which sentences contain mentions to states. These two datapoints were combined to retrieve the amount of mentions of a state for a given sentiment. This method is not without fault and can occasionally assign the wrong sentiment to a statement. The sentiment should also not be interpreted as an 'opinion', but rather as a general tone of the context in which a state is mentioned.

Current known weaknesses:

- For most states that have existed in the past but do not anymore, the model is less accurate at detecting them as geopolitical entities. Therefore, for years especially before the Cold War, this should be taken into account. An improvement will be to use a custom state-detection model.
- In this first iteration, we are defining a mention to be positive, negative or neutral if the probability that the NLP model outputs of that sentiment is the highest of the three. A better approach will be to use the raw probabilities for positive, negative and neutral sentiment in this score and not just the sentiment with the highest probability.
- Visual issue: if multiple states are mentioned in the same sentence, it only highlights one of them in the text.
- The model looks through the text sentence by sentence. This has the benefit of interpretability and simplicity but has the downside of not taking context of a sentence into account at all. If a sentence refers to an actor in a previous sentence, this is not detected. A future approach could include nearby sentences.

3.2. State sentiment index

Category: Speech
Type: Numeric
Unit: Index
Source: UNGDC

Description: This indicator measures the tone and use of language in diplomatic statements of public speeches during the UN general debate. A diplomatic tone can range from cooperative or supportive to confrontational or critical. By analysing tone, we can gain insight into how a state communicates its relationships and positions toward other states and global issues. This includes the use of positive, neutral of negative diplomatic speech. An important note here is that the sentiment is determined by the context of the sentence in which another state is mentioned and does not necessarily show one state's opinion about another. The formula for the State Sentiment Index (SSI) can be calculated with the formula below:

$$SSI = \frac{\sum_{i=1}^{n} s_i}{n}$$

- n is the total number of sentences that mention another state.
- s_i is the sentiment score of the i-th sentence, assigned as +1 for positive, 0 for neutral, and -1 for negative sentiment.

3.3. Text data

Category: Narrative
Type: String
Unit: Data
Source: UNGDC, Slava Jankin,

Description: The United Nations General Debate Corpus (UNGDC) comprises transcripts of General Debate statements from the inaugural session in 1946 (Session 1) through to 2022 (Session 77). We use the raw speeches as TXT files. We also use speeches by non-members. Every speech is split into separated texts chunks by applying sentence splitting. In the analysis, only sentences that contained a state were taken into account.