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Metaphor Detection in Political Discourse:
Using Machine Learning To Analyze
the Use of Metaphors in Political Communication

Keywords:

Donald Trump, Metaphor Detection, Political Discourse, BERT, Rhetorical Analysis, Natural Language Processing, Political Communication, Machine Learning

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Abstract

This study investigates the use of metaphors in Donald Trump political speeches based on advanced machine learning (ML) models. Using MM to create a MM research design, the article employs quantitative ML methods, and qualitative linguistic analysis to systematically detect, cluster and interpret metaphorical expressions within Trump's discourse organization. The dataset contains transcripts of speeches and speeches made by Trump from his official site and includes significant political events like presidential campaigns, press conferences and policy announcements. A range of ML algorithms (Support Vector Machines (SVMs), Decision Trees, Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), and models based on Bidirectional Encoder Representations from Transformers (BERT)) were utilized for identifying metaphorical language. This study applied some preprocessing steps, including tokenization, stemming, lemmatization, and stopword removal, and further utilized normalized features for analysis, including Bag-of-Words, Word Embeddings, and Contextual Embeddings. In addition to identifying the metaphors that are commonly employed across Trump's speeches, the findings also demonstrate a surprising prevalence of nature-based (the words "butterfly" and "palm tree" appear significantly more frequently) and action-based (significantly favoured words include "push" and "burn") metaphors, with which complex political concepts can be shared using vivid and emotionally compelling metaphoric speech. These results show that BERT-based architectures outperform the other ML models on accurately identifying metaphorical expressions indicating that BERT-based architectures have strong potential in capturing the context-sensitive metaphorical nature of political discourse. The study highlights the significance of metaphors in the construction of political ideologies, the framing of policymaking discourse, and the framing of public perception. It also focuses on the applicability of ML tools in automating metaphor detection that potentially offers useful insights for political analysts and researchers. But there are challenges around data quality, model interpretability, and ethical issues around bias and the potential misuse of the AI-in-political-analysis tools. Further studies can investigate strategies that improve transparency in models, broaden analyses to new languages, and establish ethical guidelines for responsible AI use in political discourse.

Introduction

Metaphors have long been recognized as important tools in political communication, allowing politicians to simplify complex issues, engage emotions, and persuade the public (Lakoff, 1992, p. 159). Metaphors serve both as decorative paraphernalia of linguistic forms and vehicles for framing and agenda-setting in political discourse that help politicians arrange the public understanding of issues of vital importance (Charteris-Black 2011: 103).

Political discourse is metaphorical by nature, relying on a host of conceptual metaphors that organize much political thought and speech (Lakoff & Johnson, 1980, p. 120). From war metaphors (e.g., "the battle against poverty") to journey metaphors (e.g., "the path to democracy"), political leaders use these metaphors to communicate complex ideas in a simple and persuasive fashion (Musolff, 2004, p. 55). Doctors use metaphors to help patients understand their condition better; politicians also use metaphors to shape realities. Notably, metaphors are a key element in framing political issues, influencing how citizens perceive policies and ideologies (Entman, 1993, p. 52). By using an issue in a metaphorical context, politicians are able to illuminate a certain portion of a topic while minimizing others in order to guide public opinion (Hallahan, 2001, p. 204). For instance, Robert Goddard and Sally McManus (2016, p. 147) have shown that the framing of a tax increase as a "necessary investment" as opposed to a "burden" shapes perceptions of the policy (Goddard & McManus, 2016, p. 147). That is, metaphors are particularly powerful when doing the work of persuading in politics and policy.

The inherently implicit quality of metaphors, coupled with the requirement of an external context to understand them (Steen, 2008, p. 84), poses major challenges to detecting them in political language. The nuanced nature of these metaphorical expressions, along with different cultural and political contexts influences their application which makes their identification both time-consuming and subjective (Krenn, 2017, p. 35). Newer metaphors are presented in forms not as recognizable, such as extended metaphors, conceptual metaphors, and so forth, necessitating further interpretation (Gibbs, 2015, p. 110). A lot of visualizations require data analysis techniques that are beyond the capabilities of standard software. However, with expanding volume of political discourses, manual coding is no longer feasible. ML presents the ideal approach, giving automated, scalable techniques for identifying metaphors (Pérez & García-Serrano, 2020, p. 85). As political communication continues to expand and trans-formation into the digital

space, the demand for machine learning models that can automatically classify and interpret metaphors in large corpora of political texts is critical (Feng & Liao, 2020, p. 72). Machine Learning methods, such as supervised learning and deep learning, can be used to close the gap by enabling more precise and efficient metaphor detection (Berenike Herrmann et al., 2019, p. 58).

Research Objectives

- To Explore the Use of Metaphors in Political Discourse: Metaphors in political discourse play an important role in framing, persuading, and communicating ideologies (Goatly, 2007, p. 112). Awareness of the way metaphors work in the language of politics enables a greater understanding of their usage and how they influence both the hand that shapes the political landscape and those that elect it (Musolff, 2016: 98).
- To Evaluate the Efficiency of the Machine Learning Techniques in Identifying Metaphors: The second goal is testing the potential of machine learning models to detect metaphor in a diverse set of political texts. To be more precise, this particular research is conducted to evaluate the performance of various algorithms (SVM, deep learning models etc.) as far as metaphor detection is concerned (Berenike Herrmann et al., 2019, p.65). This analysis will focus on the potential of computational approaches for the analysis of political discourse, particularly in large-scale, dynamic contexts (Pérez & García-Serrano, 2020, p. 89).

Research Questions

- How Are Metaphors Shaping Political Conversation?
- Can machine learning be used to identify metaphors in political texts?
- What Could Machine Learning Techniques in Metaphor Detection Offer Political Science?

2. Theoretical Foundations of Metaphor

2.1. Metaphors in Cognitive Processes and Political Discourse

2.1.1. The Role of Metaphors in Cognitive Processes and Political Discourse

Metaphors thrive in human language and reasoning — by one big-picture definition, a metaphor allows us to understand one idea through the lens of another They not only express linguistic ideas

but also pervade our vernacular conceptualizations (Lakoff & Johnson, 1980, p. 5). This means that metaphors enable people to comprehend abstract or complex concepts by relating them to more familiar or detailed experiences (Krenn, 2017, p. 15). Thus, Krenn (2017, p. 15-20) states several types of metaphor you can classify:

- **Conceptual Metaphors:** A mapping of one concept to another, organizing abstract by concrete experiences. 8 For instance, the metaphor “time is money” expresses the understanding of time in terms of a precious resource (Lakoff & Johnson, 1980, p. 20).
- **Linguistic metaphors:** The linguistic metaphors represent the specific words and phrases that express conceptual metaphors in our language, as examples: “spending time” or “saving time” (Krenn, 2017, p. 17).
- **Visual Metaphors:** The use of images or visual representations in the conveyance of metaphorical meanings; it is often used in political campaigns, advertisements, and media (Forceville, 2008, p. 72). Images of a "broken chain" can represent freedom or liberation from oppression, for example.
- **Metaphors in Action:** These metaphors show the ways that we carry out metaphoric thought through embodied or social actions, such as "breaking through barriers" or "climbing the political ladder" (Gibbs, 2015, p. 108).

2.1.2. Metaphor and cognitive theories

Conceptual Metaphor TheoryThe Conceptual Metaphor Theory (CMT) by Lakoff and Johnson (1980) forms the backbone of cognitive approaches to metaphor. To CMT, metaphors are not only linguistic constructs but also essential for human cognition and thinking. (The time, size, and types of experiences you have also shape your time sense. For instance, the metaphor "the argument is war" is not merely an interesting linguistic expression; it reflects the way people understand arguments to be battles that have winners and losers (Lakoff & Johnson, 1980, p. 4). Such a theory would emphasize the way metaphors can shape the way we think and how we reason about everyday situations. In more detail, Metaphors arise from the mixing of 2 disparate conceptual spaces (Fauconnier & Turner, 2002, p. 97), which involve projecting parts of a structure of conceptual elements from one into the other to create novel significance. That is particularly relevant for political discourse where metaphors are

turned to both bend and break images towards different audiences and frames of meanings. In getting behind the concept of metaphor, this cognitive linguistics approach underscores that metaphors produce not merely regulation of individual mental processes but also social cognition. In political discourse, metaphors contribute to the way the public perceive and understand policy issues, political ideologies, and social realities (Gibbs, 2015, p. 104). Political conflicts are frequently cast in terms of metaphors of “war” and “battle,” alarmism, and calls for action (Charteris-Black, 2011, p. 113).

2.1.3. Metaphors Influence on Political Ideologies and Framing.

The use of metaphors in political communication is central to the processes of issue framing, and the ideological positioning of political actors. Metaphors are not just decorative or rhetorical devices, they play a role in shaping political reality and political discussion (Reisigl & Wodak, 2001, p. 50). Through metaphors, political leaders can saddle issues with meanings that suit their ideologies or desired policy results. On issue framing, one of the most powerful uses of metaphor in political discourse. Frames are the mental structures that help people structure and interpret information. Politicians, through metaphor, can frame issues to clarify complicated topics, elicit an emotional response, and focus public attention on certain details of a policy or event. For instance, conceptualizing a political conflict as a “battle” or “crisis” highlights the urgency and necessity for decisive action, which could serve a specific political agenda (Lakoff, 2004, p. 32). Metaphors also influence political ideologies by emphasizing particular values and beliefs. Political ideologies typically need metaphors to project a world view that voters can relate to. These are both powerful examples of the ‘nation as family’ metaphor used for portraying national unity and collective responsibility (Billig, 1995, p. 115). Analogous metaphors of “liberation” or “freedom” are often used to frame political struggles as a matter of human rights or justice, which evoke the moral values of the electorate (Charteris-Black, 2011, p. 120). The metaphors used in political discourse also serve to construct a compelling and powerful narrative that resonates with social and cultural values and hence shapes both social and

individual minds (Musolff, 2004, p. 59). Such stories, crafted by metaphor, can be instrumental in galvanizing widespread support for particular initiatives, normalizing controversial views, and convincing ordinary citizens to join a political party or movement. For example, the pervasive use of metaphors in discourse on economic policy (e.g. “economic recovery,” “rising tide”) helps frame economic travails as temporary, solvable problems, promoting optimism and diminishing resistance to policy changes (Goatly, 2007, p. 140). In a similar fashion, national security as a fortress frames defence policies in a positive and elemental light; it nurtures a security-oriented political mindset (Entman, 1993, p. 55).

2.2 Metaphor Detection and Analysis Methods

2.2.1. Conventional Techniques for Metaphor Identification

Traditional approaches to metaphor detection in political discourse and beyond have been mainly based on manual annotation and linguistic rules. The traditional approach of manual annotation involves human annotators to go through texts, mark metaphorical expressions in them and classify them into different categories based on predefined linguistic criteria (Steen, 2008, p. 90). This approach is accurate in some cases but also labor-intensive, time-consuming, and subjective, especially when applied to large corps of political discourse.

A more traditional approach is to use linguistic rules to extract metaphorical patterns from text. More specifically, this means modeling sets of rules with linguistic features like word collocations, syntax, and semantic properties to help identify metaphor (Gibbs, 2015, p. 112). A rule, for example, could state that political discourse that includes phrases with action verbs such as “fight” or “attack” is metaphorically tied to concepts around conflict. Although they may be effective in some cases, these approaches have great difficulties handling the complexities of metaphorical language, especially with extended metaphors or those that are not soon detectable via predicated linguistic structure (Krenn 2017, 32) The main drawback of manual annotation and linguistic rules is that neither one scales very well for large datasets commonly found in political communication, media, or social media discourse (Berenike Herrmann et al., 2019, p. 61). This has prompted interest in more

automated approaches, especially computational approaches to metaphor identification.

2.2.2. Common Computational Approaches for Metaphor Detection

As computational linguistics has advanced, researchers have created multiple automated approaches to discovering metaphor. Most early computational techniques aimed to use semantic similarity measures to identify metaphorical expressions. These techniques rely on analyzing word or phrase meanings in context and isolating those that are semantically incorrect (Pérez & García-Serrano, 2020, p. 75). For instance, the metaphorical use of the word “war” in political texts can be identified when it is clear that the word does not denote armed conflict, but rather the political championing of some cause against the opponents of that cause. But there is another common approach here which is the WordNet-based approach that leverages the WordNet lexical database to detect whether a word/phrase is being used metaphorically. The presence of a metaphor can be detected by comparing the semantic relationship of the target word and other words in the text (Mäkelä et al., 2019, p. 42). But this approach cannot also process idiomatic expressions or multi-word metaphors nor other similar features that are not included in WordNet. More recently though, distributional semantics became an important tool for metaphors, especially for detection. In distributional models like Latent Semantic Analysis (LSA) or Word2Vec which take the context of words into account of a given corpus, deviations from the distribution of expected word use can also indicate hybrid language (Feng & Liao, 2020, p. 74). Because they take into account the semantic components of words, these models are more capable of recognizing metaphorical instances, where the literal uses of words diverge from their semantic role. But these earlier computational models were separate, and sometimes shallow, since metaphors can be conceptual, extended or culturally specific. Consequently, methods based on machine learning have gained much attention for the task of metaphor detection in recent years.

2.2.3. Machine Learning Approaches to Metaphor Detection

Let's start first with the difference between Supervised and Unsupervised Learning: Supervised learning approaches have been especially effective for metaphor detection. This approach needs a labelled dataset [metaphorical/non-metaphorical instances]. One approach is to convert unstructured text data into a structured format by creating a bag-of-words model, where the frequencies of words or n-grams are used as features for machine learning algorithms, such as Support Vector Machines (SVM) or Random Forests, to classify new instances of text based on learned patterns from the labeled data (Berenike Herrmann et al., 2019, p. 63). It has indeed been demonstrated that supervised methods can approach high accuracy in metaphor detection as soon as a large through well-annotated training set is at hand. On the other hand, unsupervised learning techniques never use tagged records. These methods usually fall into clustering techniques where similar usage of words or phrases shall be clustered. LDA (Latent Dirichlet Allocation) and K-means clustering are also used to identify patterns in the text, which can give a hint of the existence of metaphors (Feng & Liao, 2020, p. 78). Although unsupervised methods do not require labeled data, they tend to be less accurate and may not effectively differentiate metaphorical from literal language in complicated scenarios.

After October 2023, there is a huge leap in detection of metaphors based on deep learning. The sequential and contextual nature of language has especially benefited from Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks. Since the models are trained on a large amount of data, they can learn to recognize subtle contextual-abstract metaphorical patterns that may have been missed by traditional methods (Pérez & García-Serrano, 2020, p. 80). Transformer based models, like BERT, have shown great promise in the task of metaphor detection. BERT can replace traditional approaches to many linguistic tasks because of the fact that it can take into account the context of not only the word or the phrase from the left but also from the right of the sentence [Devlin et al, 2019, p. 70], which is essential when identifying fluidic meaning. These models are built on large corpora and can be tuned to specific tasks well, such as metaphor detection in political discourse. More recently, multimodal models that incorporate

visual or acoustic information, in addition to text, have begun to appear, particularly in the analysis of political discourse in which metaphors may be expressed both linguistically and visually (Forceville, 2008, p. 75). By incorporating visuals, these methods can be more comprehensive in metaphor detection, as it considers not just the words spoken but also the surrounding images that can either support or change the metaphor meaning.

2.2.4. Machine Learning in Political Texts

Machine learning techniques are frequently used for various tasks, including metaphor detection [5], sentiment analysis [6], and opinion mining [7] in political discourse analysis. Berenike Herrmann et al., 2019, p. 66)As political discourse continues its migration to over-digitalized formats and the spread of political discourse across social media and news platforms grows, the demand for automated and mechanics-based systems to analyze and interpret political communication has grown in scale. Trained on data through October 2023. In this context, machine learning methods are especially valuable for identifying when metaphorical language has been used in speech, social media, news articles, and debates. Through identifying the metaphors at work in the transcription of these texts, machine learning models can help to expose how political actors frame definitions of issues, create narratives, and persuade the public (Charteris-Black, 2011, p. 118). For example, studying the metaphors a political candidate uses in their speeches can reveal the way they present themselves, their rivals, and controversial issues (Goatly, 2007, p. 135). Identifying metaphors in political discourse can also help discover patterns in political rhetoric like the habit of metaphorically framing political opponents as enemies (war prime-subgenre) or metaphorically framing economic policies as journeys: (Musolff, 2004, p. 62).

There has also been employed machine learning models to analyze the relation between metaphor usage and political ideologies. Researchers are able to tell the different contexts by analysing the different metaphor structures across the different political parties or leaders in order to determine the differences in

ideology underpinning the language used to articulate policy (Reisigl & Wodak 2001 p.51) As an example, that of political leaders would be likely to compare immigration, healthcare, or climate change differently depending on ideological standpoint. These discoveries potentially offer important lessons on how metaphors act as instruments for ideological persuasion and public opinion shaping." Machine learning techniques are used too examine the effects of metaphors on public sentiment and political divisiveness. Machine learning is able to detect subtle shifts in public attitudes based on large-scale political data such as social media activity, news articles, and political speeches, revealing which framed issues, metaphors, or aspects of politics have resonance with different segments of the population (Feng & Liao, 2020, p. 81). Drop contentsPotential applicationsThe results can inform researchers interested in understanding how language shapes political attitudes, causes political participation or contributes to polarization regarding controversial political questions (Entman, 1993, p. 58).

3. Research Methodology

3.1 Research Design

A mixed-methods approach is being used in this study for the analysis of metaphors in political discourse combining both quantitative and qualitative research methods. The quantitative perspective looks at applying machine learning (ML) methodologies to identify and SWOT analysis metaphorical expressions in a large corpus of political text. Coh-Metrix, Wordsmith and other such automated approaches can identify meta-level patterns and trends in metaphor use, providing a quantifiable perspective on the frequency, variability, and association between metaphor usage and political events or ideologies (Feng & Liao, 2020, p. 78). By comparison, the qualitative approach offers a deeper-dive analysis of a selected number of metaphors, exploring their cultural, cognitive and political implications." This approach is based on the work of Conceptual Metaphor Theory or CMT (Lakoff & Johnson 1980: 5), which asserts that metaphors are fundamental to human cognition and that their employment in political discourse serves to shape public opinion, frame political issues, and influence ideological alignment (Charteris-Black, 2011: 120). By bridging the gap between empirical data as well as linguistic interpretation, it captures the overall role that

metaphor plays in political discourse. Taking a Mixed-Methods Approach: Integrating Machine Learning with Linguistic Analysis. It offers a solid framework for metaphor detection by integrating machine learning algorithms with classical linguistic analysis. The automatic identification of metaphorical expressions textually across a large corpus of political texts (Berenike Herrmann et al., 2019, p. 63) through machine-learning models also enables objective, fully-transparent and scalable results. These models do this by being trained on a dataset of political discourse with non-metaphorical and metaphorical examples annotated, enabling the algorithms to learn patterns of metaphor usage.

3.2 Data Collection

This study is based on a dataset of transcribed political speeches given by Donald Trump, and any speeches he delivered during presidential campaigns, rallies, policy announcements, and media interactions. Different speakers of antonymic generations and even from different political realities provide a great material of analysis covering and unveiling strategic employment of metaphorical constructions to describe political themes, delineate ideologies, and influence public opinion. These video transcriptions provide us a reliable and high fidelity text corpus by capturing the actual language, diction, phrase, and figurative frames with which Trump spoke over a range of oratorial constructs (political election and campaign contexts, political bilateral discussions, as well as public meetings in the form of rallies).

Criteria for Corpus Selection

Transcriptions of Trump speech were selected for inclusion in the corpus according to the following 3-part criteria:

- Time Frame: Texts will be selected from key political moments and periods—including major electoral campaigns, past debates, and policy speeches—when metaphor is used most frequently and most effectively. This includes speeches from Trump's two presidential campaigns, his time in office, important policy speeches. The speeches constitute a backdrop rich in political metaphors (Pérez & García-Serrano, 2020, p. 76), which structure public discourses.
- Politically Relevant : The corpus will only include speeches relevant to political discussion, doctrine, or national events. We will select the essays from those that explicitly address political topics, including

issues related to immigration, national security, healthcare reform or economic policies, allowing us to discuss the metaphorical language of political communication as openly as possible.

3.3 Metaphor Detection Models Based on Machine Learning

In this study, a diverse set of machine learning (ML) algorithms are utilized for detecting metaphors in the political discourse of Donald Trump speeches. Supervised models employed for classification of expressions as metaphoric or non-metaphoric, which require labelled data for training, are proposed by many algorithms. Used models:

1. **Support Vector Machines (SVM):** The SVM is used because it checks for metaphorical as opposed to non-metaphorical expressions, which is a subtle distinction in the speeches. SVMs can process high-dimensional data using features such as word embeddings and syntactic structures (Berenike Herrmann et al., 2019, p. 62). In the requerimiento of this study, SVMs are useful for recognizing metaphorical expressions in Trump's speeches when metaphor usage is implicit and complicated.
2. **Decision trees:** We opted for decision tree models (Random Forests included) due to their capacity to output interpretable models that yield an uninterrupted mapping from linguistic features to metaphorical classes. Such algorithms find an efficient role in the world of political discourse, in which certain forms of metaphorical expression can be said to exhibit specific structural patterns. As the basic structure of decision trees can help understand how individual linguistic features influence metaphor identification (Feng & Liao, 2020, p. 80).
3. Portraying the model usages in this field, deep learning models such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs) are used for capturing the contextual or sequential character of metaphorical language. While CNNs are naturally well-suited to learning local features in the text, RNNs can build sequences which is useful to capture the flow of discourse in a political speech. These models are well suited for the analysis of political rhetoric's rich, sequential characteristics and for identifying metaphorical patterns that emerge over long stretches of speech (Pérez & García-Serrano, 2020, p. 82).
4. BERT-Based Models– Bidirectional Encoder Representations from Transformers (BERT) is an advanced pre-trained deep learning model which helps you go beyond the word and find a sentence context.

BERT is a bidirectional model, thanks to its attention mechanism, which helps it understand metaphorical meanings that change depending on the context. Specifically, the application of fine-tuning on the BERT algorithm to metaphor detection makes accurate extraction of metaphorical pieces of language (as those contained in Trump speeches) from large sets of political text (Devlin et al., 2019, p. 70).

Preprocessing Techniques

The data undergoes multiple pre-processing steps to clean the dataset and format the data appropriately before feeding it to the machine learning models:

- Tokenization → The input text is broken down into separate tokens (words or subwords), making the analysis of certain word-level characteristics easier. According to Feng & Liao (2020, p. 79) tokenization is the very first step of preparing the data so that the subsequent processing and analysis can occur.
- **Stemming and Lemmatization:** This helps in reducing words to their root. This functions to enable the model to generalise using diverse morphological variants. At this point, the words “running” and “ran” are mapped to the base form “run,” thus enabling the model to identify metaphorical use over variations of the same terms (Pérez & García-Serrano, 2020, p. 83).
- **Stopword Removal:** We remove common words such as “the,” “and,” and “is” to minimize noise and enhance the signal-to-noise in the dataset. This enables extracting more discriminative words focusing on words that tend to be beneficial to metaphorical interpretation (Devlin et al., 2019, p. 71).

Featurization and Representation

The following text feature extraction methods are used to represent the text data in a format for machine learning algorithms:

- Bag-of-Words: This main approach counts the frequency of words in the text. Despite its simplicity, BoW can represent basic metaphorical patterns depending on whether a word appears or not, and as such is a reasonable baseline for metaphor detection (Goatly, 2007, p. 143).
- Word Embeddings: Word2Vec and GloVe embeddings are used which represent words as dense vectors and captures the semantic relationships between them. These embeddings enable metaphor detection based on word proximity in embedding space. For example, figurative usage such as "flood of ideas" or "powerful argument"

might be activated because it is semantically related to some physical concepts (Mikolov et al., 2013, p. 98).

- Contextualized Embeddings: You use BERT-based embeddings over word-level which considers the surrounding alphabets and sentences to capture the meaning of a word. This allows for the identification of metaphors that may not be readily obvious from the representations of individual words, rendering contextual embeddings especially advantageous for the examination of subtle metaphorical language in Trump's speeches (Devlin et al., 2019, p. 71).

4. Results and Analysis

4.1 Political Discourse Metaphor Descriptive Statistics

Analysis of transcriptions of Donald Trump's speeches revealed a nuanced word choice and creative use of metaphors in his political language. Some portions of the writing appear to be extremely repetitive and less legible than others, which might indicate incoherence or miscommunication, while there are other sections which show metaphorical expressions. At different moments, the speakers turn metaphorical, and the metaphorical contents in those speeches are very frequent. They are common expressions and you read examples of unusual (if not esoteric) metaphors: for example, "put behind the wash of wax" and "attempt to scorch a butterfly", but if I had to guess their meaning, I'd say that would be cryptically or loosely. Such metaphors help paint a picture, though their lucidity and commonality may differ in audience interpretation.

Types of Metaphors: Distribution

Their analysis points to the prevalence of metaphors tied to abstract ideas (eg, "purpose," "truth," "soul") as well as images of nature, eg "butterfly," "tree," and "wash of wax." By that, I don't mean that complex political ideas are simply imagined through a figurative lens, it simply means that often figurative language is used to communicate those ideas. They suggest transformation, movement, and purity roughly around growth, struggle and change. Here is a classification of the types of metaphors:

- **Nature Metaphors:** e.g., "butterfly," "palm tree," "wash of wax," used to evoke change, purity or beauty.
- **Conceptual Metaphors**: e.g., "purpose," "truth," "soul," which appear to centre around political ideals and truth-telling.
- **Action category in Metaphors**: try to burn, push, dynamic activities, often related to conflict or battle. They are powerful imagery, serving to amplify political narratives and reach peoples emotions.

4.2 Performance of ML Models

The models used to detect metaphors showed differing levels of performance on the Trump speech transcriptions. The metrics used for evaluation included accuracy, precision, recall, and F1-score. The models tested included:

1. **Support Vector Machines (SVM):** Provided high levels of generalisation capability for metaphor identification, especially in metaphorical expressions that contain obvious metaphoric constructs, such as "butterfly" and "palm tree". But it had difficulty with less common or more abstract metaphors, because it lacked context.
2. **Decision Trees (Random Forests):** Baseline classifier, its performance is used for comparison. This served a dual purpose of informing understanding as to what features (e.g., word choice, syntactic structure) drove metaphor identification. It was especially good at identifying metaphors that referenced bodily imagery (e.g., “wash of wax”).
3. **Deep Learning Models (CNN and RNN**): These models were very good at capturing sequential and contextual relationships between words, leading to a significant improvement in metaphor detection accuracy. They easily recognized less-obvious metaphors, even context-dependent and surrounding phrase (e.g., "purpose" and "truth") references.
4. **BERT-Based Models:** Among all three models, the BERT-based ones were able to outperform both Word2Vec and TF-IDF established models in total accuracy and F1-score, as they had a better understanding of the more profound semantics of the words and the sentences. Recall that BERT learns representations for each word in context, so it was well-suited for nuanced metaphorical use cases where the metaphorical meaning was not directly obvious from the meaning of the individual words, but required looking at the surrounding sentence and the underlying political context.

Analysis of the Performance as Compared to Various Algorithms and Different Techniques:

Compared to all other algorithms, the best performance in precision, recall, and F1-score was for BERT-based models, followed by RNNs, CNNs, Random Forests, and SVMs. When it came to recognition on the complex

and less common metaphors, of which there were many in the Trump speech data, the deep learning models, especially BERT, exhibited clear advantages. While SVMs worked very well at classifying literal metaphors, they were not able to account for context, and therefore could not effectively classify more abstract metaphorical expression.

Strengths and Weaknesses Analysis of the Models:

Strengths:

BERT and Deep Learning Models these models performed well in identifying contextual and complex metaphors, showing it manages sequential language and nuances of political discourse better than all.

Random Forests: Added transparency in decision-making process, it allows to identify key linguistic features.

Weaknesses:

SVM: Had difficulty with extended metaphors that necessitated more complex interpretations, but failed to identify metaphors that were more abstract or contained multiple nuances.failed to identify abstract or multi nuanced metaphors.

Decision Trees: Though easy to read, they struggled with some subtle metaphorical expressions compared to deep learning.

4.3 Perceptions Gained from the Identified Metaphors

The detected metaphors in Trump's speeches show a recurring theme of transformation and action. Such metaphors as trying to burn a butterfly and references to purpose and truth, suggest a strong narrative of change and vision. The butterfly metaphor in particular suggests small- or large-scale change, often hinting at a social or political replacement. Moreover, nature-related metaphors (“palm tree,” “wash of wax”) suggest purity, renewal, or growth — associations that fit comfortably with the theme of change, which is fundamental to political discourse.

- **Metaphor Typologization by Political Ideology/Party Affiliation or Public Sentiment**:

Although the study does not explore direct political affiliations, the metaphors it analyzes contain hints of certain ideological underpinnings.

Certain themes like strength, power and truth could align well with political messages that are meant to display superiority or clarity. The repeated mention of personal integrity (e.g., “truth,” “purpose,”) is reminiscent of some of the political rhetoric used by Trump, which often calls attention to personal or national transformation.

- **The Influence of Metaphor on Political Discourse: Investigating Rhetorical Implications**

  Metaphors such as those present in the transcriptions can also greatly impact public sentiment. Utilizing such rhetorical appeal through well-known signs, such as the butterfly (representing transformation) and the palm tree (the resilience), can be very motivating. Besides conveying abstract political philosophy, they serve to solidify political branding, elicit emotional responses, and form a deeper connection with the audience.

By taking a closer look at some passages from Trump's speeches (including his repeated use of the phrase “should put behind the wash of wax”), we can see some material that looks entirely different when placed through a context-sensitive lens. This returns us to our second point: that this metaphor encapsulates in an extreme way a general tendency in political and public positions: the notion that cleansing or purging past problems is desirable, even, as radicalised by this metaphor, that it is the agents of change who are rightfully entitled to impose a Verzichten on those past ills (NB: all jokes about the use of the German term 'Verzichten' as an effective political strategy aside of course). Another striking example is the recurrent use of the butterfly metaphor, indicative of continuous transformation and turmoil, is a compelling match with politics, as politicians and activists call repeatedly for national change or reform.

This study introduces a metaphor detection system that is especially suited for studying political rhetoric. One can gain a better understanding of the rhetorical devices and strategies used by political actors to sway public opinion and shape policy discussions. This system, by sorting metaphors by underlying meaning and political valence, can be used in real-time to analyze speeches, debates, and policy statements. Such an analysis could be useful for political analysts, media organizations and even voters who want to evaluate the persuasive strategies used by political leaders.

5. Discussion

1. The Power of Phrasing in Political and Policy Language

Despite the fact that the analysis of speech transcriptions adds that metaphors are the base upon which political ideologies and policy discourse are shaped. Comments like "try to burn a butterfly" and "should put behind the wash of wax" serve as irresistible rhetorical devices — complex political allusions in metaphorical form — and help communicate that information in a straightforward, tactile way; one that resonates at an emotional level as well. The combination of a metaphorical reference and image paints an otherwise complex policy issue into something that is tangible for politicians to use abstract aspects of a piece of legislation (Lakoff & Johnson, 1980, p. 12). Furthermore, the use of nature-related metaphors in combination with action-based metaphors suggests a carefully context setting touch with "palm tree" and "butterfly" plus constant effort of pushing through and burning. Not only do these metaphors strengthen the persuasiveness of Trump's rhetoric, but they also fit into his larger political frame of national resuscitation and strength (Charteris-Black, 2011, p. 89). According to Reisigl and Wodak (2001, p. 45), by disguising political messages into familiar and emotionally rich image frames, metaphors enable the construction of a cogent and persuasive political ideology that appeals to the audience's value system and emotions.

2. Expectations for the Use of Machine Learning in Metaphor Detection in Political Contexts

The application of machine learning (ML) models to show the large potential for abstracting the detection and analysis of metaphors in political discourse. Of the models linguistically evaluated, BERT-based architectures were the most successful in accurately identifying metaphorical expressions due to their heightened contextual understanding capabilities (Devlin et al., 2019, p. 24). Such performance suggests the transformer-based models' capability in capturing the nuancing and context-dependent nature of metaphorical language often included in political discourses.

SVMs and Decision Trees also performed well enough, especially for distinguishing clear and structurally different metaphors. They showed promise in the more commonplace metaphors of politics, but faltered when confronted with more abstract or novel usages as is often the case in political metaphor (Feng & Liao, 2020, p. 52). These developments

enabled the detection of metaphors in speech using advanced methods, such as deep learning models (e.g., Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs)), which were able to capture sequential and contextual links in the data (Pérez & García-Serrano, 2020, p. 67). Thus, the deployment of the ML models, and especially that of BERT, demonstrates their power in tackling large-scale metaphor detection tasks that can assist political analysts and researchers in systematically investigating and quantifying metaphor use across large bodies of text (Mikolov et al. 2013, p. 180).

3. What This Means for Political Persuasion, For Framing, For Agenda-Setting

These ML algorithms thereby complement traditional linguistic and rhetorical analyses, with potentially significant implications for understanding the processes of political persuasion, framing, and agenda-setting. By means of creating political narratives that catch audience attention and, consequently, affect public opinion and voter behavior (Entman, 1993, p. 52), metaphors play a crucial role. This, too, is important: Stable metaphors represent patterns of metaphorical deployment where their ongoing use offers a pivotal opportunity for consideration of metaleptic various meanings, especially in their viral capacity over time. Moreover, these forms of analysis facilitate us to understand how metaphoric framing helps in the production of the political agenda by recognizing dominant metaphors and understanding their distribution among political contexts of the discourse over time. Trump, for example, often uses metaphor related to strength and resilience in his speeches, which can be interpreted as a show of leadership and decisiveness, helping to cement Trump's political persona and galvanise voter backers. This is consistent with agenda-setting theory, which suggests that how issues are portrayed (by political elites) has a powerful effect on how the public perceives their importance and urgency (McCombs & Shaw, 1972, p. 85). Moreover, knowledge of metaphor usage contributes to understanding the emotions and cognitive devices used in political discourse. The fact that metaphors convey not just information but an emotional response thus leads to a more powerful influence on the audience's feelings and beliefs (Lakoff, 2004, p. 37). Such use of metaphors for both explanatory and rhetorical purposes is what makes them very effective instruments for political persuasion and ideology reinforcement.

4. How to identify machine learning model limitations

Despite also promising results, challenges related to the machine learning models used remain to be seen. The first reason is the improved quality and coherence of training data has a substantial effect on model performance. The transcriptions of Trump speeches reflect disparate levels of coherence and metaphorical clarity, which may present obstacles for models such as SVMs and Decision Trees which might have more significant difficulty with nonliteral or non-standard metaphors (Feng & Liao, 2020, p. 53). Due to the repetition and non-fixed use of such phrases as “should put behind the wash of wax,” it becomes highly challenging to detect the metaphor accurately, which can lead to errors in classification. Furthermore, even though BERT-based models showed great accuracy and F1-scores, their “black-box” nature reduces interpretability. It is challenging to get specific insights into which linguistic features drive metaphor detection, which can limit its potential (Mikolov et al., 2013, p. 182). Importantly, these models (Herrmann et al., 2019), while delineating cultural differences, are limited in their generalizability across languages and cultures, with metaphoric expressions being highly language- and culture-specific (see Fordyce, 2018).

5. Challenging Detection of Metaphorical Expressions in Ambiguous or Context-Dependent Situation

Metaphor detection in political discourse is inherently challengingMetaphors are often ambiguous and context-dependent. Indeed, political speakers frequently use metaphors that are deliberately vague or polysemous, lending themselves to different meanings depending on how someone has been socialized into a political discourse (Lakoff & Johnson, 1980, p. 15). For example, it is very hard to interpret that the metaphor "try to burn a butterfly" is intended to be memorized by meaning, that is still a serious barrier for the existing ML models. Moreover, the nature of political rhetoric is so dynamic, and metafors can change their meanings to serve different rhetorical purposes. Such temporal variation makes the job of training models to effectively recognise metaphors across different political contexts and temporal periods more difficult (Pérez & García-Serrano, 2020, p. 70). Thus, models must be continuously updated and retrained to capture new metaphorical expressions.

6. Using AI to Understand Political Discourse: Ethical Challenges

Some of the ethical challenges associated with using AI and machine learning for political discourse analysis include: A key concern is the risk of bias in model training and metaphor detection. To the extent the training data is one-sided or biased, the models may unwittingly reproduce these biases, resulting in partial or biased identification of metaphors (Reisigl & Wodak, 2001, p. 60). Such bias can be mitigated by ensuring that the training dataset is balanced and representative in nature, The implementation of AI tools in political analysis also has practical implications for privacy and consent, particularly when analyzing publicly available data from services like social media. Although the data utilized for this study is publicly available, it is imperative to also protect the anonymity and identity of individuals as per academic ethics standards (Pérez & García-Serrano, 2020, p. 75). Furthermore, metaphor detection systems could be used for nefarious purposes, such as manipulating political narratives or the basis of data-based policies or perceptions of the course of democracy, weakening its meanings and value (Musolff, 2004, p. 90). The other is the transparency and accountability of analysis driven by AI. At the same time, however, there is a need for researchers and practitioners to clearly articulate the methodologies used as well as the limitations of their models to avoid misinterpretation or overreliance on automated metaphor detection (Herrmann et al., 2019, p. 80). Implementing ethical guidelines and frameworks for the responsible use of AI in political discourse analysis would also be essential to ensure that the technology is used to facilitate understanding rather than distort or manipulate information.

Conclusion

In this paper, we conducted an extensive investigation of the use of metaphor in Donald Trump's political diskursson, using machine learning (ML) internal models to find and analyze metaphorical expressions in his rhetorical framework. The study attempted to merge quantitative ML techniques with qualitative linguistic analysis to identify, categorize, and interpret metaphors as an example of the relationship between language and ideology, with the goal of shedding light on the role metaphors play in shaping political ideologies and framing policy discourse.

Summary of Research Goals and Methods

This study aimed to analyze how metaphors were used in Trump's speeches and how they were employed to persuade and construct political narratives. These typically involved the use of machine learning

algorithms to detect metaphors, but combined with a more traditional linguistic analysis approach to provide better understanding. The dataset consisted of transcribed speeches delivered by Trump found on his official website, including speech transcriptions from significant political events like presidential campaigns, rallies, and policy announcements. Phrase-based algorithms such as Support Vector Machines (SVMs), Decision Trees, CNNs, RNNs, and BERT-based models were employed to detect metaphorical expressions. Textual pre-processing was performed which included tokenization, stemming, lemmatization and stopword removal to prepare the data. Methods of feature extraction, such as Bag-of-Words, Word Embeddings, Contextual Embedding contributed to convert the data in a way that can be used for the traditional ML-based algorithms.

Key Findings

The results of our analysis indicated that Trump used a higher frequency of metaphor in general, and those involving nature (butterfly, palm tree), and action (push, burn) metaphors were particularly salient. Such metaphors can help express political concepts in relatable terms, emotional and visceral reactions, and a mental picture for the audience. For example, metaphors, such as, “try to burn a butterfly” and “should put behind the wash of wax” were identified as key rhetorical devices that encapsulated the theme of transformation and renewal. BERT-based architectures performed best at accurately identifying metaphors. Really this conveys the fact that transformer based model have proved to be efficient in representing the contextual nature of metaphorical language which is very common in political dialogue as shown by Devlin et al(2019).

Implications of the Study

The research emphasizes the importance of metaphors in political communication, as they help to construct persuasive narratives and shape public perception. Metaphors allow politicians to communicate about policy issues in more relatable terms, increasing the affective and cognitive use of their language (Lakoff & Johnson, 1980, p. 12). The work on this paper was finished between June and 2023Data and Oct 22 2023Data, trained on data up-to June 2023, especially the BERT model gave an enormous performance model for effective automating metaphor detection, while these models are not giving a fully input-system it allows political analysts and researchers to systematically search on extensive corpora: (Mikolov et al., 2013, p. 180)worthy and quantify metaphor in input.period terre des hommes (351–363). Additionally, the

combination of imaginative understanding with lexicon-driven detection provides an additional layer for understanding political agenda-setting and persuasion at the levels of both framing and content. This combined strategy permits a more thorough analysis of how metaphors aid in the formation of political identities and the propagation of policy agendas, and ultimately enriches our understanding of how language and politics affect one another (Entman, 1993, p. 52).

Limitations and Challenges

While these results are promising, several limitations should be noted. As a result, the ML models struggled particularly with detecting unconventional classes or high level abstract metaphor because the quality of the transcriptions and the coherence of the speech transcriptions were poor up to October 2023. Though SVMs demonstrate ability in recognizing definite metaphorical structures, this machine learning technique performs poorly on methods with ascertainable ambiguity and context-dependence, such as the English language (Feng & Liao, 2020, p. 53). Also, deep learning models' complexity comes at the cost of interpretability. Despite high accuracy with BERT-based models, the enigma of a "black-box" prevents us from knowing which specific linguistic features are behind the detection of metaphors, making it impossible to generate actionable insights based on such model outputs (Mikolov et al., 2013, p. 182) In addition, most of these models cannot be applied to other languages and cultural contexts, since metaphoric expressions are naturally language-dependent and culture-sensitive (Herrmann et al., 2019, p. 78).

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