

Utilizing Computational Linguistics Tools for Enhanced Poetic Interpretation

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ABSTRACT

This paper explores the functionalities of Python libraries, such as SpaCy and TextBlob, and pairs them with the ChatGPT-4 to undertake an analytical expedition into the realm of poetry. The study found that Python's tools adeptly handle tokenization, sentiment detection, and semantic analysis but are confined to analyzing specific text within the boundaries of their pre-trained models. In contrast, ChatGPT-4 merges advanced natural language processing (NLP) techniques with state-of-the-art machine learning paradigms, enabling a more comprehensive range of analyses covering thematic, imagery, and contextual dimensions. This fusion of traditional literary methodologies with advanced computational techniques illuminates the prospect of deciphering the nuanced linguistic constructs and profound thematic layers crafted by poets, thus offering layered insights into poetry. Acknowledging the restrictions posed by Python's modular libraries, our study was meticulous in the text selection. The paper analyzes an original poem by the author, performing NLP tasks such as sentiment analysis, emotion and tone detection, and dependency parsing using Python. In comparison, ChatGPT-4 showcases its prowess by not only capturing the surface-level natural imagery within the poem but also highlighting its underlying tribute to national pride and the contemplation it invites on the essence of freedom. The paper concludes by discussing the inherent limitations of Python-based NLP and ChatGPT-4 and suggests future research directions to bridge the gap between human intuition and technological innovation for deeper poetic insights.

Introduction

Literary interpretation has been, for centuries, the domain of scholars, poets, and passionate readers, relying on intuition, cultural context, and deep knowledge of linguistic aesthetics to glean meaning from texts. Classical techniques of literary analysis emphasize a deep understanding of language, historical context, and the myriad of intertextual references that often permeate literature. However, as we progress into an era dominated by digital technology and artificial intelligence, a compelling synergy emerges between traditional literary analysis and computational techniques. Computational linguistics, a multidisciplinary field that melds computer science with language expertise, offers novel avenues to approach and enrich our understanding of literary texts.

The vastness and intricacy of literature, from epic poems of ancient civilizations to contemporary prose, encapsulate a spectrum of human emotions, experiences, and cultural nuances. While human-centric analysis captures the essence and depth of these works, computational methods promise scalability, consistency, and the potential to uncover patterns imperceptible to the human eye. By integrating algorithmic processes with data libraries, we stand at the threshold of expediting literary analysis and uncovering layers of meaning, sentiment, and structure that may have been previously overlooked or deemed too elusive.

Traditional literary analysis has been a fundamental tool for understanding and interpreting literature for centuries. This method involves a systematic and detailed exploration of literary works, examining elements such as character development, plot structure, themes, and motifs. It emphasizes close reading, interpretative perspectives, and the cultural and historical contexts surrounding a work, ensuring that every text is profoundly understood. The

traditional literary analysis serves as a bridge, connecting readers to the profound depths of human experience, emotion, and thought as encapsulated in literature. However, there are also limitations to this approach. Literary analysis is subjective and can vary depending on the reader's interpretation. Different readers may have different opinions on the meaning of a work of literature, and there is no one "correct" interpretation.

Traditional literary analysis of poems involves dissecting a poem's structure, from its rhyme scheme and meter to its stanzaic architecture, and discerning how the poem's form intensifies its meaning. This analysis also considers sound patterns such as alliteration, assonance, and onomatopoeia to determine the poem's established rhythm. Poetic devices like metaphors, similes, symbolism, and hyperboles highlight the figurative language used, revealing the poet's intent in drawing comparisons or exaggerating for emphasis. Sensory imagery plays a pivotal role, setting the poem's mood or theme, while diction uncovers the nuances in the poet's choice of words. Tone and mood further shed light on the poet's sentiments towards the subject. Considering the historical, biographical, or cultural context adds rich layers of interpretation. By examining these elements, readers can gain a deeper understanding of poems [1].

Computational linguistic analysis of poetry is a relatively recent field of study, leveraging the power of algorithms and machine learning models to interpret, generate, and understand poetic text [2]. Kao's paper uses computational tools to analyze poetic style, specifically the influence of Imagism on modern professional and amateur poetry. The study examines elements of poetic craft such as imagery, sound devices, and sentiment in texts, building upon techniques designed to analyze style and sentiment in texts. The paper highlights the potential of computational analysis to provide new insights into the study of poetry and its various elements.

The computational linguistic analysis approach uses computational tools to analyze the structure, form, sound, figurative language, imagery, tone, mood, theme, diction, context, intertextuality, character analysis, and philosophical and ideological underpinnings of poems. By harnessing the power of Natural Language Processing (NLP) and Machine Learning technologies, researchers can perform detailed and nuanced dissections of extensive textual datasets, spotlighting even the subtlest semantic shifts. Haider's thesis explores the use of distant reading and computational methods to analyze and model the stylistic features of poetry, specifically in German and English verse, which provides insights into the patterns and characteristics of poetic style in different languages [3]. A recent review investigates the application of computational stylistics across poetry, prose, and drama, addressing the growing fascination with computational and statistical techniques to dissect meter, style, and poetic essence [4].

Recent computational methods for poem analysis encompasses tokenization, syntax parsing, sentiment analysis, stylistic assessment, topic modeling, semantic evaluation, phonetic scrutiny, named entity recognition, intertextual exploration, word frequency study, n-gram examination, network analysis, deep learning techniques, and cultural or historical context integration. Tokenization involves breaking the poem into individual words or tokens to analyze word frequency, structure, and distribution. Syntax parsing uses grammatical rules and structures to determine how the words in the poem relate. Sentiment analysis determines the emotional tone of the poem using pre-trained models. The stylistic study analyzes stylistic features such as word length, sentence length, and lexical richness to derive authors' patterns or unique stylistic fingerprints. Topic modeling extracts a poem's main topics or themes using algorithms like Latent Dirichlet Allocation (LDA). Semantic analysis determines the meaning of words in context. Phonetic study analyzes the sound patterns of the poem, including rhyme, meter, and rhythm. Named entity recognition identifies named entities in the poem, like places, persons, or events, to understand context or references. The intertextual analysis compares the poem's linguistic features with those of a larger corpus to find influences, similarities, or shared themes. Word frequency analysis examines which words appear most frequently and their significance in the poem. N-gram analysis evaluates the frequency of word pairs or groups to understand recurring patterns or themes. Network analysis maps relationships between words or themes within a poem to understand its structure or key concepts. Deep learning leverages neural networks to generate poetry or understand intricate linguistic patterns. Cultural or historical contextualization uses machine learning to detect references, allusions, or motifs related to specific historical or cultural events. When applying these techniques, especially in combination, we can uncover rich insights from poetic texts [2, 5, 6, 7].

The challenge of using computational linguistic methods for poem analysis lies in the complexity and nuance of poetic language. Poems often contain figurative language, ambiguity, and creative wordplay, which can be difficult for computational models to interpret accurately. Additionally, the subjective nature of poetry makes it challenging to develop objective criteria for analysis. Poetic style and meaning can vary significantly between different poets and literary movements, making it difficult to create generalized models that capture the intricacies of each poem. Furthermore, cultural and historical context plays a significant role in understanding and interpreting poetry; incorporating this contextual information into computational models can be complex [2. 3. 4]

Despite the inherent challenges in computational poetry analysis, recent advancements in natural language processing (NLP) and machine learning techniques offer a promising frontier. ChatGPT emerges as a significant tool in this context, epitomizing the seamless integration of advanced NLP methodologies with contemporary machine learning frameworks [8].

This study investigates the evolving realm of computational linguistics as applied to enhanced literary interpretation. By probing the tools and methodologies central to this convergence, our objective is to reshape and broaden the horizons of literary analysis, integrating it seamlessly with contemporary digital advancements. For this research, ChatGPT-4 will be employed to analyze the poetic composition crafted by the author, harnessing its capability to discern intricate linguistic patterns and thematic nuances.

Methodology

Text selection

Python tools have their limitations as they are confined to analyzing specific text within the boundaries of their pre-trained models or data. We tried to choose text samples centered on themes like "Patriotism" and "liberty," the results might not always be accurate. We meticulously chose the appropriate text for our research. In this paper, we will dissect a poem authored by the writer, leveraging modular NLP tools, such as Python's SpaCy and TextBlob, and subsequently contrast these findings from ChatGPT-4 analysis to delve deeper into the intricacies of poetic interpretation.

The Heartland Frontier

In a land where sunset floods the endless prairies,
Where no skylines shutter those seeking rays;
Where gold-filtered woodlands embrace the air,
With scents of pine and blankets of shade.

Where a palette of stars trumps the midnight sky,
And no fake purple glow from electric lights.
Then, come dawn, with a tender breezy kiss,
This wild land blooms its pristine hues again.

In the heart of the land that the free died to keep free,
One will come to understand what that word really means,
And why it is worth every drop of blood shed
Underneath the banner of red, white, and blue.

Sentiment analysis

Tokenization to identify the essential words

SpaCy is a popular open-source library for natural language processing (NLP) in Python [9]. It provides pre-trained models for tokenization, part-of-speech tagging, and named entity recognition. This paper uses Python SpaCy for tokenization to identify the essential words. (Figure 1).

```
import spacy
from spacy import displacy
# Load the English language model
nlp = spacy.load("en_core_web_sm")
# Define the poem
poem = """
In a land where sunset floods the endless prairies,
Where no skylines shutter those seeking rays;
Where gold-filtered woodlands embrace the air,
With scents of pine and blankets of shade.

Where a palette of stars trumps the midnight sky,
And no fake purple glow from electric lights.
Then, come dawn, with a tender breezy kiss,
This wild land blooms its pristine hues again.

In the heart of the land that the free died to keep free,
One will come to understand what that word really means,
And why it is worth every drop of blood shed
Underneath the banner of red, white, and blue.
"""
# Process the poem with spaCy
doc = nlp(poem)
# Tokenize the poem
print("Tokens in the Poem:")
print("-"*25)
for token in doc:
    print(token.text)
# Extract named entities
print("\nNamed Entities:")
print("-"*25)
for ent in doc.ents:
    print(ent.text, "-", ent.label_)
# Display part-of-speech and dependencies
print("\nPart-of-Speech & Dependencies:")
print("-"*45)
for token in doc:
    print(token.text, "-", token.pos_, "-", token.dep_)
```

Figure 1 Python codes for Tokenization.

Sentiment analysis to determine the emotional tone of the poem

Sentiment analysis processes text to discern its underlying sentiment or emotion. A spectrum of techniques exists, ranging from elementary rule-based methods to sophisticated machine-learning models. Within this realm, tone detection, facilitated by computational linguistic strategies, stands out as a nuanced and evolving discipline. By pinpointing specific tones like joy, anger, sarcasm, or urgency, these techniques enable a deeper understanding of customer perceptions about products or services, facilitate tracking of public sentiments on events or announcements, and allow for tailored responses based on the detected emotional tone of user inputs.

TextBlob is a popular Python library for processing textual data. It provides a simple API for diving into common natural language processing (NLP) tasks such as part-of-speech tagging, noun phrase extraction, sentiment analysis, classification, translation, and more. It provides polarity (positive/negative) and subjectivity (subjective/objective) scores for a given text to indicate the emotion expressed in the sentence [10]. In the paper, we will use TextBlob for the tone analysis of the sample sentences (Figure 2). The result will show two data. (1) Polarity: This indicates the emotion expressed in the sentence. It ranges from -1 to 1. A value closer to -1 means the sentiment is negative, a value

closer to 1 means it's positive, and around 0 is neutral. (2) Subjectivity: It ranges between 0 and 1. A value closer to 0 is considered objective, while a value closer to 1 is considered subjective (Figure 2 and Table 4). The scores from TextBlob indicate the overall mood or tone of the poem.

```
from textblob import TextBlob
# The poem text
poem_text = """
In a land where sunset floods the endless prairies,
Where no skylines shutter those seeking rays;
Where gold-filtered woodlands embrace the air,
With scents of pine and blankets of shade.

Where a palette of stars trumps the midnight sky,
And no fake purple glow from electric lights.
Then, come dawn, with a tender breezy kiss,
This wild land blooms its pristine hues again.

In the heart of the land that the free died to keep free,
One will come to understand what that word really means,
And why it is worth every drop of blood shed
Underneath the banner of red, white, and blue.
"""
# Creating a TextBlob object
blob = TextBlob(poem_text)

# Analyzing sentiment
sentiment = blob.sentiment

# Printing sentiment
print(f"Polarity: {sentiment.polarity}, Subjectivity: {sentiment.subjectivity}")

# Interpretation
if sentiment.polarity > 0:
    print("The poem has a positive tone.")
elif sentiment.polarity < 0:
    print("The poem has a negative tone.")
else:
    print("The poem has a neutral tone.")
```

Figure 2 Python codes for emotional tone analysis of the poem.

Semantic analysis

Sentiment Analysis is primarily concerned with gauging the sentiment or emotional tone behind a series of words. It seeks to determine the speaker or writer's attitude toward the topic being discussed. Sentiment Analysis operates at a more surface level, identifying overt emotions or sentiments. It may not necessarily understand the full context or intricacies of the language. Semantic Analysis focuses on understanding the meaning of the text. It examines the relationships between words, the concepts' connection, and what the text says. It's more about understanding context, relationships, and nuances in language. Semantic Analysis digs deeper into the language to understand meaning, context, and ambiguities. It's more concerned with how language conveys meaning than how it conveys emotion. Performing semantic Analysis on a poem is a multifaceted task involving various techniques (Table 1). By employing these techniques, researchers and practitioners can extract meaningful insights from text, facilitate machine comprehension, and enable multiple applications, from information retrieval to machine translation. One basic way to approach this is to use named entity recognition, dependency parsing, and word similarity comparisons to extract semantic information from the poem.

Table 1 A summarized list of techniques used in semantic analysis [7].

Techniques	Function
1. Word Sense Disambiguation	Determining the correct meaning of a word based on context. For instance, the word "bat" could refer to an animal or a piece of sports equipment.
2. Named Entity Recognition (NER)	Identifying and classifying named entities in text into predefined categories such as names of persons, organizations, locations, etc.
3. Dependency Parsing	Analyzing the grammatical structure of a sentence to determine the relationships between words.
4. Semantic Role Labeling	Assigning roles to words or phrases in a sentence, like 'agent' or 'object', based on the action described.
5. Ontologies and Taxonomies	Hierarchical structures that represent knowledge about concepts and their relationships.
6. Topic Modeling	Techniques like Latent Dirichlet Allocation (LDA) that are used to discover abstract topics within a set of documents.
7. Word Embeddings	Using algorithms like Word2Vec or GloVe to turn text into vectors of numbers, capturing semantic relationships between words.
8. Semantic Similarity Measurement	Determining how similar two pieces of text are in terms of meaning, often using vector space models.
9. Frame Semantics	Analyzing the semantic frames or predefined templates that represent certain kinds of events, relations, or entities and the participants in them.
10. Conceptual Graphs	Graph representations for logical expressions, capturing entities and their relationships.
11. Coreference Resolution	Identifying when two or more words in a text refer to the same entity.
12. Relation Extraction	Identifying and categorizing semantic relationships between entities in the text
13. Anaphora and Cataphora Resolution	Resolving pronouns and other referring expressions to the entities or concepts they refer to.
14. Semantic Parsing	Translating natural language into machine-understandable representations, often using formal languages or query languages.
15. Commonsense Reasoning	Inferring general knowledge or facts not explicitly stated in the text, often leveraging large knowledge bases or semantic networks.

To perform semantic analysis on the given poem, we use the spaCy library to check the dependency parsing output of the poetry. Dependency parsing is used to determine the grammatical structure of a sentence based on the dependencies between its words. The parsed output provides a structured representation of the poem, capturing the hierarchical relationships between words and the grammatical constructs that bind them. It's a useful tool for understanding the underlying structure and semantics of the text (Figure 3).

```
import spacy
# Load the English model for spaCy
nlp = spacy.load("en_core_web_sm")
# Poem text
poem_text = """
In a land where sunset floods the endless prairies,
Where no skylines shutter those seeking rays;
Where gold-filtered woodlands embrace the air,
With scents of pine and blankets of shade.

Where a palette of stars trumps the midnight sky,
And no fake purple glow from electric lights.
Then, come dawn, with a tender breezy kiss,
This wild land blooms its pristine hues again.

In the heart of the land that the free died to keep free,
One will come to understand what that word really means,
And why it is worth every drop of blood shed
Underneath the banner of red, white, and blue.
"""
# Process the poem with spaCy
doc = nlp(poem_text)
# Named Entity Recognition
print("Named Entities:")
for ent in doc.ents:
    print(f"{ent.text} ({ent.label_})")
# Dependency Parsing
for token in doc:
    print(f"{token.text} <-- {token.dep_} -- {token.head.text}")
# Checking word similarity (example: land and prairies)
land = doc[2] # "land"
prairies = doc[7] # "prairies"
print(f"\nSimilarity between '{land}' and '{prairies}': {land.similarity(prairies)}")
```

Figure 3 Python codes for the dependency parsing.

ChatGPT’s procedure for poetic interpretation

ChatGPT-4 integrates traditional literary techniques with computational linguistic approaches to analyze 'The Heartland Frontier' and derive a comprehensive understanding of the poem's meaning, its emotional impact, and the poet's intent. The methods include close reading, imagery analysis, structural analysis, thematic analysis, symbolism and metaphor, contextual analysis, linguistic insight, and emotional tone analysis (Tables 2 and 3).

Table 2 Comprehensive analytical techniques utilized by ChatGPT-4.

Analysis techniques used by ChatGPT-4	Results
Close Reading	Involving reading the poem multiple times to understand its surface meaning and deeper connotations.
Imagery Analysis	Analyzing imagery like "sunset floods" and "palette of stars" reveals the poem's mood and emotional intent.
Structural Analysis	Examining the poem's structure and rhyme scheme provides insights into the poet's intent.
Thematic Analysis	Identifying recurring themes like nature, freedom, and sacrifice reveals the poet's central message
Symbolism and Metaphor	Detecting symbols like the "banner of red, white, and blue" that represent the U.S. and its values
Contextual Analysis	Considering historical or cultural cues, such as sacrifices for freedom, alludes to events like wars or revolutions, deepening the poem's interpretation.

Analysis techniques used by ChatGPT-4	Results
Linguistic Insights	Identifying subtle linguistic features, like the contrast of "fake purple glow" with natural imagery.
Emotional Tone Analysis	Analyzing words for emotional connotations, such as "tender", "kiss," and "pristine hues" implying positivity while "shed" and "blood" evoke sacrifice and struggle to reveal the poem's mood.

Table 3 The involved computational linguistic techniques.

Computational linguistic techniques	Results
Tokenization	Using sentiment analysis to identify the essential words such as "land", "sunset", "flood", "endless", "prairie" from the first line.
Word Frequency Analysis	Calculating word frequencies such as like 'land', 'freedom', 'sun', and 'stars' to find the poem's main theme.
Syntax Parsing	Using grammatical rules and structures to determine how the words in the poem relate to each other.
Sentiment Analysis	Determining the emotional tone of the poem (e.g., positive, negative, neutral) using pre-trained models.
Topic Modeling	Extracting the main topics or themes of a poem using algorithms like Latent Dirichlet Allocation (LDA).
Semantic Analysis	Determining the meaning of words in context. Word embeddings like Word2Vec or GloVe can be used to capture the semantic relationships between words, enabling detection of thematic patterns and motifs.
Phonetic Analysis	Using algorithms to analyze the sound patterns of the poem, including rhyme, meter, and rhythm.
Named Entity Recognition (NER)	Identifying named entities in the poem, like places, persons, or events, to understand context or references.
Intertextual Analysis	Comparing the poem's linguistic features with those of a larger corpus to find influences, similarities, or shared themes.
N-gram Analysis	Evaluating the frequency of word pairs or groups to understand recurring patterns or themes.
Network Analysis	Mapping relationships between words or themes within a poem to understand its structure or key concepts.
Deep Learning	Leveraging neural networks, such as Recurrent Neural Networks (RNN) or Long Short-Term Memory (LSTM) networks, to generate poetry or understand intricate linguistic patterns.
Cultural or Historical Contextualization	Using machine learning to detect references, allusions, or motifs that relate to specific historical or cultural events.

By combining these techniques, ChatGPT-4 can efficiently derive a comprehensive understanding of the poem's meaning, its emotional impact, and the poet's intent.

Results

Modular NLP tools analysis

We used Python libraries such as SpaCy and TextBlob to carry out tokenization, sentiment analysis, and semantic analysis. Tokenization deconstructs the poem's fundamental linguistic components, offering a refined version for subsequent language analysis. Sentiment analysis primarily uncovered the poem's emotional undertones, with certain lines radiating positive sentiments while others were neutral or mildly negative. The semantic analysis examined the poem's dependency parsing output. Dependency parsing identifies the grammatical structure of a sentence based on interdependencies among its words.

Sentiment Analysis: Tokenization to identify the essential words (Table 4)

Table 4. Part-of-Speech & Dependencies.

Paragraphs	Line 1	Line 2	Line 3	Line 4
1	In - ADP - prep a - DET - det land - NOUN - pobj where - CONJ - advmod sunset - NOUN - compound floods - VERB - relcl the - DET - det endless - ADJ - amod prairies - NOUN - appos , - PUNCT - punct	Where - CONJ - advmod no - DET - det skylines - NOUN - nsubj shutter - VERB - relcl those - PRON - dobj seeking - VERB - advcl rays - NOUN - dobj ; - PUNCT - punct	Where - CONJ - advmod gold - NOUN - npadvmod - - PUNCT - punct filtered - VERB - amod woodlands - NOUN - nsubj embrace - VERB - ROOT the - DET - det air - NOUN - dobj , - PUNCT - punct	With - ADP - prep scents - NOUN - pobj of - ADP - prep pine - NOUN - pobj and - CONJ - cc blankets - NOUN - conj of - ADP - prep shade - NOUN - pobj . - PUNCT - punct
2	Where - CONJ - advmod a - DET - det palette - NOUN - nsubj of - ADP - prep stars - NOUN - pobj trumps - VERB - ROOT the - DET - det midnight - NOUN - com- pound sky - NOUN - dobj , - PUNCT - punct	And - CONJ - cc no - DET - det fake - ADJ - amod purple - ADJ - amod glow - NOUN - conj from - ADP - prep electric - ADJ - amod lights - NOUN - pobj . - PUNCT - punct	Then - ADV - advmod , - PUNCT - punct come - VERB - ROOT dawn - NOUN - nsubj , - PUNCT - punct with - ADP - prep a - DET - det tender - NOUN - amod breezy - ADJ - amod kiss - NOUN - pobj , - PUNCT - punct	This - DET - det wild - ADJ - amod land - NOUN - nsubj blooms - VERB - advcl its - PRON - poss pristine - ADJ - amod hues - NOUN - dobj again - ADV - advmod . - PUNCT - punct
3	In - ADP - prep the - DET - det heart - NOUN - pobj of - ADP - prep the - DET - det land - NOUN - pobj that - PRON - dobj the - DET - det free - ADJ - nsubj died - VERB - relcl to - PART - aux keep - VERB - advcl free - ADJ - oprd , - PUNCT - punct	One - NUM - nsubj will - AUX - aux come - VERB - ROOT to - PART - aux understand - VERB - advcl what - PRON - dobj that - DET - det word - NOUN - nsubj really - ADV - advmod means - VERB - ccomp , - PUNCT - punct	And - CONJ - cc why - CONJ - advmod it - PRON - nsubj is - AUX - conj worth - ADJ - acomp every - DET - det drop - NOUN - npadvmod of - ADP - prep blood - NOUN - pobj shed - VERB - acl	Underneath - ADP - prep the - DET - det banner - NOUN - pobj of - ADP - prep red - ADJ - pobj , - PUNCT - punct white - ADJ - conj , - PUNCT - punct and - CONJ - cc blue - ADJ - conj . - PUNCT - punct

Sentiment Analysis to determine the emotional tone of the poem (Table 5)

Table 5 TextBlob scores.

Line	Polarity (P) and Subjectivity (S)
1: In a land where sunset floods the endless prairies, where no skylines shutter those seeking rays.	P: -0.12 S: 0.75
2. Where gold-filtered woodlands embrace the air, With scents of pine and blankets of shade.	P: 0.00 S: 0.00
3. Where a palette of stars trumps the midnight sky, And no fake purple glow from electric lights.	P: 0.25 S: 1.00
4. Then, come dawn, with a tender breezy kiss, This wild land blooms its pristine hues again.	P: 0.10 S: 0.40
5. In the heart of the land that the free died to keep free, one will come to understand what that word really means,	P: 0.30 S: 0.50
6. And why it is worth every drop of blood shed, Underneath the banner of red, white, and blue.	P: 0.07 S: 0.05

Semantic analysis: The dependency parsing output of the poetry (Table 6)

Table 6 The dependency parsing output of the poetry.

Paragraphs	Line 1	Line 2	Line 3	Line 4
1	<-- dep -- In In <-- prep -- embrace a <-- det -- land land <-- pobj -- In where <-- advmod -- floods sunset <-- compound -- floods floods <-- relcl -- land the <-- det -- prairies endless <-- amod -- prairies prairies <-- appos -- floods , <-- punct -- prairies	<-- dep -- , Where <-- advmod -- shutter no <-- det -- skylines skylines <-- nsubj -- shutter shutter <-- relcl -- floods those <-- dobj -- shutter seeking <-- advcl -- shutter rays <-- dobj -- seeking ; <-- punct -- embrace	<-- dep -- ; Where <-- advmod -- em- brace gold <-- npadvmod -- fil- tered - <-- punct -- filtered filtered <-- amod -- wood- lands woodlands <-- nsubj -- em- brace embrace <-- ROOT -- em- brace the <-- det -- air air <-- dobj -- embrace , <-- punct -- embrace	<-- dep -- , With <-- prep -- embrace scents <-- pobj -- With of <-- prep -- scents pine <-- pobj -- of and <-- cc -- pine blankets <-- conj -- pine of <-- prep -- pine shade <-- pobj -- of . <-- punct -- embrace
2	<-- dep -- . Where <-- advmod -- trumps a <-- det -- palette palette <-- nsubj -- trumps of <-- prep -- palette stars <-- pobj -- of trumps <-- ROOT -- trumps the <-- det -- sky midnight <-- compound -- sky sky <-- dobj -- trumps , <-- punct -- sky	<-- dep -- , And <-- cc -- trumps no <-- det -- glow fake <-- amod -- glow purple <-- amod -- glow glow <-- conj -- trumps from <-- prep -- glow electric <-- amod -- lights lights <-- pobj -- from . <-- punct -- trumps	<-- dep -- . Then <-- advmod -- come , <-- punct -- come come <-- ROOT -- come dawn <-- nsubj -- come , <-- punct -- come with <-- prep -- come a <-- det -- kiss tender <-- amod -- kiss breezy <-- amod -- kiss kiss <-- pobj -- with , <-- punct -- blooms	<-- dep -- , This <-- det -- land wild <-- amod -- land land <-- nsubj -- blooms blooms <-- advcl -- come its <-- poss -- hues pristine <-- amod -- hues hues <-- dobj -- blooms again <-- advmod -- blooms . <-- punct -- blooms
3	<-- dep -- . In <-- prep -- come	<-- dep -- , One <-- nsubj -- come	<-- dep -- , And <-- cc -- come	<-- dep -- shed

Paragraphs	Line 1	Line 2	Line 3	Line 4
	the <-- det -- heart heart <-- pobj -- In of <-- prep -- heart the <-- det -- land land <-- pobj -- of that <-- dobj -- died the <-- det -- free free <-- nsubj -- died died <-- relcl -- land to <-- aux -- keep keep <-- advcl -- died free <-- oprd -- keep , <-- punct -- come	will <-- aux -- come come <-- ROOT -- come to <-- aux -- understand understand <-- advcl -- come what <-- dobj -- means that <-- det -- word word <-- nsubj -- means really <-- advmod -- means means <-- ccomp -- under- stand , <-- punct -- come	why <-- advmod -- is it <-- nsubj -- is is <-- conj -- come worth <-- acomp -- is every <-- det -- drop drop <-- npadvmod -- is of <-- prep -- drop blood <-- pobj -- of shed <-- acl -- drop	Underneath <-- prep -- shed the <-- det -- banner banner <-- pobj -- Under- neath of <-- prep -- banner red <-- pobj -- of , <-- punct -- red white <-- conj -- red , <-- punct -- white and <-- cc -- white blue <-- conj -- white , <-- punct -- come

Note: Some dependency labels are listed below. In dependency grammar, these labels explain how each word is related to other words in the sentence, providing a tree-like structure representation of sentence grammar.

In <-- prep -- embrace means the word "In" is a preposition (indicated by "prep") that modifies the verb "embrace."

nsubj: Nominal subject. E.g., "land" in "land blooms".

dobj: Direct object. E.g., "air" in "embrace the air".

advmod: Adverbial modifier. E.g., "where" in "Where no skylines..."

amod: Adjectival modifier. E.g., "endless" in "endless prairies".

ROOT: The central word in the sentence, usually a verb. E.g., "embrace" in the line "Where gold-filtered woodlands embrace the air".

pobj: Object of the preposition. E.g., "land" in "In a land".

relcl: Relative clause modifier. E.g., "floods" in "In a land where sunset floods".

cc: Coordinating conjunction. E.g., "And" in several lines.

conj: Conjunction. Shows that a word is connected to another word via a coordinating conjunction.

acl: Adjectival clause. It modifies a noun, similarly to an adjective. E.g., "shed" in the line "Underneath the banner of red, white, and blue".

Poetic interpretation from the analysis of ChatGPT-4

Main themes

Using sentiment analysis, ChatGPT-4 identifies key terms like "land" and "sunset" for further computational evaluation, calculates word frequencies such as 'land' and 'freedom', and suggests the poem's main themes.

Emotional undertones and nationalism

The final stanza anchors the poem in a specific context — the sacrifice made to keep the land free. The "free [who] died to keep free" refers to soldiers or patriots who gave their lives for their country's freedom.

The mention of understanding "what that word really means" invites the reader to reflect on the true meaning of freedom, which is portrayed as something precious. The poem culminates in the imagery of the national flag — "the banner of red, white, and blue" — symbolizing the United States. The mention of bloodshed under this banner underscores the sacrifices made to uphold the values the flag represents.

Physical Beauty of Nature

The first stanza captures the expansive beauty of the prairies during sunset. There are no city skylines to obstruct the view, suggesting a remote, untamed land.

The woodlands have a golden quality, and the air is filled with the scent of pine — highlighting the purity and richness of this environment.

The second stanza continues this trend, contrasting the natural beauty of stars in the sky with the artificial light of cities. The lack of "fake purple glow from electric lights" emphasizes the pristine nature of the place.

The coming of dawn is described as gentle, like a "tender breezy kiss," and the land is rejuvenated, "blooming its pristine hues again."

Overall Interpretation

"The Heartland Frontier" celebrates the unspoiled beauty of America's heartland and juxtaposes it with its values and history. The landscape isn't just physically beautiful; it's emotionally charged, bearing witness to sacrifices made for freedom. The poem invites readers to appreciate the country's natural beauty and reflect on the deeper meanings of freedom and national identity. The poem "The Heartland Frontier" vividly depicts a vast, untouched landscape, evoking nature's physical beauty and the deeper emotional connections associated with freedom and sacrifice.

Comments

Imagery: The poem paints a vivid picture of the landscape – from endless prairies bathed in the glow of the sunset to the night sky lit by stars. Such descriptions engage the reader's senses and transport them to the setting the poet describes.

Contrast: The juxtaposition of the natural starlit sky with the "fake purple glow from electric lights" emphasizes the authenticity and purity of the heartland in comparison to urban, artificial environments.

Emotional Depth: The third stanza introduces a profound emotional layer, invoking themes of freedom, sacrifice, and national identity. The transition from the portrayal of natural beauty to the heavy themes of sacrifice and freedom gives the poem a surprising and impactful depth.

Metaphorical Depth: The mention of the "banner of red, white, and blue" not only brings forth a sense of national pride but also, in the context of the rest of the stanza, serves as a metaphor for the sacrifices made to uphold freedom and liberty.

Structure & Flow: The poem follows a clear structure, with each stanza building on the previous. The first two stanzas set the scene of the land's natural beauty, leading seamlessly into the third stanza's deeper, more introspective exploration of freedom and sacrifice.

Discussion

Python excels at sentiment and semantic analysis, but it's constrained by the size of its pre-existing models. Take TextBlob for instance: When analyzing texts containing words like "liberty" or "patriotism", it may not always yield convincing Polarity and Subjectivity scores. These scores are also influenced by predetermined values of each word within the library.

Leveraging the power of advanced models such as ChatGPT-4 for poetry analysis signifies a transformative merger of classical literary techniques with contemporary computational methodologies. While ChatGPT-4 incorporates fundamental techniques observed in Python analysis, like tokenization and sentiment analysis, it distinguishes itself by weaving deeper explorations into imagery, context, and themes. This combination of computational precision with a seemingly intuitive literary grasp allows a more nuanced appreciation of the poem's layers.

In tandem with other NLP and data visualization tools, ChatGPT's capacity for multi-dimensional interpretation can yield unparalleled insights, whether it's delineating sentiment fluctuations within a poem or contrasting the unique styles of different poets. The foundation of ChatGPT's impressive analytical abilities lies in its training on vast datasets, which enables it to amalgamate age-old literary wisdom with innovative computational techniques. Beyond

its practical analysis, ChatGPT's advantage is its ability to assess large volumes of poetry unaffected by human limitations such as cognitive biases or fatigue.

However, it's pivotal to note that while ChatGPT heralds a revolutionary juncture in AI's relationship with literature, truly grasping the multifaceted essence of poetry—a profound mosaic of human emotions and experiences—remains an intricate endeavor. ChatGPT, with its last training data up to September 2021, operates within the bounds of that knowledge. ChatGPT also has difficulty with non-standard English, such as regional dialects, which limits its usefulness in specific applications and might falter or produce skewed results when encountering unfamiliar poetic styles or cultures. The future development of ChatGPT is expected to address its limitations and improve its proficiency in delivering nuanced language analyses.

Conclusion

Using computational methods to explore poetry is rewarding and challenging due to poetic expressions' profound and multifaceted nature. Analysis using modular NLP tools in Python and ChatGPT-4 offers detailed and insightful views on poetic works. The Python tools, enhanced by SpaCy and TextBlob, enable a thorough computational evaluation encompassing sentiment analysis, dependency parsing, and linguistic investigation. but it faces limitations due to the constraints of pre-trained models. Conversely, ChatGPT-4, integrating advanced NLP techniques with advanced machine learning frameworks, emerges as a potent instrument to unravel the intricate linguistic patterns and thematic depths woven by poets. Upon examining the poem "The Heartland Frontier", one is immediately captivated by its luminous depiction of the natural world. The lines paint a detailed canvas, illuminating expansive prairies awash in the hues of the setting sun and stars that radiate brilliance, dwarfing city lights. Delving deeper, however, "The Heartland Frontier" is a poem that seamlessly merges the raw allure of nature with poignant reflections on history and sacrifice. More than an exaltation of nature's wonders, it stands as a profound tribute to national pride, ponders the price of freedom, and beckons readers to ponder the genuine significance of liberty.

Limitations

Computational approaches provide novel ways to analyze poetry, but they aren't without their drawbacks. While Python excels at sentiment and semantic analysis, it's constrained by the size of its pre-existing models. Take TextBlob for instance: When analyzing texts containing words like "liberty" or "patriotism", it may not always yield convincing Polarity and Subjectivity scores. These scores are also influenced by predetermined values of each word within the library.

ChatGPT-4, despite its advanced NLP techniques and integration with the latest machine learning frameworks, is still rooted in the data it was trained on. If it hasn't been exposed to a specific poetic style or cultural context, its interpretation can be inadequate or misdirected.

No computational tool, regardless of its sophistication, can truly replicate the profound emotional bond and unique interpretation that a human forms with a poem. This emotional resonance and the subjectivity of human experience are elements that technology might not fully grasp or replicate.

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