

Review Article

AI Meets Shakespeare: Translating Classical English into the Modern

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Abstract - Reading classical English literature in today's modern context can pose significant challenges, primarily due to the evolution of language over centuries. Classical texts' words, phrases, and sentence structures often differ greatly from contemporary usage, making comprehension difficult for modern readers. This study proposes a novel solution using Machine Translation (MT) techniques to bridge this gap and simplify the understanding of classical writings. In this work, Shakespeare's play *The Tragedy of Julius Caesar* has been chosen as a benchmark for classical English, given its historical significance and rich linguistic complexity. The Llama2 Chat variant, a sophisticated Large Language Model (LLM), translates Shakespearean English into contemporary language, preserving the original intent and meaning while making the text more accessible. The study not only examines the translation process but also delves into the critical parameters of the LLM that influence its performance, such as its ability to interpret context, handle ambiguities, etc. This research aims to contribute to both the appreciation of classical literature and the advancement of AI in language processing.

Keywords - AI literature, Literary prompt, Llama2, Machine translation, Prompt engineering.

1. Introduction

The primary aim of this study is to evaluate the feasibility of generating machine translation outputs that render classical English texts comprehensible to the general public. To the author's knowledge, no other published material is available specifically for this. While state-of-the-art language models like OpenAI's GPT-3.5 and GPT-4 offer exceptional translation capabilities, their usage is often restricted by cost and accessibility. In contrast, open-source models such as Llama2 provide a cost-effective and convenient alternative, making them an attractive option for wider adoption in research and practical applications. For this study, the author has leveraged the Llama2 Chat variant model, specifically the *Llama-2-7b-chat-hf* (with 7 billion parameters) version available on the Hugging Face platform. This model represents a reasonable solution for translation tasks aimed at laymen while ensuring accessibility to researchers and developers.

To systematically analyze the model's performance, the study focuses on four key parameters:

- **Temperature (t):** Governing the randomness and creativity of the model's output.
- **Prompt:** Crafting effective input prompts to guide the translation process.
- **Input Text Length:** Limiting the maximum number of words per input translation segment.

- **Maximum Tokens:** Controlling the maximum number of tokens generated in the model's response.

All experiments are conducted in the *Google Colab Pro* environment, which offers a manageable and cost-efficient platform for running computationally intensive tasks. This setup ensures accessibility even for amateur enthusiasts, reinforcing the broader usability of open-source AI tools. By investigating these parameters and their impact on the translation outputs, this study aims to provide insights into the practical applications of open-source LLMs for literary and linguistic tasks, demonstrating their potential for making classical literature more accessible to contemporary audiences.

2. Literature Survey

Machine Translation (MT) has witnessed significant advancements in recent years, driven by innovations in Large Language Models (LLMs) and methodologies like prompt engineering. This literature survey examines key studies and guidelines shaping the discourse around optimizing MT outputs, particularly on the capabilities and customizability of state-of-the-art LLMs such as ChatGPT. Recent research underscores the critical role of prompt engineering in enhancing the performance of LLMs for translation tasks. Gao, Wang, and Hou (2023) investigated how prompt designs can influence the quality of translations produced by ChatGPT



[1]. They highlighted the importance of providing clear, task-specific instructions to leverage the model's full potential, particularly in cases requiring nuanced language processing. Similarly, Gu (2023) conducted a case study on Japanese-Chinese translation and demonstrated how linguistically informed prompts can significantly improve handling complex grammatical structures, such as attributive clauses [2]. Jiao et al. (2023) evaluated ChatGPT's effectiveness as a translator, particularly when powered by the GPT-4 engine [5]. Their findings affirmed its capability to produce high-quality translations when optimized with carefully crafted prompts. The study emphasized that while GPT-4 excels in fluency and contextual understanding, its output can be further refined through targeted input prompts. Moslem et al. (2023) extended this perspective by exploring adaptive translation strategies with LLMs, showcasing how models like ChatGPT can be tailored to meet specific linguistic and contextual needs in real time [6].

Classical theories of translation also provide a foundation for understanding MT. Nida and Taber's seminal work, *The Theory and Practice of Translation* (1969/2003), remains relevant for emphasising the dynamic equivalence principle, prioritising meaning over form [7]. Their insights continue to inform how machine translation outputs are evaluated and refined. Pym (1992) further contributed to this discourse by introducing translation error analysis to assess the alignment between source and target texts, a practice increasingly integrated into MT evaluation frameworks [9].

Standards like ISO 11669:2012 and ISO 17100:2015 establish general guidelines and requirements for translation processes, emphasizing quality assurance and project management [3][4]. These standards benchmark human and machine translation services, ensuring outputs meet the intended purpose and audience expectations. Onishi and Yamada (2021) explored the application of metalanguage in translation project management, emphasizing its role in streamlining translation workflows [8]. Their work offers insights into how structured communication frameworks can be integrated into MT systems to enhance accuracy and consistency across projects.

The convergence of linguistic theory, standardization, and advanced computational techniques has created a fertile ground for innovation in MT. Studies on prompt engineering, such as those by Gao et al. (2023) [1] and Gu (2023) [2], illustrate the practical steps required to optimize LLMs like ChatGPT for specific translation tasks. Meanwhile, classical frameworks by Nida [7] and Pym [9] provide essential theoretical foundations, ensuring MT systems align with established translation principles. This body of research collectively highlights the potential of integrating adaptive LLMs with rigorous linguistic and project management standards to achieve high-quality, contextually appropriate translations.

3. Environment and Requirements

The experiments were conducted in the *Google Colab Pro* environment, utilizing 100 monthly compute units for optimized computational resources. A T4 GPU was employed to accelerate model training and inference. The setup required the installation of essential Python libraries using the following commands: `!pip install -q transformers einops accelerate langchain bitsandbytes` and `!pip install langchain_community`. Additionally, authentication to access Hugging Face-hosted models and datasets was facilitated via `!huggingface-cli login`. This configuration ensured a seamless development environment suitable for large-scale model fine-tuning and inference tasks. Note that the Python version used is 3.10.12.

4. Data Collection and Preprocessing

4.1. Data Collection

The dataset used for the translation task was sourced from Project Gutenberg, an online repository offering free access to eBooks. Specifically, the text of *The Tragedy of Julius Caesar* by William Shakespeare, written in the 16th century, was selected for this study. The play was downloaded in plain text (.txt) format, ensuring straightforward processing and compatibility with the tools used in this research. See Figure 1 for the entire flow of the project.

4.2. Data Preprocessing

The raw text included additional content beyond the play itself. The initial sections contained introductory details about the Project Gutenberg eBook of *Julius Caesar*, presented in contemporary English and unrelated to the translation objective. Similarly, the concluding portions comprised licensing agreements and usage guidelines irrelevant to the task. These extraneous segments were systematically identified and removed to create a clean, focused dataset. The resulting dataset exclusively contained the original 16th-century text of the play, ensuring it was well-suited for the translation process while minimizing noise and maintaining the integrity of the source material. The final input dataset contained a total of 21,014 words. However, the Transformer model used in this study has a maximum positional embedding limit of 4,096 tokens, which restricts the length of any single input sequence the model can process. This constraint necessitated segmenting the input data into smaller chunks to ensure compatibility with the model's architecture. The author conducted multiple experiments to determine an optimal chunk size by feeding the model input sequences of varying lengths. After analyzing the performance and efficiency across different chunk sizes, the author established a practical guideline: each chunk would consist of 100 words. It is important to note that the choice of words rather than tokens as the segmentation unit was deliberate, simplifying preprocessing and aligning well with the overall data structure. This method ensures that the model effectively processes the input data while avoiding truncation or loss of information.

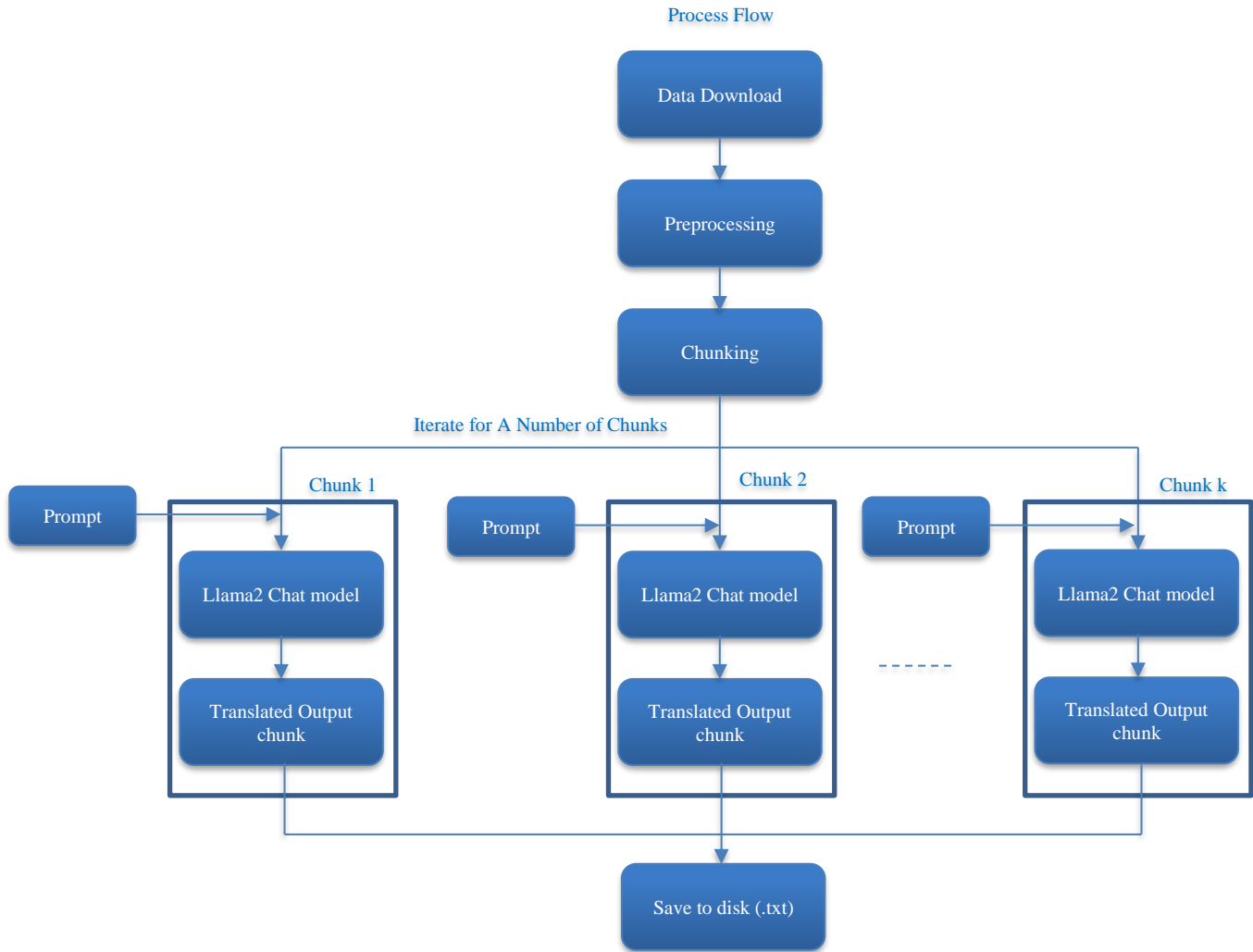


Fig. 1 Flowchart illustrating the pipeline for AI-driven text translation, including download, preprocessing, chunking, model processing, output generation, and saving

5. Parameters Used

The parameters analyzed in the study are Prompt, Temperature (*t*), Input text length and Maximum tokens.

5.1. Prompt

To begin with, the following is the format of the prompt given to the model.

""""

You are an experienced Classical English to modern English translator. Do the following:

- *Translate the given Shakespearean text to modern English. An example is given below. Do not add or edit new information in translation.*
- *All the dialogues need to be translated. Do not leave any.*
- *Do not add any end notes or comments after translation.*
- *Keep all the stage direction notes like titles, content details, [Exeunt.], [_Exit_], and anything in between [_ and _] as such.*

[Example text given]

[Example translation given]

```

    -----
    INPUT TEXT
    -----
    {text}
    -----
    TRANSLATION
    *****
  
```

Clearly defining the translation scope eliminates ambiguities and ensures the AI adheres to its role without deviation. Its insistence on uniform treatment of dialogues and formatting results in cohesive and structurally faithful translations, while the preservation of stage directions caters to academic, literary, and performance needs, retaining the theatrical essence of the text. Additionally, the prompt offers advantages such as reproducibility, enabling repeated use with

minimal adjustments for other Shakespearean works, and focus, discouraging irrelevant additions like comments or interpretive notes. Maintaining stage directions ensures that the translations respect the original context and remain usable for theatrical purposes.

5.2. Temperature (*t*)

5.2.1. Evaluation Metric

The translation is evaluated by taking a manual translation of Shakespeare's work, freely available on LitCharts as a reference. The author used BERTScore's F1 score (*bf1*) to quantify the translation process. The *bf1* score ranges from 0 to 1. The lower end indicates no semantic similarity between the translated text and the corresponding reference text. While a higher magnitude, usually >0.8 , indicates that the model has captured the essence of the original text more accurately. Note that BERTScore can be imported in a Python environment through `!pip install bert-score` command.

5.2.2. Outputs on Same Temperature

The initial experiments were conducted with a temperature setting 0 to produce deterministic translations, ensuring consistent and predictable outputs. This approach was chosen to eliminate randomness and focus on obtaining precise translations. However, as the experiments progressed, different temperature values were tested to observe their impact on the translation outputs. Interestingly, even with the temperature set to 0, achieving identical results across repeated runs proved challenging. Slight variations were observed in the translated tokens, indicating that some inherent factors in the model's generation process introduced subtle inconsistencies. These findings are illustrated in Table 1., which provides an example of these variations.

5.2.3. Outputs on Different Temperature

Table 2. illustrates the outputs generated by the LLM at varying temperature settings for translating the provided classical English text into modern English. Below is a detailed analysis of the outputs regarding word usage, fidelity to the original meaning, sentence formation, and aesthetic quality.

Each temperature uniquely balances precision, creativity, sentence structure, and aesthetic quality. At a temperature setting of 0, the translation is highly precise and deterministic, with word choices that are straightforward and devoid of embellishment, such as "noble character is not immune to temptation." This approach ensures a close adherence to the original meaning, avoiding interpretive nuances and maintaining clarity. The sentence structures are short, clear, and to the point, but the rigid adherence to structure can make the output feel mechanical. Aesthetically, the beauty of this translation lies in its precision and clarity, though the lack of poetic elements renders the reading experience less engaging. With a temperature of 0.2, the word usage becomes slightly more interpretive, incorporating phrases like "can be shaped

from the circumstances that surround you," which blend modern clarity with subtle poetic tones. The translation remains faithful to the original meaning while enhancing readability bridging classical and modern English. Sentences show improved flow and conversational tone, aided by thoughtful punctuation that enhances readability. Aesthetically, the translation strikes a pleasing balance, thoughtfully rephrasing the original text while preserving its poetic quality, resulting in an engaging and accessible output. At a temperature of 0.3, the word usage finds an optimal balance between accessibility and aesthetic appeal. However, occasional errors like the term "mClassicaled" highlight potential issues such as overfitting, tokenization challenges, or contextual confusion.

Overall, the translation in this setting achieves an ideal balance, preserving Classical English's poetic nuances while rendering them relatable to modern language. Sentences are rhythmic and well-structured, mirroring the poetic essence of the original text and showcasing peak elegance in sentence formation. The aesthetic quality is at its highest, blending modern stylistic elements with the original's poetic charm, making this setting suitable for literary and practical applications. At a temperature of 0.5, the translation focuses on simplifying word choices for maximum accessibility, as seen in phrases like "noble minds always stay with their kind." This simplification modernizes the sentiment but sacrifices some of the poetic nuances of the original text. The translation further prioritizes accessibility by simplifying the classical language, often at the expense of its more profound charm and interpretive richness. Sentences are straightforward, adopting a conversational tone that prioritizes readability over structural elegance. Aesthetically, the translation's beauty is diluted, leaning heavily on simplicity rather than preserving the poetic cadence of the original. While effective for readability, it lacks the artistic depth of higher temperatures.

5.3. Input Text Length

Down the flow, a Python function is designed to load a text file while preserving its formatting, specifically paragraph indentations, and split the content into parts, with each part containing a specified maximum number of words (*max_words*). The function reads the entire file and splits its content into paragraphs using line breaks (split lines). It iterates over these paragraphs, calculating the word count and appending paragraphs to a "current part" until the word limit for that part is reached. [This is done to identify how the original writing has been translated easily] Once the limit is exceeded, the accumulated text is saved to a list of parts, and the process repeats for subsequent paragraphs. If there are leftover paragraphs at the end, they are added as a final part. The function handles potential errors, such as file not found or other exceptions, by printing appropriate error messages. The result is a list of strings, each preserving the original paragraph structure and containing up to *max_words*.

In this experiment, the author took *max_words* = 100.

Table 1. Outputs on the same temperatures at different runs are compared

Input Text	Reference	Output Text		
		t=0 (first run) [bf1 = 0.8985]	t=0 (second run) [bf1 = 0.8968]	t=0 (third run) [bf1 = 0.8959]
CASSIUS. But, soft! I pray you. What, did Caesar swoon?	CASSIUS Stop for a moment, please. What, did Caesar faint?	CASSIUS. But wait! I ask you. Did Caesar faint?	CASSIUS. But wait! I ask you. Did Caesar faint?	CASSIUS. But wait! I ask you. Did Caesar faint?
CASCA. He fell down in the market-place, and foam'd at the mouth, and was speechless.	CASCA He fell down in the marketplace and, foamed at the mouth and couldn't speak.	CASCA. He collapsed in the marketplace, foamed at the mouth, and was unable to speak.	CASCA. He collapsed in the marketplace, foamed at the mouth, and was unable to speak.	CASCA. He collapsed in the marketplace, foaming at the mouth and unable to speak.
BRUTUS. 'Tis very like: he hath the falling-sickness.	BRUTUS That's very likely. He has epilepsy, the falling sickness.	BRUTUS. It's very possible: he's suffering from epilepsy.	BRUTUS. It's true; he has the epilepsy.	BRUTUS. It's very likely; he's suffering from epilepsy.
CASSIUS. No, Caesar hath it not, but you, and I, And honest Casca, we have the falling-sickness.	CASSIUS No, Caesar doesn't have it. But you and I, and honest Casca, we have the falling sickness.	CASSIUS. No, Caesar doesn't have it, but you, me, and Casca do.	CASSIUS. No, Caesar doesn't have it; you, me, and Casca do.	CASSIUS. No, Caesar doesn't have it, but you, me, and Casca do

Table 2. Outputs of different temperatures compared

Input Text	Reference	Output Text			
		t=0 [bf1 = 0.8803]	t=0.2 [bf1 = 0.8789]	t=0.3 [bf1 = 0.8782]	t=0.5 [bf1 = 0.8856]
[_Exit Brutus.] Well, Brutus, thou art noble; yet I see, Thy honourable metal may be wrought From that, it is dispos'd: therefore 'tis meet That noble minds keep ever with their likes; For who so firm that cannot be seduc'd?	Brutus exits. Well, Brutus, you're noble. Yet I see that your honorable nature can be turned from its usual inclination. Therefore, it's better for noblemen to spend time only with other noblemen, because who is so firm that he can't be seduced?	[_Exit Brutus.] Oh, Brutus, you are noble, but I see your noble character is not immune to temptation. It is only natural that those with similar values and beliefs stick together, as they are more likely to be influenced by each other. No one is entirely immune to being swayed by persuasion, after all.	[_Exit Brutus.] Well, Brutus, you are noble; yet I see, Your honorable nature can be shaped From the circumstances that surround you; therefore, It is fitting that noble minds associate with their peers; For who can remain steadfast and unwavering If they are not influenced by their surroundings?	[_Exit Brutus.] Oh, Brutus, you are noble, yet I see that your noble character may be mClasscaled From the circumstances that surround you; therefore it is fitting That noble minds always associate with their peers; for who is so steadfast That they cannot be swayed by persuasion?	[_Exit Brutus.] Oh, Brutus, you are noble, yet I notice, Your honorable nature can be shaped By the circumstances that surround you; therefore, It is fitting that noble minds always stay with their own kind; For who is so strong that they cannot be swayed?

5.4. Maximum tokens

The max_new_tokens parameter specifies the maximum number of tokens the model can generate in response to the input. It limits the model’s output to no more than ‘n’ new tokens, where tokens can represent words, sub-words, or characters depending on the tokenizer. This control ensures that the generated response does not exceed a specified length, providing a way to manage the output size. The max_new_tokens in this experiment were obtained by the trial-and-error method and were fixed as n = 1200. Further increasing its magnitude would get GPU disconnection in

Google Colab, and computations would be impossible. The token count is based on the new tokens generated by the model, so if the input text already contains some tokens, the model will generate enough additional tokens to stay within the total limit of ‘n’ new tokens. This helps to maintain control over the length of the model’s response.

6. Tabulated Analysis

Table 3 contains the analysis of the translation work done by the model on certain literary and language aspects.

Table 3. A high-level analysis of various aspects is tabulated below. All the translations are done on temperature =0.3.

Aspect	Example	Strengths	Weaknesses	Improvements Needed
1. Accuracy in Capturing Meaning	Original: Friends, Romans, countrymen, lend me your ears; I come to bury Caesar, not to praise him. The evil that men do lives after them, The good is oft interred with their bones; So let it be with Caesar.	Meaning is generally preserved, especially the contrast between good and evil deeds.	"Mourn Caesar" changes the intent from formal duty to personal grief.	Retain key phrases like "bury Caesar" to preserve the original intent.
	Translated: Friends, fellow citizens, listen to me; I come to mourn Caesar, not to praise him. The wrongs that people do live on after them, While the good is often buried with their remains, So let it be with Caesar.		"Wrongs" vs. "evil" softens the rhetorical power.	
2. Retaining Emotional Impact	Original: Men, at some time, are masters of their fates: The fault, dear Brutus, is not in our stars, But in ourselves, that we are underlings. "Brutus" and "Caesar": what should be in that "Caesar"?	Philosophical idea of self-determination is intact.	"Problem" instead of "fault" reduces personal accountability.	Preserve key terms like "fault" and "underlings" to maintain the tone and message.
	Translated: Men sometimes are the masters of their own destiny: The problem, dear Brutus, is not in the stars, But in ourselves, we are weaklings. "Brutus" and "Caesar": what should be in that "Caesar"?		"Underlings" to "weaklings" alters focus from societal inferiority to physical weakness.	
3. Preservation of Literary Devices	Original: Cowards die many times before their deaths; The valiant never taste of death but once. Of all the wonders that I yet have heard, It seems to me most strange that men should fear, Seeing that death, a necessary end, Will come when it will come.	Metaphor comparing fear to repeated deaths is preserved.	"Incredible" and "bizarre" weaken the poetic rhythm and grandeur.	Retain stronger poetic language, avoiding casual or overly modern terms like "bizarre."
	Translated: Cowards die many times before their deaths; The brave never experience death but once. Of all the incredible things I've		"Necessary end" is softened into "inevitable fate."	

	heard, It seems to me most bizarre that people should be afraid, Considering that death, an inevitable fate, Will come when it will come.			
4. Appropriateness of Modernization	<p>Original: CAESAR. _Et tu, Brute?—Then fall, Caesar! [_Dies. The Senators and People retire in confusion.] CINNA. Liberty! Freedom! Tyranny is dead! Run hence, proclaim, cry it about the streets.</p>	Modernization is minimal, respecting the iconic nature of the line.	Simplifying "Et tu, Brute?" removes its historical and linguistic gravitas.	Retain iconic lines like "Et tu, Brute?" to preserve cultural and emotional significance.
	<p>Translated: CAESAR. And you, Brutus?—Then fall, Caesar! [_Dies. The Senators and People retreat in confusion.] CINNA. Liberty! Freedom! Tyranny is dead! Run off, and announce it throughout the streets.</p>			
5. Handling Archaic Words and Phrases	<p>Original: Shall in these confines with a monarch's voice Cry havoc and let slip the dogs of war, that this foul deed shall smell above the earth With carrion men, groaning for burial.</p>	The idea of unleashing destruction is maintained.	"Cry havoc" is diluted into "Cry out," losing dramatic quality.	Retain unique Shakespearean idioms wherever possible, as they carry significant imagery.
	<p>Translated: Will resound within these walls with royal voice, Cry out and release the dogs of war, So that this foul deed will spread its stench Above the earth, with rotting corpses, men Groaning for burial.</p>		"Let slip" replaced by "release," reducing metaphorical impact.	
6. Faithfulness to Character Voice	<p>Original: SOOTHSAYER. Beware the Ides of March. CAESAR. What man is that? BRUTUS. A soothsayer bids you beware the Ides of March.CAESAR. Set him before me; let me see his face.</p>	The warning is clear and precise.	Replacing "Ides of March" with "15th of March" loses its historical and ominous tone.	Retain culturally significant phrases like "Ides of March" to preserve the prophetic and cryptic voice.
	<p>Translated: SOOTHSAYER.Beware the 15th of March. CAESAR. Who is that man? BRUTUS. A soothsayer warns you to beware on the 15th of March.CAESAR. Bring him before me; I want to see his face.</p>			
7. Context Awareness	<p>Original: CALPHURNIA. When beggars die, there are no comets seen; The heavens themselves blaze forth the death of princes.</p>	A sense of cosmic significance is partially preserved.	"Shooting stars" oversimplifies "comets," losing historical association with omens.	Use historically and symbolically appropriate terms like "comets" and retain the specificity of "princes."

	<p>Translated: When beggars die, there are no shooting stars visible; The heavens themselves shine brightly to signal the death of powerful individuals.</p>		<p>"Powerful individuals" lack specificity and drama compared to "princes."</p>	
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7. Conclusion

The analysis of modern translations of Shakespeare's *Julius Caesar* highlights the challenges and opportunities in adapting classical texts for contemporary audiences. The experiments show that the variations within *bfl* scores on the same temperatures at different runs [Table 1] are negligible compared to those of *bfl* scores within different temperatures [Table 2]. In a way, it is true to say that temperature thus controls the creativity of the model's output. In addition, the *bfl* constantly decreased while increasing the temperature until $t=0.5$, at which point it declined again [Table 2.]. This indicates that the temperature within a limit may not have much effect on *bfl* scores. However, this shall be studied deeply for large ranges and inputs-output pairs. While the translations generally preserve the original's core meaning and philosophical essence, certain nuances—such as the emotional impact, literary devices, and historical specificity—are often diluted. Key phrases like "Et tu, Brute?" and "Ides of March,"

which carry cultural and symbolic weight, lose their gravitas when overly modernized.

Additionally, simplifying metaphors and idiomatic expressions, as seen in "Cry Havoc and Let Slip the Dogs of War," compromises the poetic rhythm and dramatic intensity inherent in Shakespeare's work. Although modernization facilitates accessibility, it occasionally sacrifices the richness of the original's rhetorical and poetic structure. Thus, while modern translations serve as a valuable bridge for engaging broader audiences, care must be taken to balance accessibility with fidelity to the original text's depth and artistry. Future work should focus on preserving Shakespeare's literary and historical essence while ensuring relevance to modern readers.

GitHub Repo

The GitHub Repo of this project can be found at: <https://github.com/sandyiswell/AI-Meets-Shakespeare>

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