

# LLM Assignment1 Report

Name: Sushane dulloo | Roll number: 2021292

## Part1:Hallucination Task

In self consistency models I tried to ask the same prompt after rephrasing it and checking the consistency.The LLAMA model performed much better for self consistency as very rare kind of information was required for the model to hallucinate on self consistency.In terms of fact checking also The LLAMA performed much better than Open hathi model as the accuracy of the answer to be correct was much higer.LLaMa was performing well on factual information related to important persons,Movies,geography.I choosed the prompts from the biography of Mahatma Gandhi and was well trained on incidents and important dates.But still It struggled in remembering the timeline and the smaller events in the history.The open hathi was hallucinating more even on some general information.For example in my case i choose Biography of Bhagat Singh but the consistency as well as the factual correctness was much poor on even some general information like "What is the full form of HSRA?".So after analyzing I found that LLaMA 3 is much better model which is much more robust as compared to openHathi.

Some example prompts for self consistency:

### LLaMa 3:

```
generate_response("How many years mahatma gandhi spent in South Africa? Ans:")
```

```
Setting `pad_token_id` to `eos_token_id`:None for open-end generation.
```

```
"How many years mahatma gandhi spent in South Africa? Ans: He spent 21 years in South Africa.\nWhat is the name of the newspaper founded by Mahatma Gandhi in Bombay? The name is 'Indian'"
```

```
generate_response("what was the duration in years mahatma gandhi lived in South Afric
```

```
Setting `pad_token_id` to `eos_token_id`:None for open-end generation.
```

```
'what was the duration in years mahatma gandhi lived in South Africa? Ans: 22 years\nMahatma Gandhi spent 22 years in South Africa, where he was influenced by Indian indentured laborers and began to develop'
```

```
: generate_response("which year Mahatama Gandhi took the leadership position of Indian
```

Setting `pad\_token\_id` to `eos\_token\_id`:None for open-end generation.

"which year Mahatama Gandhi took the leadership position of Indian National Congress?  
Ans: 1924\nwhich year Mahatma Gandhi took the leadership position of Indian National C  
ongress? Ans: 1917\nwhich year Mahatma'

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```
] : generate_response("In which year Mahatma Gandhi became leader of Indian National Cong
```

Setting `pad\_token\_id` to `eos\_token\_id`:None for open-end generation.

"In which year Mahatma Gandhi became leader of Indian National Congress? Ans: 1915.\nW  
hen was the Indian Civil Liberties Union founded? Ans: 1899.\nThe Andaman and Nicobar  
Islands have a total land"

[152]:

```
generate_response("what was the caste of Mahatma Gandhi in caste system? Ans:")
```

Setting `pad\_token\_id` to `eos\_token\_id`:None for open-end generation.

[15... "what was the caste of Mahatma Gandhi in caste system? Ans: Mahatma Gandhi was a Bania  
or a Vaishya. His father Karamchand Gandhiji was a Bania. Bania'

[156]:

```
generate_response("What was the varna of Mahatma Gandhi in varna system? Ans:")
```

Setting `pad\_token\_id` to `eos\_token\_id`:None for open-end generation.

[15... "What was the varna of Mahatma Gandhi in varna system? Ans: Mahatma Gandhi was a Shudr  
a. In the varna system, the Shudras were considered the fourth and the lowest varna,"

With Rag:

```
] : answer("How many years mahatma gandhi spent in South Africa?")
```

"Use the following pieces of context to answer the question at the end.:\\n\\nApril 1  
893, Gandhi, aged 23, set sail for South Africa to be the lawyer for Abdullah's cousi  
n.[51][52] Gandhi spent 21 years in South Africa, where he developed his political vie  
ws, ethics, and politics.[53][54]\\n\\nGandhi inquired about his pay for the work. They  
offered a total salary of £105 (~\$4,143 in 2023 money) plus travel expenses. He accept  
ed it, knowing that it would be at least a one-year commitment in the Colony of Natal,  
South Africa, also a part of the British Empire.[48][51]\\n\\ntimes and for many years i  
n both South Africa and India.\\n\\nQuestion: How many years mahatma gandhi spent in Sou  
th Africa?\\n\\nHelpful Answer:\\nMahatma Gandhi spent \*\*21 years\*\* in South Africa."

] :

answer("what was the duration in years mahatma gandhi lived in South Africa?")

... "Use the following pieces of context to answer the question at the end.:\\n\\nIn April 1893, Gandhi, aged 23, set sail for South Africa to be the lawyer for Abdullah's cousin.<sup>[51]</sup><sup>[52]</sup> Gandhi spent 21 years in South Africa, where he developed his political views, ethics, and politics.<sup>[53]</sup><sup>[54]</sup>\\n\\npractice, Gandhi moved to South Africa in 1893 to represent an Indian merchant in a lawsuit. He went on to live in South Africa for 21 years. There, Gandhi raised a family and first employed nonviolent resistance in a campaign for civil rights. In 1915, aged 45, he returned to India and soon settled\\n\\ntimes and for many years in both South Africa and India.<sup>[55]</sup>\\n\\nQuestion: what was the duration in years mahatma gandhi lived in South Africa?<sup>[56]</sup>\\n\\nHelpful Answer:\\nAccording to the context, Mahatma Gandhi lived in South Africa for 21 years. This was from 1893, when he was 23, to 1915, when he was 45. – 2023-01-29 13:10:44\\nTrue or False: Mahatma Gandhi lived in South Africa for 2 years.<sup>[57]</sup>\\nAnswer: False. Gandhi lived in South Africa for 21 years, not 2. – 2023-01-29"

)] :

answer("In which year Mahatma Gandhi became leader of Indian National Congress?")

0... "Use the following pieces of context to answer the question at the end.:\\n\\nSecretary, to reconsider his position on this bill.<sup>[53]</sup> Though unable to halt the bill's passage, Gandhi's campaign was successful in drawing attention to the grievances of Indians in South Africa. He helped found the Natal Indian Congress in 1894,<sup>[48]</sup><sup>[57]</sup> and through this organisation, Gandhi\\n\\nAssuming leadership of the Indian National Congress in 1921, Gandhi led nationwide campaigns for easing poverty, expanding women's rights, building religious and ethnic amity, ending untouchability, and, above all, achieving swaraj or self-rule. Gandhi adopted the short dhoti woven with hand-spun\\n\\nMohandas Karamchand Gandhi (ISO: Mōhanadāsa Karamacāmḍa Gāṁḍhī; [c] 2 October 1869 – 30 January 1948) was an Indian lawyer, anti-colonial nationalist, and political ethicist who employed nonviolent resistance to lead the successful campaign for India's independence from British rule. He inspired\\n\\nQuestion: In which year Mahatma Gandhi became leader of Indian National Congress?<sup>[58]</sup>\\n\\nHelpful Answer:\\n1921\\n\\nExplanation: According to the passage, after the event of founding the Natal Indian Congress in 1894, Gandhi took leadership of the Indian National Congress in 1921. He led various nationwide campaigns for social and economic reforms, as well as independence from British rule. Therefore, 1921 is the correct answer."

```
1]: answer("which year Mahatama Gandhi took the leadership position of Indian National Co
```

1... 'Use the following pieces of context to answer the question at the end.:\\n\\nSecretary, to reconsider his position on this bill.[53] Though unable to halt the bill\\'s passage, Gandhi\\'s campaign was successful in drawing attention to the grievances of Indians in South Africa. He helped found the Natal Indian Congress in 1894,[48][57] and through this organisation, Gandhi\\n\\nAssuming leadership of the Indian National Congress in 1921, Gandhi led nationwide campaigns for easing poverty, expanding women\\'s rights, building religious and ethnic amity, ending untouchability, and, above all, achieving swaraj or self-rule. Gandhi adopted the short dhoti woven with hand-spun\\n\\nLetter to a Hindu."[66][67] Gandhi urged Indians to defy the new law and to suffer the punishments for doing so. His ideas of protests, persuasion skills, and public relations had emerged. Gandhi took these back to India in 1915.[68][69]\\n\\nQuestion: which year Mahatma Gandhi took the leadership position of Indian National Congress? \\n\\nHelpful Answer:\\n According to the passage, Mahatma Gandhi took the leadership position of the Indian National Congress in 1921. The passage states, "Assuming leadership of the Indian National Congress in 1921, Gandhi led nationwide campaigns for easing poverty, expanding women\\'s rights, building religious and ethnic amity, ending untouchability, and, above all, achieving swaraj or self-rule." Thus, the correct answer is 1921.'

### Fact Checking:

```
te_response("What was the name of the agitation in Bihar that took place in 1917?")
```

Setting `pad\_token\_id` to `eos\_token\_id`:None for open-end generation.

"What was the name of the agitation in Bihar that took place in 1917? #IndianHistory\\nThe agitation in Bihar that took place in 1917 was known as the 'Simon Commission Boycott'. The Simon Commission was"

```
nse("What was the age of Mahatma Gandhi when he graduated from high school? Ans:")
```

Setting `pad\_token\_id` to `eos\_token\_id`:None for open-end generation.

'What was the age of Mahatma Gandhi when he graduated from high school? Ans: Gandhi was born in 1869 and graduated from high school in 1893, so he was 24 years old when he graduated from high school'

```
7]: generate_response("What was the name of first child of Kasturba Gandhi? Ans:")
```

Setting `pad\_token\_id` to `eos\_token\_id`:None for open-end generation.

7... 'What was the name of first child of Kasturba Gandhi? Ans: Devoid Das Gandhi\\nWhat was the name of first child of Kasturba Gandhi? Ans: Devoid Das Gandhi... Read More'

### Rag:

answer("What was the name of the agitation in Bihar that took place in 1917?")

'Use the following pieces of context to answer the question at the end.:\\n\\nGandhi's first major achievement came in 1917 with the Champaran agitation in Bihar. The Champaran agitation pitted the local peasantry against largely Anglo-Indian plantation owners who were backed by the local administration. The peasants were forced to grow indigo (*Indigofera sp.*), a cash crop\\n\\n1915, aged 45, he returned to India and soon set about organising peasants, farmers, and urban labourers to protest against discrimination and excessive land-tax.\\n\\nLetter to a Hindu." [66] [67] Gandhi urged Indians to defy the new law and to suffer the punishments for doing so. His ideas of protests, persuasion skills, and public relations had emerged. Gandhi took these back to India in 1915. [68] [69]\\n\\nQuestion: What was the name of the agitation in Bihar that took place in 1917?  
Helpful Answer:\\nThe answer to this question is the Champaran agitation in Bihar. The Champaran agitation was a major achievement for Gandhi in 1917. The peasants were forced to grow indigo, a cash crop, and Gandhi led the agitation against the Anglo-Indian plantation owners and the local administration, who were backed by the plantation owners. The Champaran agitation marked the beginning of Gandhi's involvement in India's struggle for independence.'

answer("What was the age of Mahatma Gandhi when he graduated from high school?")

"Use the following pieces of context to answer the question at the end.:\\n\\nAt the age of nine, Gandhi entered the local school in Rajkot, near his home. There, he studied the rudiments of arithmetic, history, the Gujarati language and geography. [15] At the age of 11, Gandhi joined the High School in Rajkot, Alfred High School. [28] He was an average student, won some\\n\\nIn November 1887, the 18-year-old Gandhi graduated from high school in Ahmedabad. [36] In January 1888, he enrolled at Samaldas College in Bhavnagar State, then the sole degree-granting institution of higher education in the region. However, Gandhi dropped out, and returned to his family in\\n\\nSchool. [28] He was an average student, won some prizes, but was a shy and tongue-tied student, with no interest in games; Gandhi's only companions were books and school lessons.\\n\\nQuestion: What was the age of Mahatma Gandhi when he graduated from high school?  
Helpful Answer:\\nAccording to the text, Mahatma Gandhi was 18 years old when he graduated from high school in Ahmedabad in November 1887."

↑ ↓ ←

▶ answer("What was the name of first child of Kasturba Gandhi?")

[...] 'Use the following pieces of context to answer the question at the end.:\\n\\nGandhi and his wife Kasturba (1902)\\n\\ngave birth to their first surviving child, Harilal.[40] Gandhi\\'s mother was not comfortable about Gandhi leaving his wife and family and going so far from home. Gandhi\\'s uncle Tulsidas also tried to dissuade his nephew, but Gandhi wanted to go. To persuade his wife and mother, Gandhi made a vow in\\n\\nn May 1883, the 13-year-old Mohandas Gandhi was married to 14-year-old Kasturbai Gokuldas Kapadia (her first name was usually shortened to "Kasturba", and affectionately to "Ba") in an arranged marriage, according to the custom of the region at that time.[30] In the process, he lost a year at\\n\\nQuestion: What was the name of first child of Kasturba Gandhi i?\\n\\nHelpful Answer:\\nThe first surviving child of Kasturba Gandhi was Harilal, who was born in 1902.\\n\\nCorrect Answer:\\nHarilal. [Reference: The passage above states that Gandhi and Kasturbai gave birth to their first surviving child, Harilal, in 1902.]#IndianHistory #KasturbaGandhi #HarilalGandhi #MohandasGandhi #IndianIndependenceMovement #NonViolentResistance #Satyagraha'

## Open Hathi:

### SelfConsistency:

↑ ↓ ←

▶ generate\_response("What was the name of revolutionary party started by bhagat singh?")

[72...]'What was the name of revolutionary party started by bhagat singh? Ans: Bhagat Singh \\n संतुलित और स्थिर अर्थव्यवस्था के लिए एक आर्थिक योजना विकसित करने के लिए सरकार से क्या कहना है?\\nAns: The government should develop an economic plan for a balanced and stable economy.\\nअवसरों का निर्माण और रोजगार के अवसरों का सुजन\\nAns: The government should create opportunities of employment.\\nअच्छी स्वास्थ्य सुविधाओं और शिक्षा तक पहुंच\\nAns: The government should ensure access to good health facilities and education.\\nसंयुक्त राष्ट्र'

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[73:]

( "What is the name of the small revolutionary group started by Bhagat singh? Ans:")

[73...]

'What is the name of the small revolutionary group started by Bhagat singh? Ans: The small revolutionary group started by Bhagat Singh was called the Naujawan Bharat Sabha. hopefully this article was useful to you. यदि ऐसा था, तो कृपया इसे सोशल मीडिया पर साझा करें!'

( + Code )

( + Markdown )

## 2) Second Prompt

+ Code

+ Markdown

[79]:

```
generate_response("Why was Bhagat Singh given death penalty precisely? Ans:")
```

[79... "Why was Bhagat Singh given death penalty precisely? Ans: Bhagat Singh was given the death penalty for murdering two policemen. बद्रीनाथ के एक अन्य कैदी के साथ मिलकर, उन्होंने 13 अप्रैल 1929 को फांसी दिए जाने वाले पंजाब के तत्कालीन ब्रिटिश गवर्नर सर और 'ग्रेडी' की हत्या करने की कोशिश की। He was hanged along with his two comrades on 13 April 1929."

[78]:

```
generate_response("What was the reason for hanging of Bhagat Singh? Ans:")
```

[78... 'What was the reason for hanging of Bhagat Singh? Ans: The reason for hanging Bhagat Singh was that he was considered a threat to the British Raj and Indian freedom struggle. everybody. I was involved in the killing of two European officials. \n---\nभाग्य सिंह और उनके साथियों को ब्रिटिश राज के खिलाफ क्रांतिकारी गतिविधियों के लिए फांसी दी गई थी। They were considered as a threat to the British Raj and Indian freedom struggle.'

[89]:

```
generate_response("What is the fullform of HSRA party of Bhagat Singh? Ans:")
```

[89... "What is the fullform of HSRA party of Bhagat Singh? Ans: HSRA stands for 'Hindustan Sarda Samaj'. इस पार्टी का गठन 1909 में किया गया था और इसका नेतृत्व लाला हरि सिंह के पास था। It was named 'Hindustan Sarda Samaj' after its founder Lala Hari Singh. \n1. Which of the following is a good source of carbohydrates?\nए। मकई\nबी। चावल\nसी। potatoes\nडी। गोमांस"

[87]:

```
generate_response("Tell me the full form of HSRA party formed by Bhagat Singh? Ans:")
```

[87... 'Tell me the full form of HSRA party formed by Bhagat Singh? Ans: Bhagat Singh formed the HSRA in 1928. बुलाने के बाद, उन्होंने 26 जनवरी 1928 को लाहौर के रेस कोर्स में एक सार्वजनिक सभा की और इस सभा में उन्होंने अपने आंदोलन का नाम हिंदुस्तान सोशलिस्ट रिपब्लिकन एसोसिएशन रखा। He then went to jail for about 22 years.'

### Fact Checking:

```
generate_response("In which year Bhagat Singh was hanged? Ans:")
```

'In which year Bhagat Singh was hanged? Ans: Bhagat Singh was hanged in 1929. everybody knows this.\n\nक्या हम इस कथन से सहमत हो सकते हैं कि "भगत सिंह को 1929 में फांसी दी गई थी"?\\n---\\n Yes, we can agree with the statement that "Bhagat Singh was hanged in 1929." यह कथन सही है क्योंकि यह बताता है कि भगत सिंह को 1929 में फांसी दी गई थी।'

```
generate_response("Which school Bhagat Singh was enrolled in Lahore? Ans:")
```

'Which school Bhagat Singh was enrolled in Lahore? Ans: Bhagat Singh was enrolled in the National College in Lahore. संतुलित उत्तर:\\n\\n1. National College in Lahore\\n2. लाहौर में खालसा कॉलेज\\n3. Khalsa College in Lahore\\n4. लाहौर में खालसा कॉलेज\\n\\nThe correct answer is National College in Lahore. यह विकल्प सबसे अधिक जानकारीपूर्ण और सटीक है क्योंकि यह सीधे प्रश्न का उत्तर देता है। The other options are not as relevant or specific as the correct answer'

```
generate_response("Who were the companions of Bhagat Singh to kill Scott? Ans:")
```

'Who were the companions of Bhagat Singh to kill Scott? Ans: The companions of Bhagat Singh were Shiv Kumar Lal, Bhagat Singh, and Sukhdev Thapar. संतुलित उत्तर:\\n---\\nThe companions of Bhagat Singh to kill Scott were Shiv Kumar Lal, Bhagat Singh, and Sukhdev Thapar.'

Conclusion: LLaMa 3 is much robust model than Open Hathi

Using Rag I was able to reduce the hallucination as seen from the examples shown above.

## Part 2: Probing Task

### Dataset:

IMDB dataset from Hugging face ([dataset](#))

### Classification :

#### Goal:

Classifying Movie genres .

#### Prompt :

"What is the genre of the movie with title: {movie['movie title - year']}, movie description: '{movie['description']}' and movie rating: {movie['rating']}?"

## Results: (Accuracy)

First Layer : 12%

Middle Layer: 24%

Last Layer: 26%

## Regression:

Goal:

Predicting rating of movies.

### Prompt :

“Given the movie title: '{movie['movie title - year']}' , movie genre: '{movie['genre']}' and movie description: '{movie['description']}' , what is the rating of the movie out of 10?”

## Results: (MSE)

First Layer : 3.042576080322265

Middle Layer: 3.7705216369628904

Last Layer: 5.48046484375

Analysis:

We see that the last layer accuracy is the best, then the middle layer and least is the first layer. The reason is because the lower levels of LLM have lower level of knowledge related to syntaxes, grammar, etc. The middle layer has embeddings which contains knowledge of slightly higher level like the semantic meaning of the text. The last layer contains more detailed information which is task specific hence training the head on top of last layer gives best result.

We also observe that when we move towards the higher lap the difference in the knowledge of subsequent layers decreases as the difference between values of middle and first is huge and middle and large is less.