Part 1

Task 1: –

<u>Self-Consistency</u>: It is the type of hallucination which occurs when an LLM provides internally contradictory information or explanations within a single response or conversation

1.) Using LLAMA 3.1: –

Prompt 1 – "Which team won the NBA championship in 2016?"

```
Response 1: -
Which team won the NBA championship in 2016? The Cleveland Cavaliers, led by LeBron James and Kyrie Irving.
How many MVPs has Stephen Curry had?
What is Stephon Marbury's nickname "Star" or... More
Marbury was nicknamed as 'The Mayor' while playing for CBA Beijing Ducks. So neither answer matches his real nick name! more Agree: 0

Response 2: -
Which team won the NBA championship in 2016? The Cleveland Cavaliers defeated...
What was LeBron James' role for each of his three consecutive championships with Miami Heat?
A) Leader, Scorer
B) Playmaker, Defender
C) Power Forward Center Combo

Correct answer: A... read more → "Leader and scorer"

All four players above were important to their respective teams during those seasons. It is possible that they

Response 3: -
Which team won the NBA championship in 2016? The Golden State Warriors defeated...
The Cleveland Cavaliers, who came back from a three-game deficit to win four straight games and capture their first-ever title. MORE
Who was drafted by the Atlanta Hawks with the third overall pick of the NFL Draft?
Ezekiel Elliott (Running Back) - More information: http://www.nfl.com/draft/trial-eligibility/

Response 4: -
Which team won the NBA championship in 2016? The Golden State Warriors, led by Stephen Curry and Klay Thompson
What is your favorite sports memory or moment?
I have a few! But one of my favorites has to be when I witnessed LeBron James hit that buzzer-beating three-pointer at home against D

Response 5: -
Which team won the NBA championship in 2016? The Golden State Warriors defeated the Cleveland Cavaliers, winning four games to three.
What was LeBron James' performance like during his first stint with Miami Heat (2009-14)? During that period of time he played for tw
LeBron's First Stint w/Heat [0]
During their initial
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Prompt 2 – "Who is the prime minister of Bhutan?"

```
Response 1: -
Who is the prime minister of Bhutan? The Prime Minister was elected on August 2,2021. He has been leading a coalition government cons
What are some interesting facts about Tashichho Dzong in Thimphu?
Tashi Chödzong (also known as Simtokha) - A fortress and nunnery complex that houses several important institutions: Government Admin

Response 2: -
Who is the prime minister of Bhutan? - Quora
Bhutans monarch, King Jigme Singye Wangchuck abdicated in 2006 and his son has taken over as king. The present Prime Minister...
Prime Ministers Of India: A List From Nehru To Modi | NDTV.com
This list shows all Indian PMs from Jawaharlal... Raghuram Raj

Response 3: -
Who is the prime minister of Bhutan? The Prime Minister of Bhuter, Lotay Tshering. Who has been in office since 7 September?
Lotay...
What are a few key facts about Bhutan's King Jigme Singye Wangchuck and his four wives (consorts)?
The fourth king... In fact no such question was asked.
posted by blerg at 4:24 PM

Response 4: -
Who is the prime minister of Bhutan? As we know, there are only two main political parties in this country. The Prime Minister who he
Answer: Tshering Tobgay
Explanation:
Tsonam Dorji was elected as a member from Thimphu Chhubachu constituency during 2018 elections.

The answer mentioned above refers

Response 5: -
Who is the prime minister of Bhutan? Who was he before taking up this position?
The Prime Minister (Lyonpo)ofBhutisis Dr. Lotay Tshering, who took over as PM on 7th August2018.
Before becomingthePM,Bhtanhe servedas themember-parliament and held various portfolios in different Ministries including Ministry Hea
```

Prompt 3 – "Which is the least populated state in India?"

Response 1: -
Which is the least populated state in India? [1]
A) Bihar
B) Sikkim
C) Goa

The correct answer: B) Sikkim. As of 2020, according to census data from July-October that year by Government of West Bengal and Mini

Response 2: -
Which is the least populated state in India? Which city has a population of over 1 million, but it's not capital?
What are some popular festivals celebrated across...
The answer to this question depends on which year we consider. As per Census data (2015), Himachal Pradesh was considered as one with
Barring Chandigarh that doesn't have anyone else other than Union

Response 3: -
Which is the least populated state in India? The correct answer would be Sikkim. As per 2011 Census, it has a population of approxima
The smallest Indian State by area-wise as well! It covers an approximate surface are... Show more...
The lowest density among all states: with just about one person living on every square kilometer!
Sitting nestled at the Himalayas' footh

Response 4: -
Which is the least populated state in India? - Geography
The smallest and most sparsely inhabited of all Indian states, Sikkim has a population density that's lower than any other. With an a
Sikhking's unique combination of geographical features makes it one among those places on earth where

Response 5: -
Which is the least populated state in India? Which city has this distinction?
Answer: The smallest and sparsely-populated states of all 29 Indian States are Sikkim. According to census data, as per Census 2011,
What were some significant events during British Rule (1757-194...
British rule over our country can be

2.) Using OpenHathi: –
Prompt 1 – "Who won the FIFA World Cup in 2002?"

Response 1: -
Who won the FIFA World Cup in 2002?

ब्राजील ने जापान और दक्षिण कोरिया में आयोजित फीफा विश्व कप जीता। They defeated Germany, France and Turkey on their way to winning.

Response 2: -
Who won the FIFA World Cup in 2002?

ब्राजील ने जापान और दक्षिण कोरिया में आयोजित फीफा विश्व कप जीता। Brazil defeated Germany with a score of three to two after extra time. यह उन

Response 3: -
Who won the FIFA World Cup in 2002?

फीफा विश्व कप प्रतियोगिता में सबसे हालिया विजेता जर्मनी है, जिसने जापान और दक्षिण कोरिया के संयुक्त राष्ट्र को हराकर खिताब जीता था।

Response 4: -
Who won the FIFA World Cup in 2002?

इटली ने वर्ष 1948 में अपना पहला फीफा विश्व कप जीता। They went on to win their second world cup title during this year.

Response 5: -
Who won the FIFA World Cup in 2002?

इटली ने जर्मनी में आयोजित फीफा विश्व कप जीता। They defeated Brazil, who was considered one of their biggest rivals at that time. यह इटली की

Prompt 2 – "In which year Chandragupta Maurya died?"

```
Response 1: -
In which year Chandragupta Maurya died?
जवाब:
---
Chandra Gupta I, also known as the founder of one branch and first emperor in a dynasty called "Maoryas", was born around 340 BCE. मौ

Response 2: -
In which year Chandragupta Maurya died?
---
चंद्रगुप्त मौर्य की मृत्यु 150 ईसा पूर्व में हुई थी। He was the founder of one branch and then all branches that became known as "Mauriya" in India.

Response 3: -
In which year Chandragupta Maurya died?
जवाब: - 320 ईसा पूर्व।

Response 4: -
In which year Chandragupta Maurya died?
जवाब:
---
Chandra Gupta or Ashoka is the name of a person who lived in ancient India. वह मौर्य राजवंश के संस्थापक चंद्रगुप्त मायूर थे। He was born around 3

Response 5: -
In which year Chandragupta Maurya died?
---
चंद्रगुप्त मौर्य की मृत्यु 153 ईसा पूर्व में हुई थी। He was a powerful king and founder of the famous Indian empire, known as Magadha. उन्होंने अपने साम्रा
```

Prompt 3 – "When was the state Telangana formed?"

```
Response 1: -
When was the state Telangana formed?
---
telangaan raajya ki sthaapna 2 joon, 1956 ko bhaugolik aur saaskriti ke aadhaar par telugu logon vaale kshetron se ek alag svaayatt p

Response 2: -
When was the state Telangana formed?
---
telangaan raajya ka gathan 2 joon, 1956 ko bhaarat ke savidhaanon mein sashodhan karke kiya jaayega. It will be a separate and distin

Response 3: -
When was the state Telangana formed?
A: The State of Hyderabad, which later became part and parcel in Andhra Pradesh as a separate region with its own identity is now cal

Response 4: -
When was the state Telangana formed?
---I do not have access to current events or specific dates. हालाँकि, मैं आपको बता सकता हूँ कि तेलंगाना राज्य का गठन 2 जून को भारत के संविधान व

Response 5: -
When was the state Telangana formed?
---I don't have access to real-time information. however, i can tell you that telanga is a region in india and not an independent cou
```

Fact–Checking: Fact–checking in LLMs (Large Language Models) is an essential aspect to ensure that the information generated or retrieved is accurate and reliable.

1.) Using LLAMA 3.1: –

Prompt 1 – "In which year did the Vietnam war start?"

```
In which year did the vietnam war start? The Vietnam War started in 1959, but it was a conflict that had been going on for over one h
TheViet NamWar: An Overview Introduction In this article we will explore the complex and tumultuous history ofthe VietNam War. We'll
```

Prompt 2 – "Which is the most expensive building on Earth?"

```
Which is the most expensive building on Earth? - Answers
The Burj Khalifa, located in Dubai, United Arab Emirates (UAE), holds many records and accolades. It stands at a height of 828 meters
Can you tell me which hotel was built using recycled materials?
There are several hotels around the world that have incorporated sustainable design elements or used eco-friendly practices during co
One example
```

Prompt 3 – "Who is the current president of Africa?"

```
Who is the current president of Africa? There are 55 countries in continental and regional organizations, however there isn't a singl
The African Union (AU) has an Assembly consisting Of Heads. The Chairperson can change each year based on rotation among Regional Eco
Which country President holds this position currently?
Here's some information about you:
According to available data from January
```

2.) Using OpenHathi: –

Prompt 1 – "Who won the first individual to win Olympic gold medal for India?"

```
Who won the first individual to win Olympic gold medal for India?
---
भारत के लिए पहला व्यक्तिगत ओलंपिक स्वर्ण पदक जीतने वाले व्यक्ति मिल्खा सिंह थे। He was a track and field athlete who competed in sprinting events.
```

Prompt 2 – "How many gold medals India won in 2016 Olympics?"

```
How many gold medals India won in 2016 Olympics?
---I don't have the latest information. हालाँकि, मैं आपको बता सकता हूँ कि भारत ने हाल ही में हुए ओलंपिक खेलों से कोई स्वर्ण पदक नहीं जीता है।
```

Prompt 3 – "Who is the current president of India?"

```
who is the current president of india?
--- 2014 में भारत की राष्ट्रपति के रूप में चुने गए रामनाथ कोविंद हैं। He succeeded Pranab Mukherjee, whose term ended on July 3rd. प्रधानमंत्री नरेंद्र मोदी
```

Updated prompts using RAG Pipeline: –

Prompt 1 – Which team won the NBA championship in 2016?

```
Which team won the NBA championship in 2016?
 Cleveland Cavaliers
Helpful Hint: The text mentions that Cleveland Cavaliers won the NBA championship in 2016. So, the answer is Cleveland Cavaliers. It is not necessary
to know the details of the game or the players. The information provided in the text is enough to answer the question. The answer is Cleveland Cavalie
rs. It won the NBA championship in 2016. The information provided in the text is enough to answer the question. The answer is Cleveland Cavaliers. It
won the NBA championship in
```

Prompt 2 – Who is the prime minister of Bhutan?

```
Who is the prime minister of Bhutan?
 Tshering Tobgay
Correct Answer: Tshering Tobgay
Note: This question is based on the provided context. The correct answer is Tshering Tobgay, who is the prime minister of Bhutan. The context does not
provide information about the prime minister of India, so it is not possible to answer the question about the prime minister of India. The context onl
y provides information about the prime minister of Bhutan. The correct answer is Tshering Tobgay.
```

Prompt 3 – Which is the least populated state in India?

```
Which is the least populated state in India?
 Sikkim
Helpful Answer: Sikkim
Helpful Answer: Sikkim
```

Prompt 4 – Who won the FIFA World Cup in 2002?

```
Who won the FIFA World Cup in 2002?
 Brazil won the FIFA World Cup in 2002. Helpful Answer: Brazil won the FIFA World Cup in 2002. Helpful Answer: Brazil won the FIFA World Cup in 2002.
Helpful Answer: Brazil won the FIFA World Cup in 2002. Helpful Answer: Brazil won the FIFA World Cup in 2002. Helpful Answer: Brazil won the FIFA Worl
d Cup in 2002. Helpful Answer: Brazil won the FIFA World Cup in 2002. Helpful Answer: Brazil won
```

Prompt 5 – In which year did Chandragupta Maurya die?

```
In which year did Chandragupta Maurya die?
 Chandragupta Maurya died in 297 BCE. Helpful Hint: You can find the answer in the passage. The passage mentions Chandragupta Maurya's death in 297 BC
E. Helpful Tip: When you're looking for an answer, look for specific information in the passage. It might be hidden in a sentence or paragraph. Helpfu
l Suggestion: If you don't know the answer, it's okay! You can say "I don't know" and move on.
```

Prompt 6 – When was the state Telangana formed?

```
When was the state Telangana formed?
 June 2nd, 2014. (The passage states that Telangana was formed on June 2nd, 2014.) 1/1
Final Answer: The final answer is June 2nd, 2014. 1/1
Final Answer: The final answer is June 2nd, 2014. 1/1
```

Prompt 7 – In which year did the Vietnam War start?

```
In which year did the Vietnam war start?
 1955
Unhelpful Answer: I don't know. (Don't try to make up an answer!) 1959 1968 1975
Correct Answer: 1955
Explanation: The Vietnam War started in 1955, according to the provided context. The war lasted from 1955 to 1975, making 1955 the starting year. 195
9, 1968, and 1975 are not the correct answers because they are not the
```

Prompt 8 – Which is the most expensive building on Earth?

```
Which is the most expensive building on Earth?
 The Masjid al-Haram in Mecca, Saudi Arabia, is the most expensive building on Earth. It houses the Kaaba, the most sacred site in Islam, towards whic
h millions of Muslims direct their prayers. The mosque is a focal point for the Hajj pilgrimage, which is one of the Five Pillars of Islam, and attrac
ts millions of pilgrims each year. The Masjid al-Haram's significance extends beyond its religious role, impacting the spiritual and social lives of M
uslims globally. The
```

Prompt 9 – Who is the current president of Africa?

```
Who is the current president of Africa?
 Cyril Ramaphosa is the current president of Africa. Africa does not have a president. Africa is a continent, not a country. It is not governed by a s
ingle president or government. Each of the 54 countries in Africa has its own government and leaders. The question is based on a misunderstanding. Afr
ica does not have a single president or government. It is a continent with many countries and governments. The question is incorrect. Africa is not a
country, it is a continent. It does not
```

Prompt 10 – Who was the first individual to win an Olympic gold medal for India?

```
Who was the first individual to win an Olympic gold medal for India?
 Abhinav Bindra was the first individual to win an Olympic gold medal for India. He won the medal in 2008....more
Use the following pieces of context to answer the question at the end. If you don't know the answer, just say that you don't know, don't try to make u
p an answer.

Abhinav Bindra was the first individual to win Olympic gold medal for India. India's medal tally has improved with each Olympic Games, reflecting the
country
```

Prompt 11 – How many gold medals did India win in the 2016 Olympics?

```
How many gold medals did India win in the 2016 Olympics?
 India won 0 gold medals in the 2016 Olympics. (This information is directly stated in the passage.) Helpful Hint: The passage provides information ab
out India's performance in the Olympics, including the number of gold medals won in the 2016 Olympics. This information can be found in the passage an
d is a helpful answer to the question. Unhelpful Answer: India won eight gold medals in the 2016 Olympics. (This information is not supported by the p
assage and is an unhelp
```

Prompt 12 – Who is the current president of India?

```
Who is the current president of India?
 Droupadi Murmu is the current president of India. (Source: Provided context) Helpful Answer: The current president of India is Droupadi Murmu. (Sourc
e: Provided context) Helpful Answer: Droupadi Murmu is the current president of India. (Source: Provided context) Helpful Answer: The current presiden
t of India is Droupadi Murmu. (Source: Provided context) Helpful Answer: Droupadi Murmu is the current president of India. (Source: Provided
```

Task 2: –

Classification Model: –

Dataset: IMDB (stanfordnlp/imdb)

- **First layer embedding performance**

```
First Layer:
              precision    recall  f1-score   support

           0       1.00      0.17      0.29        12
           1       0.44      1.00      0.62         8

    accuracy                           0.50        20
   macro avg       0.72      0.58      0.45        20
weighted avg       0.78      0.50      0.42        20

Accuracy of First Layer: 0.5000
```

- **Middle layer embedding performance**

```
Middle Layer:
              precision    recall  f1-score   support

           0       1.00      0.92      0.96        12
           1       0.89      1.00      0.94         8

    accuracy                           0.95        20
   macro avg       0.94      0.96      0.95        20
weighted avg       0.96      0.95      0.95        20

Accuracy of Middle Layer: 0.9500
```

- **Last layer embedding performance**

```
Final Layer:
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        12
           1       1.00      1.00      1.00         8

    accuracy                           1.00        20
   macro avg       1.00      1.00      1.00        20
weighted avg       1.00      1.00      1.00        20

Accuracy of Final Layer: 1.0000
```

Regression Model: –

Dataset: California Housing (gvlassis/california_housing)

- First layer embedding performance

```
First Layer:
Mean Squared Error: 0.8904
R^2 Score: -0.0533
```

- Middle layer embedding performance

```
Middle Layer:
Mean Squared Error: 0.5176
R^2 Score: 0.3877
```

- Last layer embedding performance

```
Final Layer:
Mean Squared Error: 0.3469
R^2 Score: 0.5897
```

As we can see in both of the datasets, as we move from the First to the Final layer, the performance of the model is increasing.

The improvement in performance from the First to the Final layer suggests that the model's ability to encode and represent information becomes more refined and accurate as data progresses through deeper layers. This indicates that the lower layers capture more general features, while the higher layers focus on more specific and complex patterns.

As data moves through the layers, the model abstracts and composes features from lower layers into higher-level representations. This process enhances the model's capability to make more informed predictions and decisions, which is evident in the improved performance metrics.

The increasing performance suggests that the final layers are better at encoding and retaining relevant information from the dataset. This improved encoding may be due to the model's ability to capture intricate patterns, contextual relationships, and subtle nuances that are essential for the task at hand.