Lab 1: Introduction to ChatGPT

Introduction

ChatGPT is an advanced AI language model developed by OpenAI, based on the **GPT (Generative Pretrained Transformer)** architecture. GPT models are trained on massive amounts of text data and use **transformers**, a deep learning model introduced by Vaswani et al. in 2017, to understand and generate human-like text. The current version of ChatGPT (GPT-4) can process both **text and image inputs** and is capable of holding conversations, generating content, solving problems, and assisting in a wide range of tasks.

How It Works

ChatGPT operates using a **transformer-based neural network**, which uses layers of attention mechanisms to predict the next word in a sentence. The model is trained in two phases:

1. **Pretraining**: The model learns language patterns from a large dataset.

2. **Fine-tuning**: The model is adjusted using supervised learning and reinforcement learning (e.g., RLHF – Reinforcement Learning from Human Feedback) to improve its usefulness and safety.

Exploring the ChatGPT Interface

Users can interact with ChatGPT through a simple chat interface. You type a prompt, and ChatGPT responds in natural language. The interface supports text formatting, code, and even file uploads in premium versions. It is designed to be user-friendly for students, developers, educators, and professionals.

Transformer Architecture (Visualization Insight)

The key component of ChatGPT is the **transformer**, which uses **self-attention** to weigh the importance of each word in a sentence. This allows it to understand context better than previous models. Visualization tools such as "transformer attention heatmaps" help in understanding how different parts of a sentence relate to each other during processing.

Real-World Applications

1. **Education:**
    - Assists students with homework, explains difficult concepts
    - Generates quizzes, summaries, and educational content
2. **Healthcare**:
    - Provides mental health support (as a chatbot)
    - Helps doctors with preliminary diagnosis based on symptoms
3. **Business**:
    - Automates customer service with chatbots
    - Drafts emails, reports, and manages calendars
4. **Creativity**:
    - Aids in writing stories, poetry, or music lyrics
    - Supports artists with brainstorming and ideation

Conclusion

ChatGPT is a powerful tool that simulates human conversation and supports countless applications across industries. Its transformer-based design allows it to understand context and deliver meaningful, coherent, and helpful responses. As AI evolves, tools like ChatGPT are becoming essential in everyday life.

Lab 2: Types of Prompts and Prompt Engineering Basics

Objective

To understand different types of prompts (instructional, interrogative, zero-shot, few-shot) and how prompt design affects the quality of responses.

🔹 Instructional Prompts (5 Examples)

Prompts that directly tell the AI what to do.

Prompt	Response (Summary)
1. "Summarize the paragraph below in one sentence."	Clear, one-sentence summary.
2. "Convert the text to bullet points."	Output given as well-structured bullets.
3. "Write a formal email to request leave for two days."	Properly formatted, polite email.
4. "List three benefits of regular exercise."	Accurate and relevant points listed.
5. "Explain how a refrigerator works in simple terms."	Easy-to-understand explanation provided.

🔹 Zero-Shot Prompts (5 Examples)

No examples provided; relies on model's general understanding.

Prompt	Response (Summary)
1. "Translate this into Hindi: 'Knowledge is power.'"	Correct translation: "ज्ञान ही शक्ति है।"
2. "Write a haiku about the ocean."	Proper haiku with 5-7-5 structure.
3. "Generate a list of three startup ideas."	Relevant ideas, varied industries.
4. "Explain blockchain to a 10-year-old."	Simple analogy used, easy to grasp.
5. "Describe a futuristic city."	Creative, vivid description.

🔹 Few-Shot Prompts (5 Examples)

Includes examples in the prompt to guide the model's behavior or formatting.

Prompt	Response (Summary)
1. **Prompt:** "Convert to past tense: 'She walks.' → 'She walked.' Now: 'He runs.'"	
Response: "He ran."	
2. **Prompt:** "Translate: 'Good morning' → 'Bonjour'. 'Thank you' → 'Merci'. Now: 'Please'"	
Response: "S'il vous plaît"	
3. **Prompt:** "List hobbies like: 1. Reading 2. Swimming. Now add one more."	
Response: "3. Painting"	
4. **Prompt:** "Explain AI like this: 'AI is like a robot brain.' Now: 'Machine learning'"	
Response: "Machine learning is like teaching a robot by showing examples."	
5. **Prompt:** "Give fun facts: 'Cats sleep 16 hours a day.' Now one about dogs."	
Response: "Dogs have a sense of smell up to 100,000 times better than humans."	

📊 Comparison of Results

Type	Strength	Use Cases	Quality
Instructional	Clear output, easy to control	Formal tasks, summaries, formatting	★★★★★
Interrogative	Informational, concise	Q&A, general knowledge	★★★★☆

Zero-Shot	Fast, requires no prep	General, creative, or simple tasks	★★★☆☆
Few-Shot	High control, best for structure/style	Language tasks, pattern-based logic	★★★★★

Conclusion

Prompt engineering is crucial to unlocking ChatGPT's potential. While **zero-shot** is convenient, **few-shot** prompting is especially powerful when consistency, style, or logic is important. responses. By practicing these types, we can build more effective and intelligent AI interactions.Instructional prompts work best for direct tasks, and interrogative prompts excel at factual

Lab 3: Precision Prompting for Information Extraction

Objective

To learn how to extract **structured data** such as contact details, resume sections, and keywords from unstructured text using **precision prompting** with JSON or tabular output formats.

🛠️ Activities Performed

✔️ Activity 1: Format Response in JSON

Prompt:

> Extract the following details in JSON format:
> **Full Name, Email, Phone Number, Skills** from this text:
> "My name is Rahul Mehta. You can reach me at rahul.mehta@email.com or call me at 9876543210. I'm skilled in Python, SQL, and data visualization."

Output (JSON):

{

"Full Name": "Rahul Mehta",

"Email": "rahul.mehta@email.com",

"Phone Number": "9876543210",

"Skills": ["Python", "SQL", "data visualization"]

}

✔️ **Activity 2: Extract Resume Sections in Table Format**

Prompt:

> **From the following text, extract resume sections and format in a table:**
> **"Education: B.Tech in Computer Science from IIT Delhi. Experience: Worked at Infosys as Software Engineer. Skills: Java, HTML, CSS. Projects: Built an e-commerce site using MERN stack."**

Output (Table):

Section	Details
Education	B.Tech in Computer Science from IIT Delhi
Experience	Worked at Infosys as Software Engineer
Skills	Java, HTML, CSS
Projects	Built an e-commerce site using MERN stack

✔️ **Activity 3: Extract Keywords from a Paragraph**

Prompt:

> **Extract key technical keywords from this text:**
> **"Artificial intelligence and machine learning are transforming industries. Tools like neural networks, decision trees, and natural language processing are widely used."**

Output (Keywords List):

- **Artificial intelligence**
- **Machine learning**
- **Neural networks**
- **Decision trees**
- **Natural language processing**

Accuracy: ✔️ ***Correct keywords with good coverage of technical terms***

🔍 Prompt Design Strategies Used

- **Clear instruction (e.g., "Extract in JSON format")**
- **Defined fields (name, email, etc.)**
- **Structured formatting requests (JSON, table, list)**
- **Context-aware parsing (from resumes, bios, or technical content)**

✔️ Conclusion

Precision prompting allows for highly accurate information extraction when instructions are clear and format expectations are defined. JSON and tabular formats are ideal for structured data extraction tasks like contact parsing, resume analysis, and keyword extraction.

Lab 4: Summarization and Text Transformation

Objective

To use ChatGPT for performing tasks such as **summarizing long texts**, **rewriting content**, and **changing the tone** (formal/informal) of messages while preserving the core meaning.

✔️ Activity 1: News Article Summarization

Prompt:

> Summarize the following article in 3-4 bullet points:
> "The Indian Space Research Organisation (ISRO) successfully launched the Gaganyaan test vehicle on Saturday. The mission is a crucial step in India's plan to send astronauts to space. The vehicle carried systems to simulate crew module separation. ISRO plans to conduct more such tests before the final human mission in 2025."

Output Summary:

- ISRO launched the Gaganyaan test vehicle successfully.
- The mission supports India's human spaceflight plans.
- Crew module separation systems were tested.
- Final mission with astronauts is targeted for 2025.

Accuracy: ✔️ *Concise, accurate, and covers all key points.*

✔️ Activity 2: Research Abstract Summarization

Prompt:

> Summarize this abstract:
> "This study explores the effectiveness of blended learning in higher education. By combining online resources with in-class teaching, student engagement and performance improved significantly. Data from 300 students was analyzed using statistical methods to assess learning outcomes."

Output Summary:

- The study analyzes blended learning in higher education.
- Combines online and classroom methods.
- Results showed improved engagement and performance.
- Based on data from 300 students.

Accuracy: ✔️ *Clear and well-structured summary.*

✔️ Activity 3: Tone Transformation – Informal to Formal Email

Original (Informal):

> “Hey, I can't make it to the meeting tomorrow. Got something else lined up. Can we reschedule?”

Prompt:

> Rewrite the email in a formal tone.

Formal Version:

> “Dear [Recipient],
> I regret to inform you that I will be unable to attend tomorrow’s meeting due to a prior commitment. Kindly let me know if we can reschedule at a mutually convenient time.
> Best regards,
> [Your Name]”

✔️ *Tone shifted to professional while keeping the intent.*

✔️ Activity 4: Tone Transformation – Formal to Informal

Original (Formal):

> “Please be advised that your presence is required at the team briefing scheduled for Monday at 10 a.m.”

Prompt:

> Rewrite the message informally.

Informal Version:

> “Just a heads-up — there’s a team briefing on Monday at 10 a.m. Would be great if you could join!”

✔️ *Appropriate casual tone achieved without losing meaning.*

📌 Conclusion

ChatGPT can accurately **summarize**, **rewrite**, and **transform text tone** when given clear instructions. It is a valuable tool for academic, professional, and casual communication tasks.

Lab 5: ChatGPT in Code Generation and Debugging

Objective

To explore how ChatGPT can be used to **generate code** and **debug existing programs** in various programming languages such as Python, C++, and Java. This lab demonstrates ChatGPT's utility as a coding assistant for both beginners and professionals.

✔️ Activity 1: Code Generation from Prompt

Prompt:

> Write a Python program to find the factorial of a number using recursion.

ChatGPT Output:

```
def factorial(n):
    if n == 0 or n == 1:
        return 1
    return n * factorial(n - 1)

# Example usage
num = 5
print("Factorial of", num, "is", factorial(num))
```

Expected Output:

> Factorial of 5 is 120

✔️ **Match:** Output was correct, logic is clear, and code runs successfully.

✔️ Activity 2: C++ Code Generation

Prompt:

Write a C++ program to check whether a number is prime.

ChatGPT Output:

```
#include <iostream>
using namespace std;

bool isPrime(int n) {
    if (n <= 1) return false;
    for (int i = 2; i * i <= n; i++) {
        if (n % i == 0)
            return false;
    }
    return true;
}

int main() {
    int num = 17;
    if (isPrime(num))
        cout << num << " is a prime number.";
    else
        cout << num << " is not a prime number.";
    return 0;
}
```

Expected Output:

17 is a prime number.

✔️ **Match:** Code compiles and works as expected.

✔️ Activity 3: Code Debugging

Prompt:

The following Python code has an error. Fix it:

```
def add_numbers(a, b)
```

```
    return a + b
```

ChatGPT Output:

```
def add_numbers(a, b):
    return a + b
```

✔️ Fix: Missing colon was added. Code runs without errors.
✔️ Activity 4: Debugging Java Code

Prompt:

Debug this Java code snippet to print “Hello World”:

```
public class Main {
    public static void main(String args) {
        System.out.println("Hello World")
    }
}
```

ChatGPT Output (Corrected):

```
public class Main {
    public static void main(String[] args) {
        System.out.println("Hello World");
    }
}
```

✔️ **Fixes Made:**

- Added `[]` to `args`
- Added semicolon after `println`
- Result: Code compiles and prints correctly

📊 Comparison & Evaluation

Task	Prompt Type	ChatGPT Output	Accuracy
Python recursion	Code generation	✔️ Matches	100%
C++ prime check	Code generation	✔️ Matches	100%
Python syntax fix	Debugging	✔️ Fixed	100%
Java debug	Debugging	✔️ Fixed	100%

📌 Conclusion

ChatGPT is a powerful assistant for **code generation** and **debugging**. It understands syntax, logic, and context, making it ideal for solving common programming problems and fixing errors. Its output closely matches expected results when prompts are specific and well-structured.

Lab 6: Domain-Specific Applications

Selected Task: *Educational Quiz Generation*

Objective

To explore how ChatGPT can be used to generate domain-specific content—in this case, **educational quizzes**—using well-designed prompts to create questions, answers, and options across academic subjects.

✔️ Prompt Design

Prompt Used:

> *Generate a multiple-choice quiz on "Photosynthesis" for Grade 8 students. Include 5 questions with 4 options each and indicate the correct answer after each question.*

Reasoning Behind Prompt Design:

- **Topic** and **grade level** specified for appropriate difficulty
- **Number of questions** and **format** (MCQs) clearly stated
- **Output structure** (options and answer key) explicitly mentioned

✔️ Output (Sample)

1. What is the main purpose of photosynthesis?
A) To produce oxygen
B) To absorb water
C) To create glucose for energy
D) To release carbon dioxide
✔️ **Correct Answer: C**

2. Which gas is absorbed by plants during photosynthesis?
A) Oxygen
B) Carbon monoxide
C) Carbon dioxide
D) Nitrogen
✔️ **Correct Answer: C**

(3 more questions followed similarly)

✔️ Evaluation

Criteria	Evaluation
Relevance to topic	✔️ Questions aligned with topic
Clarity of options	✔️ Clear, age-appropriate language
Difficulty level	✔️ Suitable for Grade 8
Format and structure	✔️ Followed instruction fully
Answer accuracy	✔️ All correct answers were logical