ChatGPT: Introduction, Working, and Real-World Applications

Origin and Basics

ChatGPT is an advanced AI language model developed by **OpenAI**, built on the **GPT** (**Generative Pre-trained Transformer**) architecture. It was first introduced in 2018 (GPT-1) and has evolved through multiple versions, with GPT-4.5 being one of the latest. It is designed to generate human-like text based on given prompts.

How It Works

- **Transformer Architecture**: ChatGPT uses a transformer model that processes text in tokens.
- **Training**: It is trained on massive datasets of books, websites, and articles to learn grammar, facts, reasoning, and context.
- Mechanism:
 - 1. **Tokenization** Breaks text into small units (tokens).
 - 2. **Attention Mechanism** Determines which words in a sentence are most relevant to each other.
 - 3. **Generation** Predicts the next token repeatedly to form coherent responses.

(Visualization: Transformer architecture shows encoder-decoder blocks with multi-head attention layers.)

Capabilities

- **Text Generation** Essays, stories, scripts.
- **Information Retrieval** Summaries, explanations.

- Reasoning & Problem Solving Logic, math, coding.
- **Conversational Interaction** Chatbot, personal assistant.

Real-World Applications

1. Education -

- Homework help & concept explanation (e.g., explaining physics laws).
- Quiz and worksheet generation for teachers.

2. Healthcare -

- Symptom checking & health information (not a substitute for doctors).
- Medical report summarization.

3. Business -

- Customer support automation.
- Market analysis summaries.

4. Creativity -

- Story, poem, and content creation.
- o Game dialogues and brainstorming.

Conclusion

ChatGPT combines powerful **natural language understanding** with **generation capabilities** to assist in multiple domains. Its potential spans education, healthcare, business, and creative industries, making it a versatile tool for real-world problem solving.

Lab 2: Types of Prompts and Prompt Engineering Basics

1. Instructional Prompts

(Directly tell ChatGPT what to do.)

Example	Expected Output (Summary)

Explain Newton's 3 laws of motion in simple terms. Short, simplified explanation.

Write a formal email requesting leave for 2 days. Professional leave email.

Summarize "Romeo and Juliet" in 100 words. Concise summary.

Generate 5 creative slogans for a coffee shop. 5 catchy slogans.

Translate "Good morning, how are you?" into Spanish. "Buenos días, ¿cómo estás?"

2. Interrogative Prompts

(Ask questions to elicit information.)

Example	Expected Output (Summary)
What are the main differences between Python and Java?	Key points comparison.
How does the human respiratory system work?	Step-by-step explanation.
Why is photosynthesis important for life?	Biological significance.
What are the pros and cons of electric vehicles?	Advantages vs disadvantages.
How does blockchain technology ensure security?	Technical explanation.

3. Zero-Shot Prompts

(No examples given, just the task.)

Exam	ole
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Expected Output (Summary)

Categorize this sentence as positive, negative, or neutral: "I love this phone!"

Positive

Create a short bedtime story for a 6-year-old about a rabbit.

Simple story.

Suggest a one-week vegetarian meal plan.

List of meals by day.

Convert "The meeting is tomorrow at 10 AM" into French translation. French.

Give a list of 10 synonyms for "happy."

10 synonyms.

4. Few-Shot Prompts

(Provide a few examples, then ask for another similar output.)

Example Prompt:

Example 1: Input: "I love sunny days" → Sentiment: Positive

Example 2: Input: "This food is terrible" → Sentiment: Negative

Example 3: Input: "The room is clean" → Sentiment: Neutral

Input: "The movie was amazing" → Sentiment: ?

Expected Output: Sentiment: Positive

Task	Few-Shot Examples Given	Expected Output
Translate English → French	2 examples	Correct translation
Classify animals as mammal, bird, reptile	3 examples	Correct classification
Generate haikus	2 sample haikus	New haiku
Math reasoning	2 worked-out examples	Correct answer
Coding pattern	2 sample codes	New code following pattern

Comparison of Results

Туре	Advantages	Limitations
Instructional	Direct, fast, easy	May be vague if unclear instructions
Interrogative	Good for explanations	Less control over format
Zero-Shot	Quick, no prep needed	Accuracy may drop for complex tasks
Few-Shot	More accurate, consistent style	Requires crafting good examples

Lab 3: Precision Prompting for Information Extraction

Objective:

Learn how to extract structured data (like contact details, resume sections, or keywords) by designing precise prompts and formatting outputs in **JSON** or **tables**.

Activity 1: Extract Contact Information

Prompt:

Extract the contact information from the text below and format it in JSON.

"You can reach me at John Smith, email: johnsmith@example.com, phone: +1-202-555-0182. My office is at 45 Green Street, New York."

Output (JSON):

```
{
"Name": "John Smith",
"Email": "johnsmith@example.com",
"Phone": "+1-202-555-0182",
"Address": "45 Green Street, New York"
}
```

Activity 2: Extract Resume Sections

Prompt:

From the following text, extract the resume sections and present them in a table with columns: Section, Content.

"Jane Doe is a Software Engineer with 5 years of experience.

Skills: Python, JavaScript, SQL

Education: B.Tech in Computer Science

Experience: Worked at ABC Corp (2019-2023)"

Output (Table):

Section	Content
Name	Jane Doe
Title	Software Engineer
Experience	5 years
Skills	Python, JavaScript, SQL
Education	B.Tech in Computer Science

Activity 3: Extract Keywords

Prompt:

Extract the top 5 keywords from the following text and return them in JSON format.

"Artificial Intelligence (AI) is transforming industries by automating tasks, improving decision-making, and enabling advanced analytics in healthcare, finance, and manufacturing."

Output (JSON):

```
{
    "Keywords": [
        "Artificial Intelligence",
        "Automation",
        "Decision-making",
        "Advanced Analytics",
        "Healthcare"
    ]
}
```

✓ Output Accuracy & Format

Activity	Accuracy	Format Used
Contact Info Extraction	100%	JSON
Resume Sections	100%	Table
Keyword Extraction	100%	JSON

Lab 4: Summarization and Text Transformation

Objective:

Practice using ChatGPT to **summarize text** (news, research abstracts) and **transform writing style** (formal ↔ informal).

Activity 1: Summarization of a News Article

Prompt:

Summarize the following news article in 3 sentences:

"The Indian Space Research Organisation (ISRO) successfully launched its latest communication satellite, GSAT-30, from French Guiana. The satellite will replace INSAT-4A and will enhance communication services across the country. The launch was carried out aboard an Ariane-5 rocket by Arianespace."

Output (Summary):

ISRO has successfully launched the GSAT-30 satellite aboard an Ariane-5 rocket from French Guiana. The satellite will replace INSAT-4A and enhance India's communication services. This marks another milestone in India's space achievements.

Activity 2: Summarization of a Research Abstract

Prompt:

Summarize this research abstract in 2-3 sentences:

"Machine learning has emerged as a powerful tool for analyzing medical data. In this study, we develop a deep learning model to predict heart disease based on patient records. Our model achieves 92% accuracy, outperforming traditional statistical methods. The findings highlight the potential of AI in early diagnosis and improved patient care."

Output (Summary):

A deep learning model was developed to predict heart disease from patient records, achieving 92% accuracy. The study demonstrates that AI can outperform traditional methods and improve early diagnosis and patient care.

Activity 3: Email Tone Transformation

Original Email (Informal)

Hi Sir,

I wanted to say I can't attend the meeting tomorrow because of some work. Can we reschedule to Thursday?

Thanks

Prompt (Formal Conversion):

Rewrite this email in a formal tone.

Output (Formal Email):

Subject: Request to Reschedule Meeting

Dear Sir,

I regret to inform you that I will be unable to attend the scheduled meeting tomorrow due to prior work commitments. I kindly request if it would be possible to reschedule the meeting to Thursday at a convenient time.

Thank you for your understanding.
Sincerely,
[Your Name]

Transformation Report

Task	Original (Input)	Output (Transformed)
News Article Summary	Full 3-sentence news paragraph	Condensed 3-sentence summary focusing on key facts
Research Abstract Summary	Full abstract with technical details	Concise summary highlighting model, accuracy, and significance
Email Tone Transformation	Informal wording ("I can't attend some work")	Formal, professional wording with subject line and polite phrasing

Lab 5: ChatGPT in Code Generation and Debugging

Objective

To explore how ChatGPT can assist in writing and debugging code in Python, C++, and Java, and to compare ChatGPT's generated solutions with the expected outputs.

Activities

- **Output** Code Generation Examples
 - **Prompt**: Write a Python program to check if a number is prime.
 - ChatGPT Output (Python):

```
def is_prime(num):
    if num <= 1:
    return False
    for i in range(2, int(num**0.5) + 1):
    if num % i == 0:
    return False
    return True

# Test
number = 29
print(f"{number} is prime: {is_prime(number)}")</pre>
```

• Expected Output:

```
29 is prime: True
```

- Matches expected output.
 - **Prompt**: Write a C++ program to reverse a string.
 - ChatGPT Output (C++):

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

int main() {
    string str = "Hello";
    reverse(str.begin(), str.end());
    cout << "Reversed string: " << str << endl;
    return 0;
}</pre>
```

• Expected Output:

Reversed string: olleH

✓ Matches expected output.

- **Prompt**: Write a Java program to calculate factorial using recursion.
- ChatGPT Output (Java):

```
class Factorial {
    static int factorial(int n) {
    if (n == 0) return 1;
    return n * factorial(n - 1);
```

```
}
       public static void main(String[] args) {
       int num = 5;
       System.out.println("Factorial of " + num + " = " + factorial(num));
      }
}
Expected Output:
Factorial of 5 = 120
Matches expected output.
Debugging Example
   • Given Buggy Python Code:
def add_numbers(a, b)
       return a + b
print(add_numbers(5, 10))
Error Identified by ChatGPT: Missing colon (:) after function definition.
Corrected Code:
def add_numbers(a, b):
       return a + b
print(add numbers(5, 10))
Expected Output:
15
Matches expected output.
```

Comparison of ChatGPT's Output vs Expected Output

Language	Task	ChatGPT Output	Expected Output	Match
Python	Prime Check	✓ Correct	✓ Correct	V

C++	String Reverse	✓ Correct	✓ Correct	V
Java	Factorial Recursion	✓ Correct	✓ Correct	V
Python	Debugging Syntax Error	✓ Corrected	✓ Correct	V

Conclusion

ChatGPT generated correct, working code for Python, C++, and Java as per prompts and successfully debugged the provided Python code. The outputs matched expectations without modification.

Lab 6: Domain-Specific Applications

Objective

To explore ChatGPT's ability to handle domain-specific tasks by generating educational quizzes, simulating a teaching assistant role.

Activity Chosen

Educational Quiz Generation – Creating a multiple-choice quiz for high school students on the topic "**Photosynthesis**".

Prompt Design

Prompt Used:

"You are a quiz generator for high school biology. Create 5 multiple-choice questions on the topic of Photosynthesis. Each question should have 4 options (A, B, C, D) with only one correct answer. Provide the correct answer at the end in a separate answer key."

ChatGPT Output

Generated Quiz:

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1.	Which organelle is responsible for photosynthesis in plant cells? A) Mitochondria B) Chloroplast C) Ribosome D) Nucleus
2.	Which pigment primarily absorbs light for photosynthesis? A) Chlorophyll B) Carotene C) Xanthophyll D) Anthocyanin
3.	Which gas is consumed during photosynthesis? A) Oxygen B) Carbon Dioxide C) Nitrogen D) Hydrogen
4.	What is the main product of the Calvin Cycle? A) ATP B) NADPH C) Glucose D) Oxygen
5.	Which of the following is a correct equation for photosynthesis? A) $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O + Energy$ B) $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$ (in presence of light) C) $H_2O + O_2 \rightarrow CO_2 + C_6H_{12}O_6$ D) $C_6H_{12}O_6 \rightarrow CO_2 + Energy$ Answer Key:
1.	В
2.	A
3.	В
4.	С
5.	В

Evaluation of Output

Criteria Evaluation

Accuracy All answers correct and scientifically accurate.

Difficulty Level Suitable for high school level.

Clarity Questions are clear, with no ambiguity.

Format Compliance Correct MC