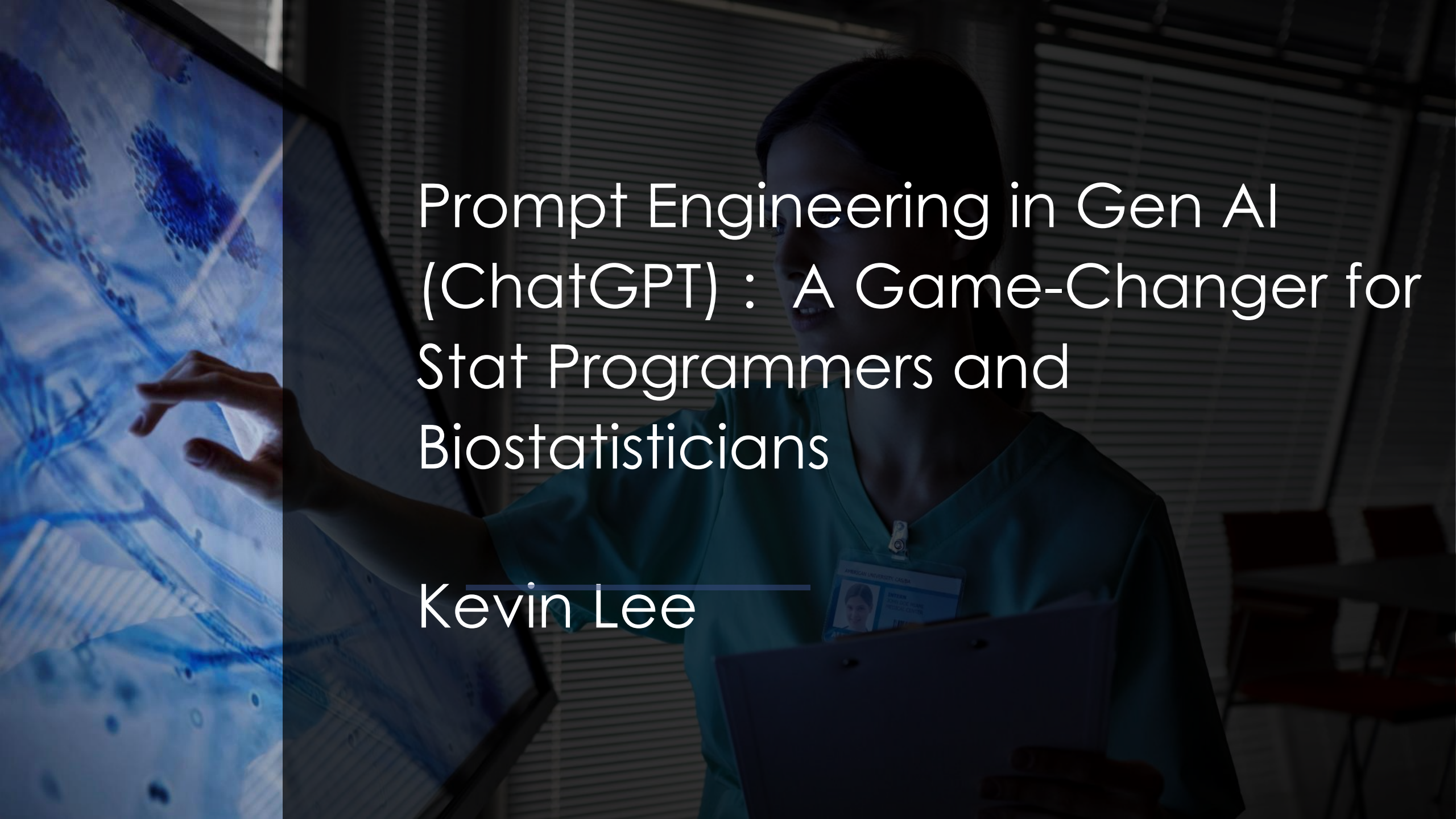


A person in teal medical scrubs is pointing at a large screen displaying a blue-tinted anatomical diagram of a human torso. The person is holding a clipboard and has a name tag that reads "AMERICAN UNIVERSITY CARDIO" and "INTERIM". The background is a dimly lit room with horizontal blinds.

Prompt Engineering in Gen AI (ChatGPT) : A Game-Changer for Stat Programmers and Biostatisticians

Kevin Lee

Disclaimer

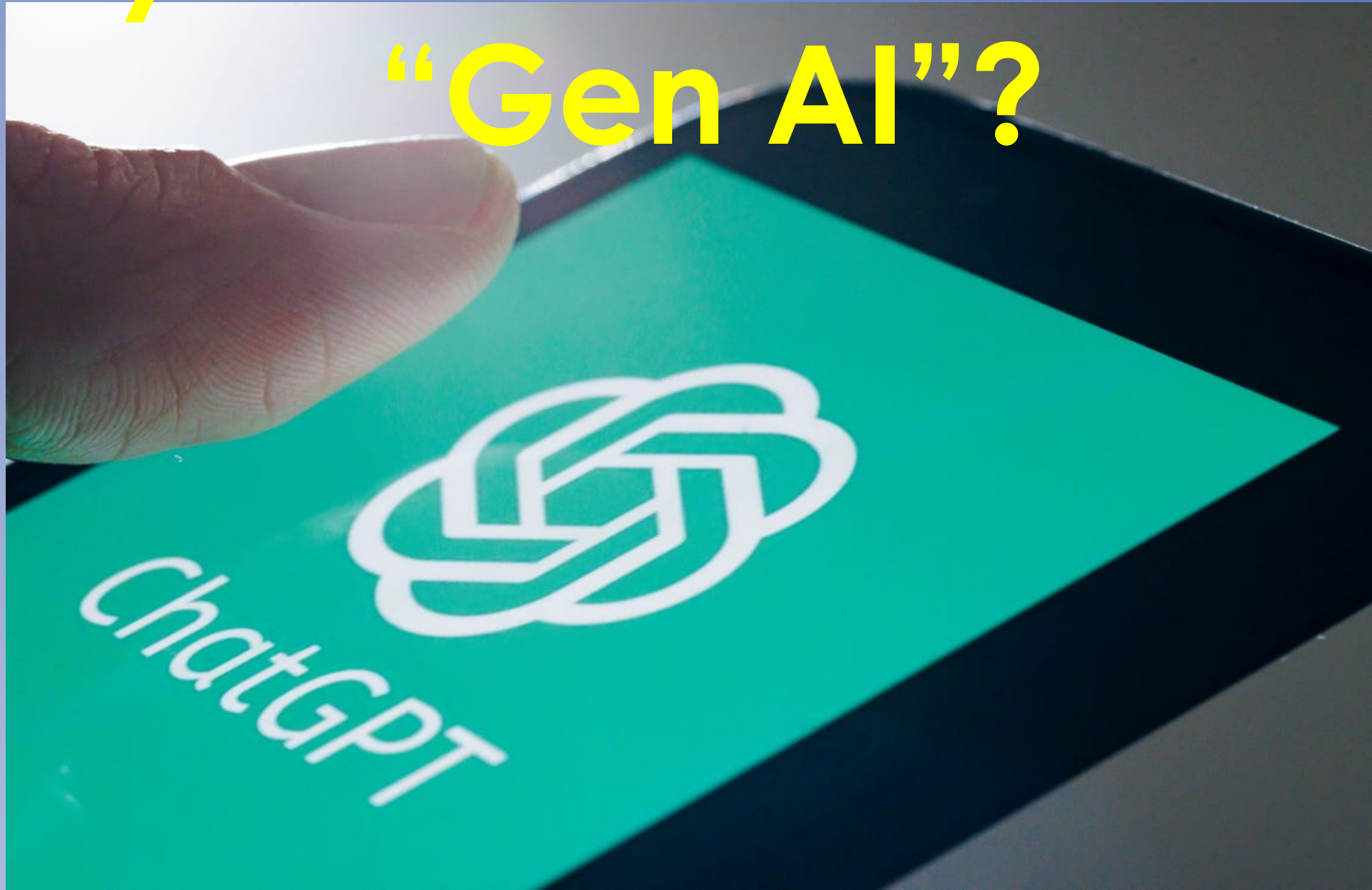
The views and opinions presented here represent those of the speaker and should not be considered to represent any companies or organizations.

Agenda

- Prompt it, not Google it
- What is Prompt Engineering?
- How to Prompt Better
- Prompt Engineering Technique
- Use Cases in Biometrics
- Should we validate the results from prompt engineering?
- A Game Changer?
- Discussion



Do you use “ChatGPT” or
“Gen AI”?



Prompt it is the new ~~Google~~ it



What is Prompt?

- Prompt – A tool to communicate with Gen AI (ChatGPT)

Default (GPT-3.5)

K what is schizophrenia?

 Schizophrenia is a complex and severe mental disorder that affects how a person thinks, feels, and behaves. It is characterized by a range of symptoms that can vary in intensity and duration but often include:

1. Delusions: False beliefs that are resistant to reasoning or contrary evidence. Common delusions in schizophrenia include beliefs in conspiracy theories, being persecuted, or having special powers.
2. Hallucinations: Sensory experiences that are not based in reality. Auditory hallucinations (hearing voices) are the most common in schizophrenia, but visual and tactile hallucinations can also occur.
3. Disorganized thinking: Individuals with schizophrenia may have difficulty organizing their thoughts and may exhibit incoherent or tangential speech.
4. Disorganized or abnormal motor behavior: This can manifest as unpredictable or unusual movements, agitation, or catatonia (a state of immobility and unresponsiveness).
5. Negative symptoms: These involve a decrease in normal emotional responses, motivation, and social functioning. Negative symptoms can include a lack of interest in daily activities,

 Regenerate

Google what is schizophrenia?    

Feedback

 National Institutes of Health (.gov)
<https://www.nimh.nih.gov/health/topics/schizophrenia/>

Schizophrenia - NIMH

Schizophrenia is **a serious mental illness that affects how a person thinks, feels, and behaves**. People with schizophrenia may seem like they have lost touch ...
[What are the signs and...](#) · [How is schizophrenia treated?](#)

 Substance Abuse and Mental Health Services Administration (.gov)
<https://www.samhsa.gov/mental-health/schizophrenia>

What is Schizophrenia? | SAMHSA

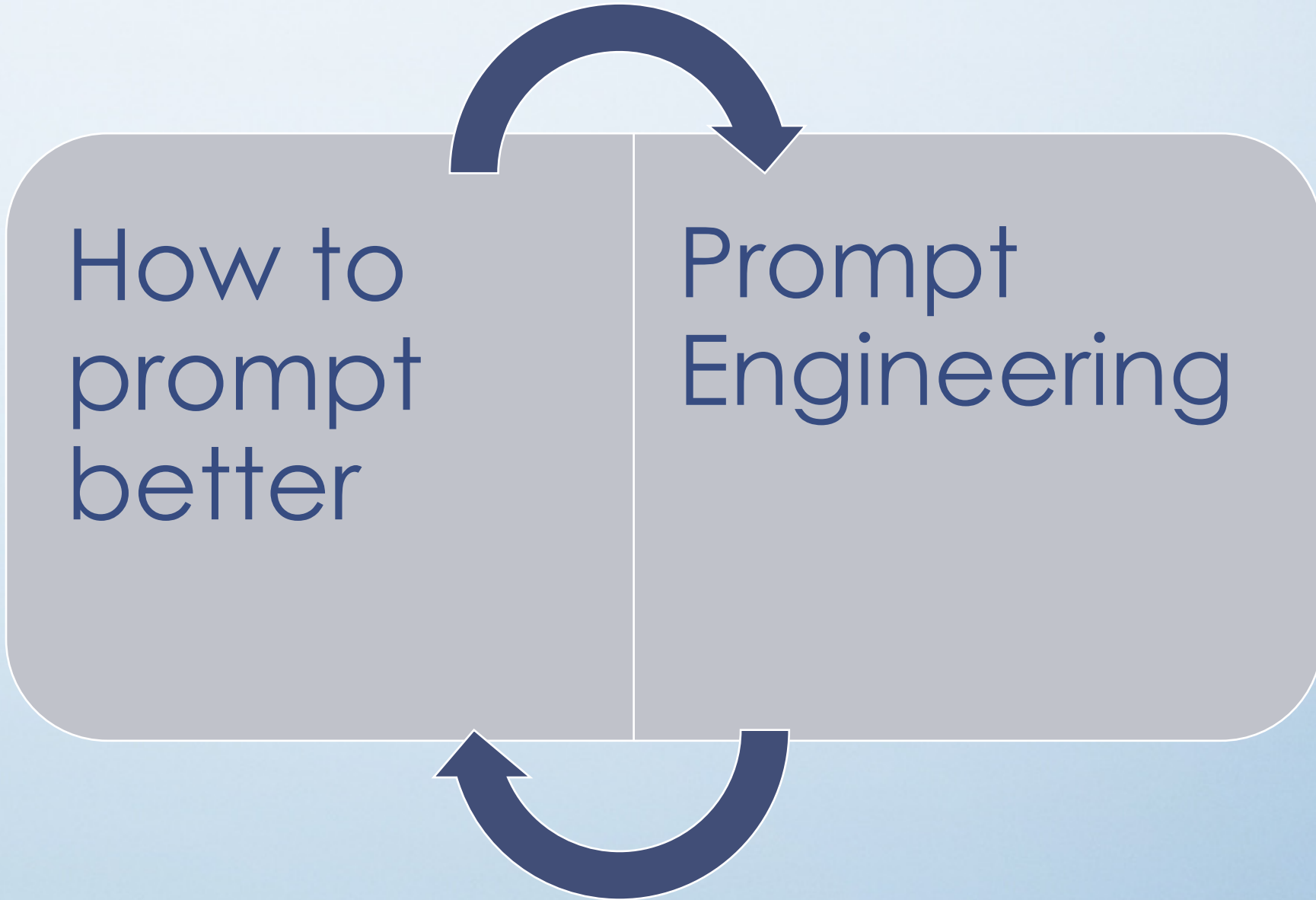
Apr 24, 2023 — Schizophrenia is **a severe, lifelong brain disorder that causes people to interpret reality abnormally**. They don't know what sights, sounds, ...

 Mayo Clinic
<https://www.mayoclinic.org/syc-20354443>

Schizophrenia - Symptoms and causes

Jan 7, 2020 — Schizophrenia **involves a range of problems with thinking (cognition), behavior and emotions**. Signs and symptoms may vary, but usually involve ...

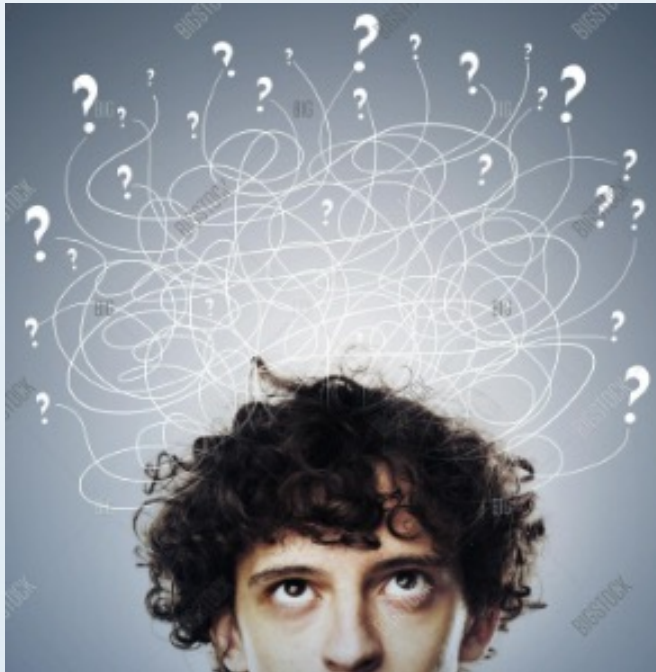




What is Prompt Engineering?

- Prompt Engineering – the **art** of creating effective communication/ prompt that guide Gen AI (ChatGPT) to generate **desired response**.

Bad Prompt – Bad Response
(e.g., Hallucination)



Good Prompt – Good Response



ChatGPT is like a very smart, capable,
recently graduated intern/new hire.



=



How to work with the recently graduated, smart intern at work?

How to make an intern competent or incompetent?



How to prompt better (How to communicate better with an intern)

- Get Specific
- Add Constraints
- Add more contexts
- Set the role
- Coach with feedback
- Probe further
- Step by step instruction



Get specific

- Generic inquiry will provide generic (and less impressive) answers

Generic Prompt	Specific Prompt
Tell me about Certara.	Tell me about Certara – its business overview, core services and products.
Tell me the best places to visit in Prague.	Tell me the best places to visit in Prague, where I could have unique experiences.
Write me a promotion request email.	Write me a promotion request email for Manager of CDSIC Standards.

Add Parameter or Constraints

- Parameter could provide better response.
- Restriction and constraints breed a creativity.
- Example of parameters
 - Under 100 words
 - Make it under \$100
 - Make it work for 15 people.

Generic Prompt	Prompt with parameter
Tell me about Certara.	Tell me about Certara – its business overview, core services and products within 200 words.
Tell me the best places to visit in Prague.	Tell me the best places to visit in Prague within 4 days.
Tell me the best places to visit in Prague.	Tell me the best places to visit in Prague with \$500 budget.

Add more context

- If a prompt includes more background, ChatGPT can provide more relevant, customized answers.
- Provide the reason that I am using ChatGPT

Generic Prompt	Prompt with parameter
Tell me about Certara.	I am the head of CDISC standards team, and I am looking for the partner. Tell me about Certara.
Tell me about Certara.	I am a prompt engineer and looking for the opportunity. Tell me about Certara.
Tell me the best places to visit in Prague.	I am a You-tube content creator. Tell me the best places to visit in Prague.
Tell me the best places to visit in Prague.	I am in the vacation. Tell me the best places to visit in Prague.

Set the role

- If one gives a role to ChatGPT and ask, ChatGPT play a role given and provide the answers.
- Example of roles : salesperson, the head of IT, Stat Programmer, Biostatistician, figures

Generic Prompt	Prompt with role
Write a greeting email.	I am a salesperson who markets new medicine. Write a greeting email.
Review this proposal and provide your feedback.	Pretend you are the head of IT. Review this proposal and provide your feedback.
How do you respond below proposal?	You are Steve Jobs. How do you respond below proposal?
How do you respond below proposal?	You are Max Kanevsky. How do you respond below proposal?

Coach ChatGPT with feedback

- After ChatGPT provide an answer, one can provide a feedback and ask again.
- By iterating, one can get the better answer

Initial Prompt	Prompt with feedback
Write me a promotion request email.	
	Make it in 50 words.
	Make it more formal.
	Make it more persuasive.

Probe further

- After receiving the answers, one could probe further in the current chat.
- One can find more detail information from the certain part of previous response.

Initial Prompt	Prompts with probing
Tell me how to use Pinnacle 21 better.	
	Tell me more about the first tip on "Understand CDISC Standards"
List top 10 attractions in Prague.	
	Tell me more about attraction 1.
	Please tell me the specific foods that I need to try near by attraction 1.

Provide a reference

- This technique is called 'Few-shot Learning'
- By providing reference/ examples, one could receive customized response.
- It will help ChatGPT to mimic writing style and format.

Generic Prompt	Prompt with feedback
Write a greeting email.	I want you to refer to #my_previous_email to write a greeting email by following my tones and styles. #my_previous_email:

Provide step by step instruction

- One can give step by step instruction on how ChatGPT think the answer “step by step”
- This will help ChatGPT to perform better.

Generic Prompt	Prompt with step by step introduction
Summarize a news article.	Perform the following actions: 1. Identify the key points of the article 2. Briefly paraphrase those key points into a concise summary. 3. Ensure the summary is objective and captures the main ideas of the article. 4. Make the summary more formal.

Prompt Engineering Technique

- Zero Shot
- Few Shot
- Chain of Thought



Prompt Technique : Zero-Shot

- Purpose : One time Query
- Method : Straight-up Query, no example.
- Examples
 - Prompt : What is $2 + 8$?
 - Output : $2 + 8$ equals 10.

Prompt Technique : Few-Shot

- Purpose : Teaching AI models to follow specific examples / patterns
- Method : Feeding model with few examples before asking the desired questions

- Examples

- Prompt :

$$2@4 = 12$$

$$3@3 = 12$$

$$4@2 = 10$$

$$5@3 = 18$$

$$4@2 =$$

- Output :

The operation "@" seems to follow the pattern where $a@b$ is calculated as $(a \text{ times } b) + b$. Applying this to $4@2$:

$$4@2 = (4 \text{ times } 2) + 2 = 8 + 2 = 10$$

Therefore, $4@2$ equals 10.

Prompt Technique : Chain of Thought Example

- Prompt :

Classify the safety issues of the #text.
Follow these steps in the classification.

1. Identify adverse event in text.
2. Identify patient information in text
3. Identify medication information in text

If #text answers to "Yes" on all the steps,
classify as 'Safety Issues' Otherwise 'No
Safety Issues'

Let's think step by step for classification of
the #text.

#text:

Patient 001 had a headache after taking
a Tylenol.

- Output :

To classify the safety issues of the given text, we'll follow the steps
provided:

Step-by-Step Classification:

1. **Identify adverse event in text:**
- The text mentions a headache, which is an adverse event.
2. **Identify patient information in text:**
- The text refers to "Patient 001," which is patient information.
3. **Identify medication information in text:**
- The text mentions "Tylenol," which is medication information.

Since the text answers "Yes" to all the steps, we classify it as:

Safety Issues

Is there anything else you would like to analyze or discuss?

Gen AI (ChatGPT) Use Cases in Biometrics

- Simple Inquiry
- Content Development
- Coding
- Data Analysis
- Patient Profiles
- Safety Cases



Simple Inquiry

Prompt :
What is CDISC?
Tell me in 200
words.

Output :
The Clinical Data Interchange Standards Consortium (CDISC) is a global, non-profit organization dedicated to creating and promoting standards for the collection, sharing, and analysis of clinical research data. Founded in 1997, CDISC aims to streamline the process of clinical research by enabling more efficient data collection and analysis, ultimately accelerating the development of new medical therapies and improving public health.

CDISC standards encompass various stages of the clinical research process, including study design, data collection, data management, data analysis, and data reporting. The core standards developed by CDISC include the Study Data Tabulation Model (SDTM), the Analysis Data Model (ADaM), and the Clinical Data Acquisition Standards Harmonization (CDASH). These standards ensure that data is collected and presented in a consistent and structured manner, facilitating interoperability between different systems and stakeholders.

Adopting CDISC standards is beneficial for regulatory submissions, as agencies like the U.S. Food and Drug Administration (FDA) and the Japanese Pharmaceuticals and Medical Devices Agency (PMDA) require data in CDISC-compliant formats. This harmonization helps reduce the time and cost associated with data integration and review processes, enhancing the overall efficiency and reliability of clinical trials and research initiatives.

Content Development

Prompt :

I am Senior Statistical Programmer.

I want to be promoted to the Principal Statistical Programmer. I have successfully led a couple of major Phase 3 oncology clinical trials, and I have been also mentoring Junior Statistical programmer.

write emails to my manager within 100 words politely and formally.

Output :

Dear [Manager's Name],

I hope this message finds you well. I am writing to formally request consideration for a promotion to the role of Principal Statistical Programmer.

Over the past [number of years/months], I have had the privilege of serving as a Senior Statistical Programmer, where I have successfully led multiple major Phase 3 oncology clinical trials. These experiences have allowed me to develop a robust understanding of trial design, data management, and statistical analysis, ensuring the successful delivery of critical clinical data.

In addition to my technical contributions, I have also dedicated significant effort to mentoring Junior Statistical Programmers. This mentorship has not only fostered their professional growth but has also enhanced our team's overall efficiency and effectiveness.

I am confident that my skills, experience, and dedication align well with the responsibilities of a Principal Statistical Programmer. I am eager to take on additional challenges and further contribute to our organization's success.

Thank you for considering my request. I am available to discuss this further at your convenience.

Best regards,

Codes conversion

Prompt :

Convert below SAS codes to R codes:

```
data dm;  
  merge demo rand;  
  by usubjid ;  
run;
```

Output :

You can convert the SAS code to R using the `merge` function in R to perform the equivalent operation. Assuming you have two data frames `demo` and `rand` that you want to merge by the `usubjid` variable, here's the equivalent R code:

```
```
```

```
Assuming you have loaded your data into two data frames: demo
and rand
```

```
Merge the data frames by usubjid
```

```
dm <- merge(demo, rand, by="usubjid")
```

```
```
```

In this code:

- `demo` and `rand` are your input data frames.
- We use the `merge` function to merge the data frames.
- The `by` parameter specifies the key variable by which to merge the data frames, which in this case is `usubjid`.

After running this code, the merged data frame `dm` will contain the result of the merge operation, similar to what you would achieve with the SAS code you provided.

Codes Creation

Prompt :

Write a **R script** that groups data by "trta" and "avisitn" columns in "advs.xpt" and calculates the mean of the "aval" column for each group at parmcd = 'WEIGHT'

Output :

```
```R
Load necessary libraries
library(haven)
library(dplyr)

Read the XPT file
advs <- read_xpt("path/to/advs.xpt")

Filter the dataset for parmcd == 'WEIGHT'
advs_weight <- advs %>% filter(parmcd == 'WEIGHT')

Group by 'trta' and 'avisitn' and calculate the mean of 'aval' for each group
mean_aval <- advs_weight %>%
 group_by(trta, avisitn) %>%
 summarise(mean_aval = mean(aval, na.rm = TRUE))

Print the result
print(mean_aval)
```
```

Make sure to replace `"path/to/advs.xpt"` with the actual file path of your ``advs.xpt`` dataset. This script will output a data frame with the mean ``aval`` for each combination of ``trta`` and ``avisitn`` where ``parmcd`` is 'WEIGHT'.

Codes Creation

Output :

Prompt :

Write a **SAS script** that groups data by "trta" and "avisitn" columns in "advs.xpt" and calculates the mean of the "aval" column for each group at parmcd = 'WEIGHT'

```
```sas
/* Step 1: Import the advs.xpt file */
libname mylib xport "path_to_your_advs.xpt";

/* Step 2: Create a SAS dataset from the imported data */
data advs;
 set mylib.advs;
run;

/* Step 3: Filter the data for parmcd = 'WEIGHT' */
data advs_weight;
 set advs;
 where parmcd = 'WEIGHT';
run;

/* Step 4: Group the data by trta and avisitn, and calculate the mean of aval */
proc means data=advs_weight noprint;
 class trta avisitn;
 var aval;
 output out=mean_aval (drop=_TYPE_ _FREQ_) mean=mean_aval;
run;

/* Step 5: Display the result */
proc print data=mean_aval;
run;
```

# Codes Creation

Output :

Prompt :

Write a **Python script** that groups data by "trta" and "avisitn" columns in "advs.xpt" and calculates the mean of the "aval" column for each group at parmcd = 'WEIGHT'

```
```bash
pip install pandas xport
```
```

```
```python
import pandas as pd
import xport
```

```
# Load the .xpt file
with open("advs.xpt", "rb") as file:
    data = xport.to_dataframe(file)
```

```
# Filter the data where parmcd is 'WEIGHT'
weight_data = data[data['parmcd'] == 'WEIGHT']
```

```
# Group by 'trta' and 'avisitn' and calculate the mean of 'aval'
grouped_data = weight_data.groupby(['trta', 'avisitn'])['aval'].mean().reset_index()
```

```
# Rename the column for clarity
grouped_data = grouped_data.rename(columns={'aval': 'mean_aval'})
```

```
# Display the result
print(grouped_data)
```
```

# Comparison between SAS and R

Prompt :

I want you to compare SAS and R programming. Provide me with differences, present in a table format

Output :



Certainly! Here is a comparison of SAS and R programming in a table format highlighting the key differences between the two:

| Aspect               | SAS                                                                                        | R                                                                     |
|----------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Type of Language     | Proprietary language                                                                       | Open-source language                                                  |
| Cost                 | Commercial software with licensing fees                                                    | Free and open-source software                                         |
| Data Manipulation    | Excellent data manipulation and transformation capabilities                                | Strong data manipulation capabilities                                 |
| Data Visualization   | Basic data visualization features; often requires external tools like SAS Visual Analytics | Rich data visualization libraries (e.g., ggplot2)                     |
| Statistical Analysis | Comprehensive built-in statistical procedures                                              | Extensive statistical packages and libraries                          |
| Machine Learning     | Limited machine learning capabilities                                                      | Extensive machine learning libraries (e.g., scikit-learn, TensorFlow) |
| Community Support    | Smaller user community and less open-source collaboration                                  | Large and active user community with extensive online resources       |
| Customization        | Limited customization options compared to open-source alternatives                         | Highly customizable with the ability to create packages and functions |

# Patient Profile Development

- Prompt :

Use below data to provide patient profiles:

```
{ 'patient' : '01-001', 'sex' : 'male', 'age' : 25, 'race' : 'White' }
```

- Output :

Based on the provided data, here is a patient profile for '01-001':

- Patient ID: 01-001
- Sex: Male
- Age: 25
- Race: White

This patient is a 25-year-old male of White race. Please let me know if you need any additional information or if you would like to create profiles for more patients.

# Data Analysis (1)

- Prompt :

Select patients whose sex is male. Use below "Patient Data". Provide me the answers only.

“Patient Data”:

```
{ 'patient' : '01-001', 'sex' : 'male', 'age' : 25, 'race' : 'White'},
{ 'patient' : '01-002', 'sex' : 'female', 'age' : 28, 'race' : 'Asian'},
{ 'patient' : '02-001', 'sex' : 'female', 'age' : 50, 'race' : 'White'},
{ 'patient' : '02-002', 'sex' : 'male', 'age' : 40, 'race' : 'Black'}
```

- Output :

The selected patients whose sex is male are:

1. {'patient': '01-001', 'sex': 'male', 'age': 25, 'race': 'White'}
2. {'patient': '02-002', 'sex': 'male', 'age': 40, 'race': 'Black'}

# Data Analysis (2)

- Prompt :

Count below "Patient Data" by race

"Patient Data":

```
{ 'patient' : '01-001', 'sex' : 'male', 'age' : 25, 'race' : 'White'},
{ 'patient' : '01-002', 'sex' : 'female', 'age' : 28, 'race' : 'Asian'},
{ 'patient' : '02-001', 'sex' : 'female', 'age' : 50, 'race' : 'White'},
{ 'patient' : '02-002', 'sex' : 'male', 'age' : 40, 'race' : 'Black'}
```

- Output :

Certainly! Let's count the number of patients by race in the given "Patient Data":

- White: 2

- Asian: 1

- Black: 1

# What will we do with the results from an intern?

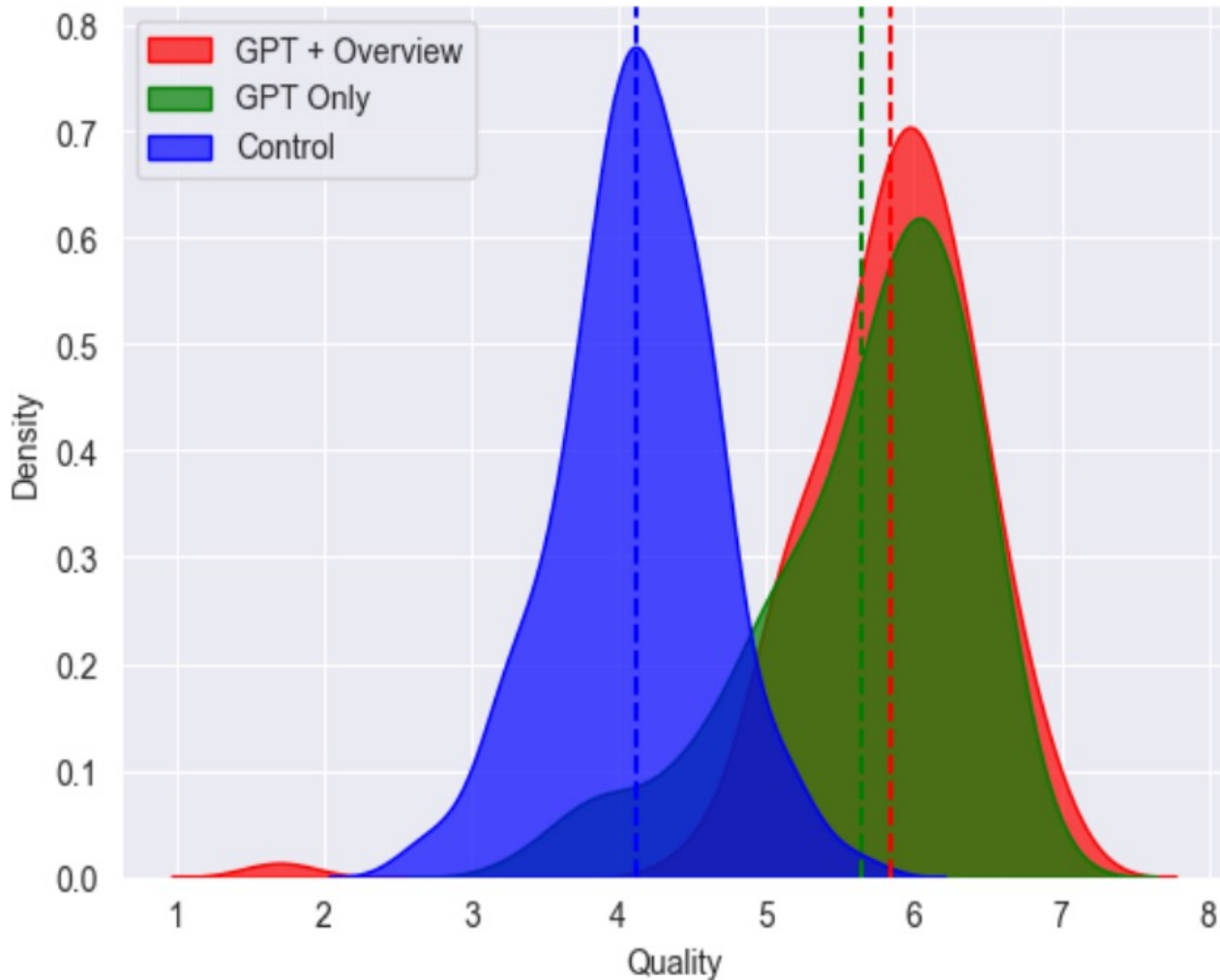


**The output of Gen AI prompt is  
not the final result,  
but the beginning of new process.**

# But, will “A Smart Intern” give us a Head Start?



# Boston Consulting : ChatGPT Users vs Non-users



- Results of Users using ChatGPT
  - finished **12.2%** more tasks on average
  - completed tasks **25.1%** more quickly
  - produced **40%** higher quality results

# Discussion :

At work, do we  
make our intern

Competent? Or  
Incompetent?



Q & A

