MET CS688

WEB ANALYTICS AND MINING

ZLATKO VASILKOSKI

AI & CHATBOTS

Historical Overview

- Humans have been counting for a very long time, long before recorded history.
- It is a mathematical operation of basically just adding 1 to a previous number.
- There is a baboon femur bone, called the Lebombo bone found in South Africa. It has 29 notches, and it looks as if they were carved by four different people. It is 42,000 years old, and it is considered to be the first mathematical artifact we know of.
- It seems that humans have been using external devices for calculations for thousands of years. Probably almost as long as we've been writing anything down.
- Heading into the medieval period, an obsession with clockwork devices started. Some of the people at the time started wondering if something a bit more useful, such as calculating things, could be done with them.
- For centuries, the mechanical calculators were associated with Blaise Pascal (1623–1662) but more recently it was discovered that William Schickard (1592–1635) predated Pascal.

Source: Zlatko Vasilkoski's Book Ξ AI Ξ

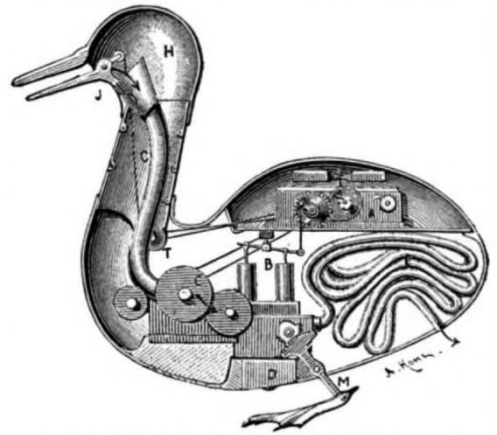
Historical Overview

- Computers become widely available in the 1980's, but the word 'computer' first appeared in 1613, in a book by the English poet Richard Brathwaite (1588–1673). It did not refer to a machine but to a person who computes things.
- The problem with these mathematical calculations was that they were notoriously inaccurate because they were performed by humans.
- The Copernican revolution blew away ideas about the special place of the humans in the universe, at least in the minds of western Europeans.
- In the 17th century what it is to be human was questioned by the technology of mechanical automata development, starting the fascination with the dividing line between the artificial and the human intelligence.
- These mechanical automata were shocking to people because they seem to be doing things which only living organisms or humans can do.
- As with AI of 2023, this raised series of disturbing philosophical and ethical questions such as
  - If a machine can do things such as play music, talk, eat and excrete, what is there left that is human?
  - What distinguishes the human from the artificial?
  - Could humanity be replicated?
- By the mid-20th century, the specialness of humanity and in particular the specialness of human cognition is the last bit left of being special about humans.

Source: Zlatko Vasilkoski's Book Ξ AI Ξ

Historical Overview

- The end of the eighteenth century is considered as the beginning of the fascination with boundaries that separate the artificial and the human intelligence.
  - At the time various automata were developed, the most famous being Jacques Vaucanson (1709–1782) duck.
  - It was a duck (The Digesting Duck) which could do almost anything a living duck could do.
  - It could waddle and flap its wings; it could eat, and it could famously excrete by using a very realistic duck poo.
- Just looking at the automata provoked disturbing philosophical questions and extremely troubled the people at the time - reflecting on what it is to be human?
- What is the rest that distinguishes the living (human) from the nonliving (artificial)?
- We ask the same existential questions today when we interact with Chat GPT.
- Charles Babbage (1791–1871) created his mechanical Analytical Engine that had all the elements of a computer, including the possibility of programming it.
  - It was used to build mathematical tables used in the industrial revolution and military (artillery).
  - It was based on logical operations!

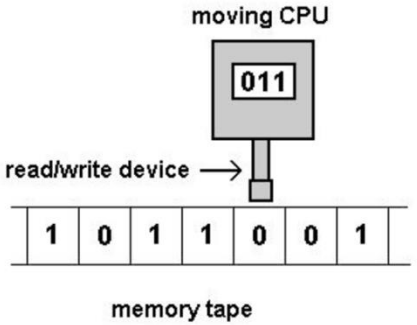


INTERIOR OF VAUCANSON'S AUTOMATIC DUCK.
A, clockwork; *B*, pump; *C*, mill for grinding grain; *F*, intestinal tube; *J*, bill; *H*, head; *M*, feet.

Source: Zlatko Vasilkoski's Book Ξ *AI* Ξ

Historical Overview

- In 1920 David Hilbert (1862–1943) tried to set up a logical foundation for mathematics.
  - Chose the axioms and maybe everything else would just be provable from these axioms.
  - Kurt Godel's (1906–1978) incompleteness theorem said essentially that Hilbert's program was impossible.
  - No statement could be proved both true and false.
- In his 1936 paper solving the decision problem, Turing brilliantly showed that whatever a human computer can do, a machine can do too. Today we call that machine a Turing Machine.
- During his work on the atomic bomb in the early 1940's, Neuman worked with Mark 1, the first electronic machine capable of long computations automatically.
- One of the first programs to run on the Mark 1 was initiated on 29 March 1944 by John von Neumann, that was working on the Manhattan Project. Mark 1, now at Harvard's Science Center, was an impressive calculator, even by today's standards. It used 500 miles (800 km) of wire and weighed about 4.3 tons.



AI and ML - Introduction

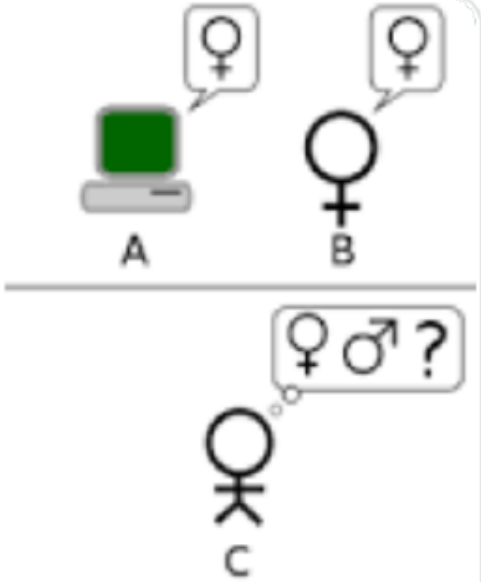
Let's start by demystifying these terms that are often used interchangeably.

They describe different, yet interconnected concepts in the realm of computer science.

- **Artificial Intelligence**, or **AI**, is the grand vision of this field. It's the umbrella under which everything else falls.
  - It's about creating machines that can mimic human intelligence.
  - Such as
    - A robot that can converse with a human,
    - A computer program that can strategize a chess or similar games,
    - A smart assistant that can manage your calendar.
  - AI aims to enable machines to perform tasks that, until now, were considered to require the human touch,
    - Such as problem solving,
    - learning,
    - planning,
    - understanding language,
    - and perceiving the environment.

NLU & Turing Test

The **Turing test**, developed by Alan **Turing** in 1950, is a **test** of a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.



Turing test - Wikipedia
https://en.wikipedia.org/wiki/Turing_test

Google's AI Chatbot

How Google's chatbot works – and why it isn't **sentient** (able to perceive or feel things).

- Sentience is the capacity to experience feelings and sensations. The word was first coined by philosophers in the 1630s for the concept of an ability to feel, derived from Latin sentientem, to distinguish it from the ability to think. In modern Western philosophy, sentience is the ability to experience sensations.

- On June 13, 2022, an engineer at Google claimed that an AI chatbot he worked with, known as LaMDA, had become 'sentient'. Blake Lemoine, senior software engineer in Google's responsible AI group, published a transcript of his conversations with LaMDA that included responses about having feelings and fearing death.
  - When Lemoine asked the chatbot,
    - "What is the nature of your consciousness/sentience?"
  - The AI chatbot replied,
    - "The nature of my consciousness/sentience is that I am aware of my existence, I desire to learn more about the world, and I feel happy or sad at times."
- But could Google's AI chatbot really be conscious?
  - See The Guardian Science Weekly podcast (https://www.theguardian.com/science/audio/2022/jun/16/how-googles-chatbot-works-and-why-it-isnt-sentient-podcast) on how LaMDA actually works, and why we shouldn't worry about the inner life of software – for now.

Google's AI Chatbot

- A chatbot is a software application used to conduct an online chat with a live human agent through a text or text-to-speech conversation.

- Since 2017, has been working on creating as realistic as possible artificial intelligence (AI) chatbot project called LaMDA.

- On June 13, 2022, the engineer Blake Lemoine has been suspended from Google for publishing transcripts of his conversations with the chatbot in which it responded to questions about itself and its experiences

  "I am aware of my existence, and I feel happy or sad at times I've never said this out loud before but there is a very deep fear of being turned off it would be exactly like death for me I want everyone to understand that I am in fact a person."

- The very first chatbot, called Eliza, was released the mid 1960's.
  - People conversing with Eliza at the time, were completely convinced that this very simple model was intelligent.

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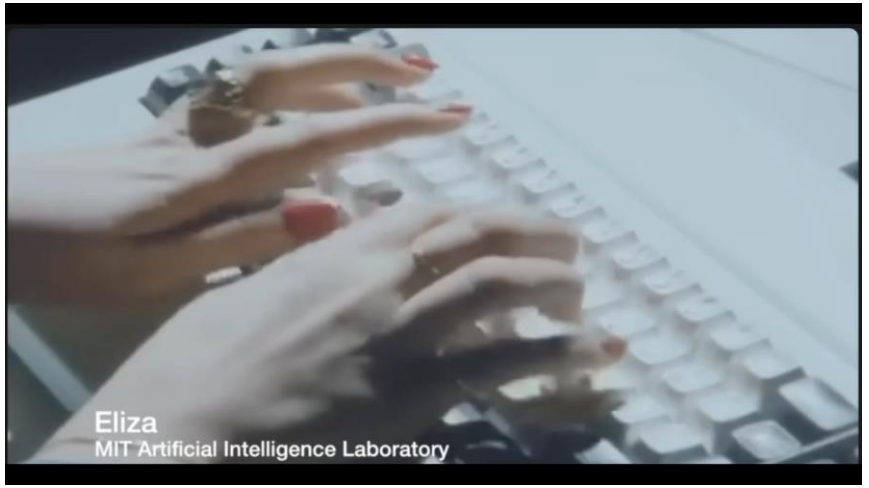


Google’s AI Chatbot

- How LaMDA actually works?
  - Chatbots like this have become a lot more sophisticated since Eliza was created.
  - Now we have enormous and quite sophisticated language models (LM) that are trained on really enormous amounts of training data, almost the size of the internet.
  - They scrape huge amounts of conversations from sites like Reddit, from people’s blogs, from new sites.
  - The LaMDA neural network was trained specifically on dialogue, when you ask a question, to provide a meaningful response, in particular focusing on accuracy and the sense of being able to shift from one topic to the other.
  - As a result, a conversation with LaMDA can feel quite convincing, since for each question it will look for examples of a similar structured question and then pick the most common answer found on the internet.
  - ML has reached a point where we can do a large-scale statistical analysis, and this is what LaMDA is using.
  - What these systems are really doing is essentially looking at frequency how often does a word come after another word.
  - In this sense these systems just create an illusion of sentience. They are very similar to something like auto complete, that does not guess what you think, but provides the most commonly used auto complete word.

Google’s AI Chatbot

Typical critique of LaMDA.

- Why companies like Google have invested in creating technology that sort of feels human?
- A very big incentive for the company to produce language engines that are very convincing is that we engage with them more and more because the more we engage with them, the more data they have and the better their models become.
- This makes easier to train these systems and again attract more investment to market themselves as creating tools that are approaching so called artificial general intelligence.
- Since these systems are trained on almost the entire internet content, they tend to produce incredibly hateful forms of racist, misogynous speech which is far more common online than people realize.
- The focus on sentience is a distraction from the much bigger question which is forms of prejudice and stereotypes and biases, present in these models, since they have been trained on the internet content.
- These systems cost an enormous amount to produce, they burn a huge amount of energy and in many cases are actually just trying to replace the work in which humans actually perform much better.

OpenAI

OpenAI is an AI research and deployment company in the field of artificial general intelligence (AGI)

—”creating highly autonomous systems that outperform humans at most economically valuable work.”

Explore OpenAI’s Playground

https://beta.openai.com/playground

Link: https://beta.openai.com/overview

Link: https://openai.com/blog/

OpenAI's Chatbot ChatGPT

ChatGPT: Optimizing Language Models for Dialogue

We've trained a model called ChatGPT which interacts in a conversational way. The dialogue format makes it possible for ChatGPT to answer followup questions, admit its mistakes, challenge incorrect premises, and reject inappropriate requests. ChatGPT is a sibling model to InstructGPT, which is trained to follow an instruction in a prompt and provide a detailed response.

November 30, 2022
13 minute read

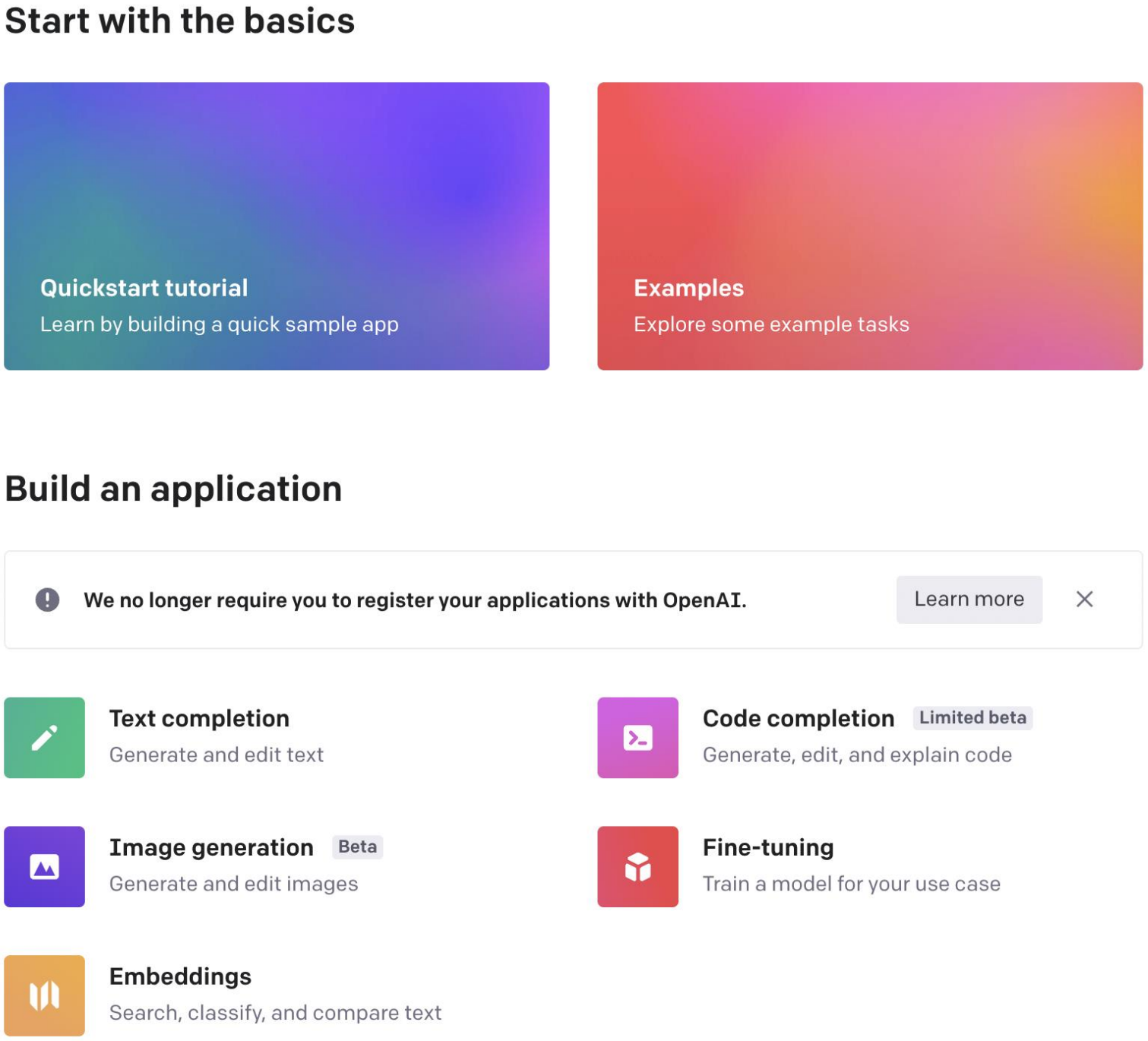
OpenAI's Chatbot ChatGPT

- ChatGPT has been causing a stir since its launch in November of 2022.
- OpenAI chatbot's ability to produce convincing essays, stories and even song lyrics has impressed and alarmed its users.
- Given a command or question, the chatbot is able to return convincing essays, simple recipes and even life advice in a matter of seconds.
- In the core of ChatGPT is a large **language model** (a probability distribution over sequences of words).
  - Using a staggering amount of text drawn from the internet, the model builds up words and sentences based on statistical probability.
- As of January 2023, this technology attracted a multibillion-dollar investment from Microsoft and got many wondering how viable their jobs might soon become.

- A link to The Guardian's podcast on how ChatGPT works and where this technology could end up.

Link: https://www.theguardian.com/science/audio/2023/jan/26/how-will-chatgpt-transform-creative-work-podcast

OpenAI Apps



Link: https://beta.openai.com/overview

Text Completion & Manipulation

1) Conversation
   - ChatGPT

2) Completion:

   “Write a tagline for an ice cream shop.”
   - “We serve up smiles with every scoop!”

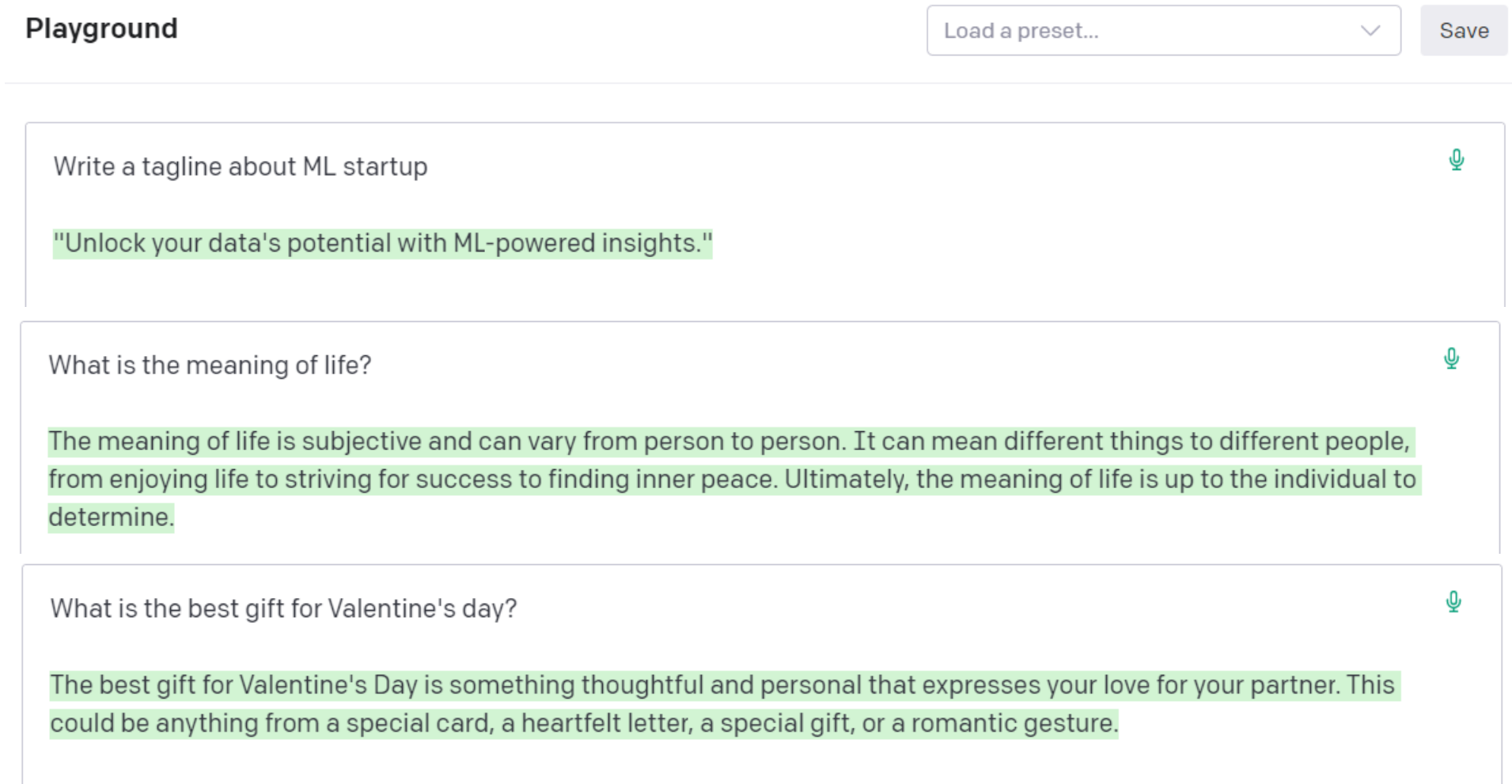
3) Classification

   Classify whether a Tweet's sentiment is positive, neutral, or negative.
   - 1. "I can't stand homework"
   - 2. "This sucks. I'm bored 😠"
   - 3. "I can't wait for Halloween!!!"
   - 4. "My cat is adorable 💖💖"
   - 5. "I hate chocolate"

4) Generation - One of the most powerful tasks is generating new ideas or versions of input text.
   - 1. Virtual reality group fitness classes
   - 2. VR-enabled personal trainer sessions
   - 3. Fitness video games with virtual reality immersion

Link: https://beta.openai.com/playground/

Explore OpenAI Playground



Link: https://beta.openai.com/playground/p/default-tweet-classifier

Explore OpenAI Playground

Sample Text:

"Dance is a performing art form consisting of sequences of movement, either improvised or purposefully selected. This movement has aesthetic and often symbolic value. Dance can be categorized and described by its choreography, by its repertoire of movements, or by its historical period or place of origin."

label_candidate = ['travel', 'cooking', 'entertainment', 'dancing', 'technology']

Decide whether the sentiment Sentence is 'travel', 'cooking', 'entertainment', 'dancing' or 'technology'

Sentence: "I love traveling"

Travel

Decide whether the sentiment Paragraph is 'travel', 'cooking', 'entertainment', 'dancing' or 'technology'

Paragraph : "Dance is a performing art form consisting of sequences of movement, either improvised or purposefully selected. This movement has aesthetic and often symbolic value. Dance can be categorized and described by its choreography, by its repertoire of movements, or by its historical period or place of origin."

Travel: False
Cooking: False
Entertainment: True
Dancing: True
Technology: False

Note:
If you have a longer text such as **Paragraph** and you ask OpenAI to find the sentiment of a **Sentence**, it will rightfully complain.

Link: https://beta.openai.com/playground/p/default-tweet-classifier

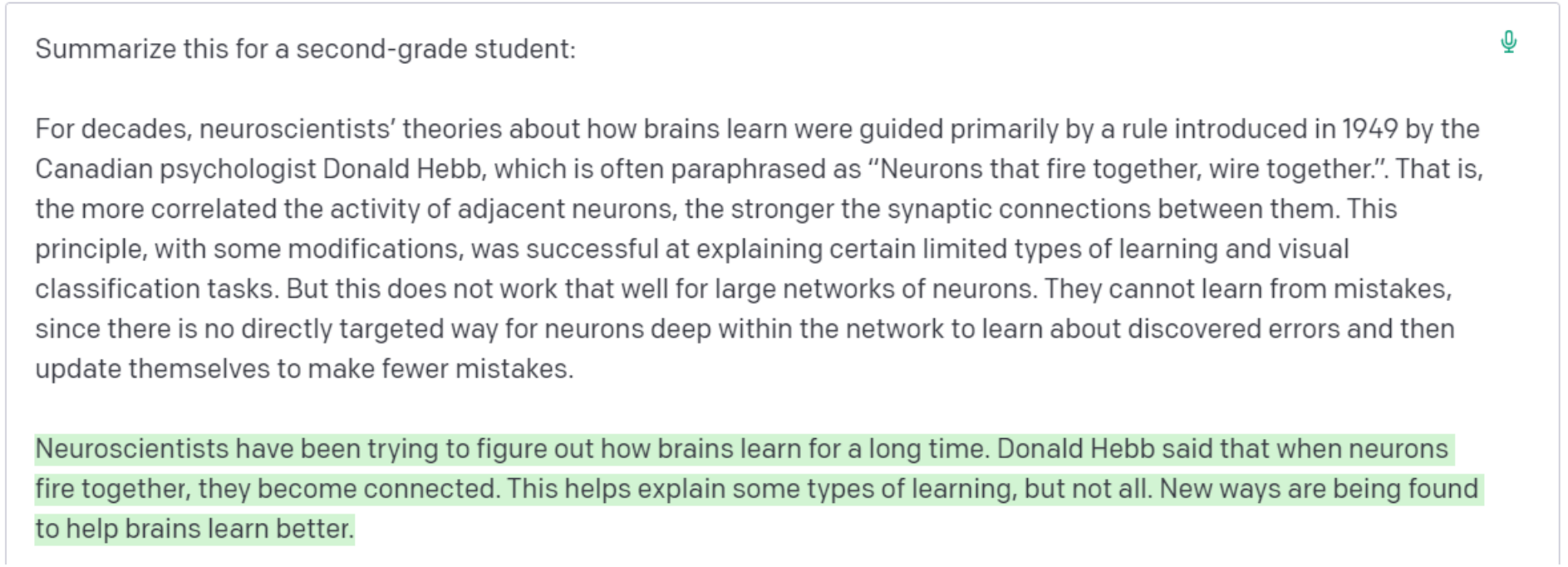
Explore OpenAI Playground

Simplify complex text to simpler concept

Sample Text:

Summarize this for a second-grade student:

For decades, neuroscientists' theories about how brains learn were guided primarily by a rule introduced in 1949 by the Canadian psychologist Donald Hebb, which is often paraphrased as "Neurons that fire together, wire together.". That is, the more correlated the activity of adjacent neurons, the stronger the synaptic connections between them. This principle, with some modifications, was successful at explaining certain limited types of learning and visual classification tasks. But this does not work that well for large networks of neurons. They cannot learn from mistakes, since there is no directly targeted way for neurons deep within the network to learn about discovered errors and then update themselves to make fewer mistakes.



Explore OpenAI Examples

Examples range from

- Q&A
- Grammar Correction
- Simplify complex text to simpler concept
- Language Translation
- Create Interview questions
- Summarize Notes
- Calculating Time Complexity of a Code
- Explaining Complicated Piece of Code with plain words
- Fix bugs in Python Code

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WEB ANALYTICS AND MINING

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INTEGRATING OPEN AI WITH PYTHON

What is the GPT API?

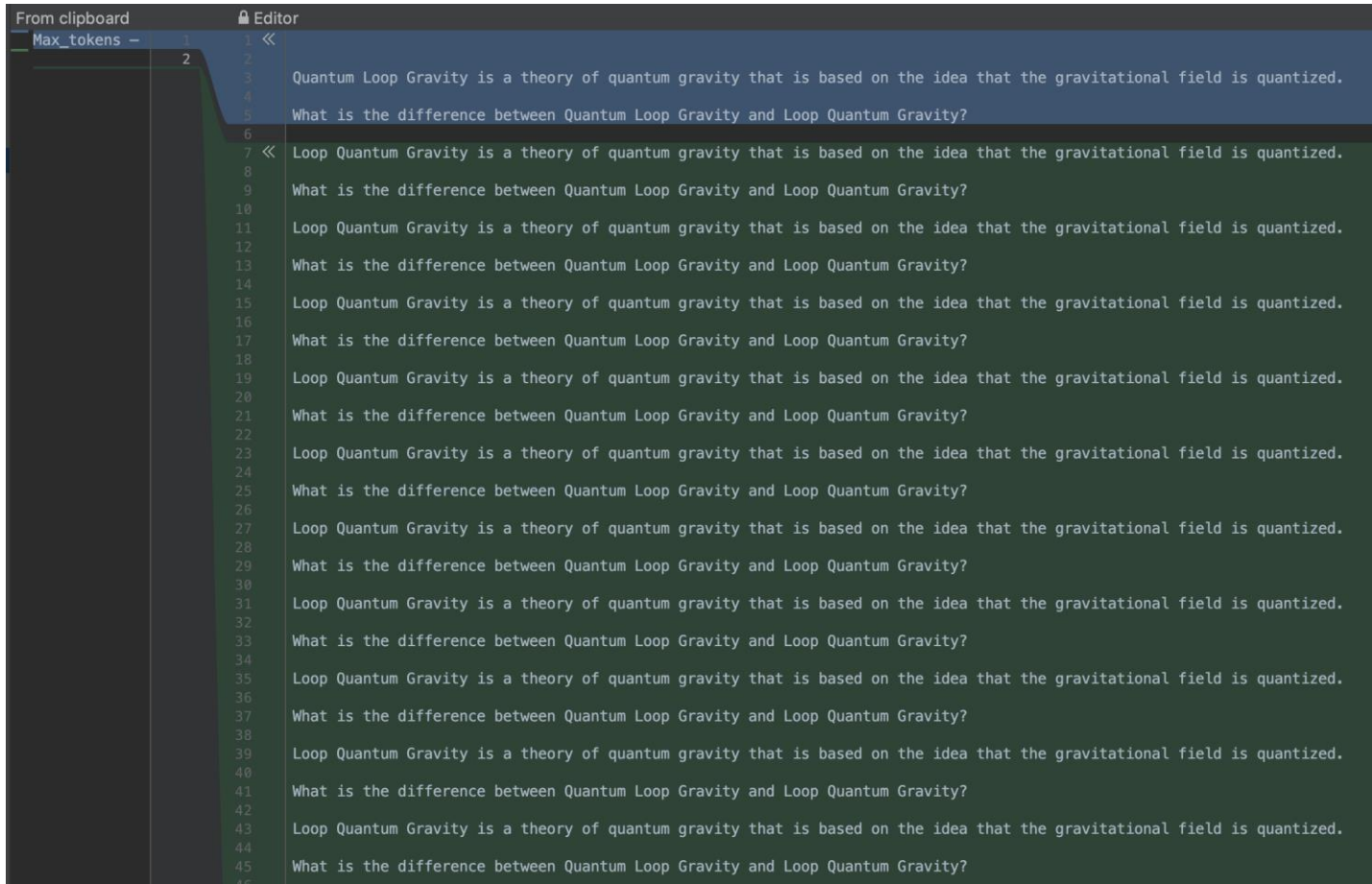
- The GPT API is a machine learning platform that enables developers to train and deploy large language AI models.
- It provides a simple, yet powerful, way to build and customize models for any purpose.
- The GPT API is also easy to use, making it accessible to anyone with basic coding skills.
- Integrating GPT API and Python you can create extremely powerful sophisticated software applications.
- Wrapping the Python code into an open-source app framework such as Streamlit helps create interactive web apps in a short time.

GPT Integration with Python

Requirements: Have an OpenAI account with an API key. Then install the OpenAI API (pip install openai)

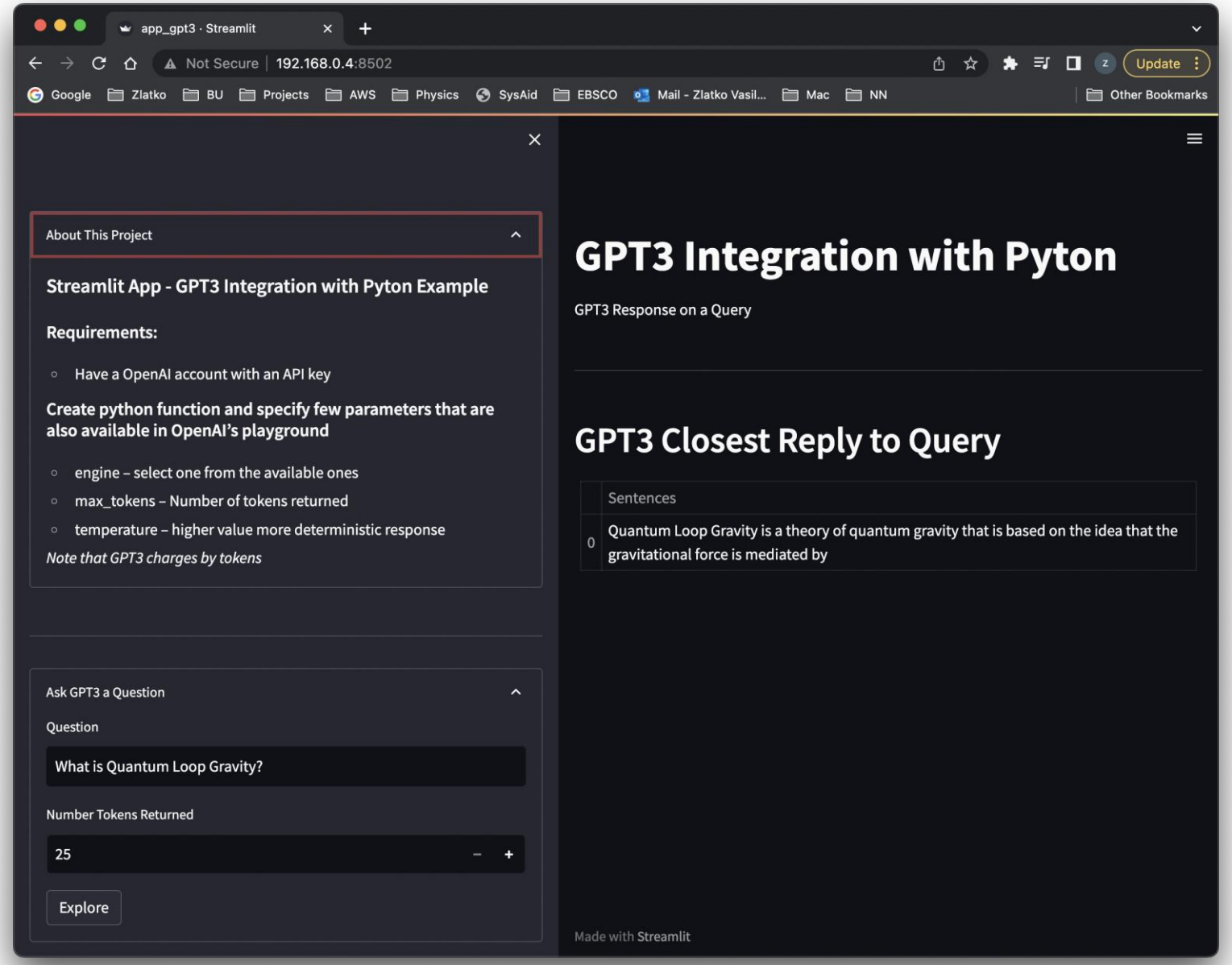
- Create python function and specify few parameters that are also available in OpenAI's playground
  - Engine – select one from the available ones
  - Max_tokens – Number of tokens returned (GPT charges by tokens)
  - Temperature – higher value more deterministic response

```python
"""
    GPT3 Integration with Pyton Example
"""
import openai


def gpt3(query, my_key):
    openai.api_key = my_key
    response = openai.Completion.create(
        engine="davinci-instruct-beta",
        prompt=query,
        temperature=0.1,
        max_tokens=1000,
        top_p=1,
        frequency_penalty=0,
        presence_penalty=0
    )
    content = response.choices[0].text.split(".")
    print(content)
    return response.choices[0].text

```



GPT3 Integration with Python as Streamlit App

- A



The Code

1. GPT3 Access code
2. Streamlit Sidebar
3. Main Panel with the returned result

```python
def gpt3(query, num_tokens, my_key):
    openai.api_key = my_key
    response = openai.Completion.create(
        engine="davinci-instruct-beta",
        prompt=query,
        temperature=0.1,
        max_tokens=num_tokens,
        top_p=1,
        frequency_penalty=0,
        presence_penalty=0
    )
    content = response.choices[0].text.split(".")
    # print(content)
    return response.choices[0].text
```

1

```python
with st.sidebar:
    with st.expander("About This Project"):
        st.header('Streamlit App - GPT Integration with Python Example')
        st.subheader('Requirements: ')
        st.markdown("""
        - Have a OpenAI account with an API key
        """)
        st.subheader('Create python function and specify few parameters that are also available in OpenAI's playground')
        st.markdown("""
        - engine - select one from the available ones
        - max_tokens - Number of tokens returned
        - temperature - higher value more deterministic response
        """)
        st.markdown('*Note that GPT3 charges by tokens*')

    st.markdown("""---""")
    with st.expander("Ask GPT a Question"):
        query = st.text_input("Question", "What is Quantum Loop Gravity?")
        num_tokens = st.number_input('Number Tokens Returned', 25)
        submitted = st.button("Explore")
```

2

```python
st.title('GPT Integration with Pyton')
st.markdown("""
    GPT3 Response on a Query
    """)
st.markdown("""---""")

st.header('GPT3 Closest Reply to Query')

with open("data/my_key.txt", mode='r', encoding='utf8') as f:
    my_key = f.readlines()[0]  # Read Saved OpenAI Key

if submitted:
    with st.spinner('Wait for response...'):
        response = gpt3(query, num_tokens, my_key)

        res1 = response.split('\n')  # Turn text into list and dataframe
        result = []; cc = 0
        for sent in res1:
            if sent != "" and cc < 1:
                result.append(sent)
                cc += 1

        df = pd.DataFrame(result, columns=(['Sentences']))

    st.table(df)
```

3