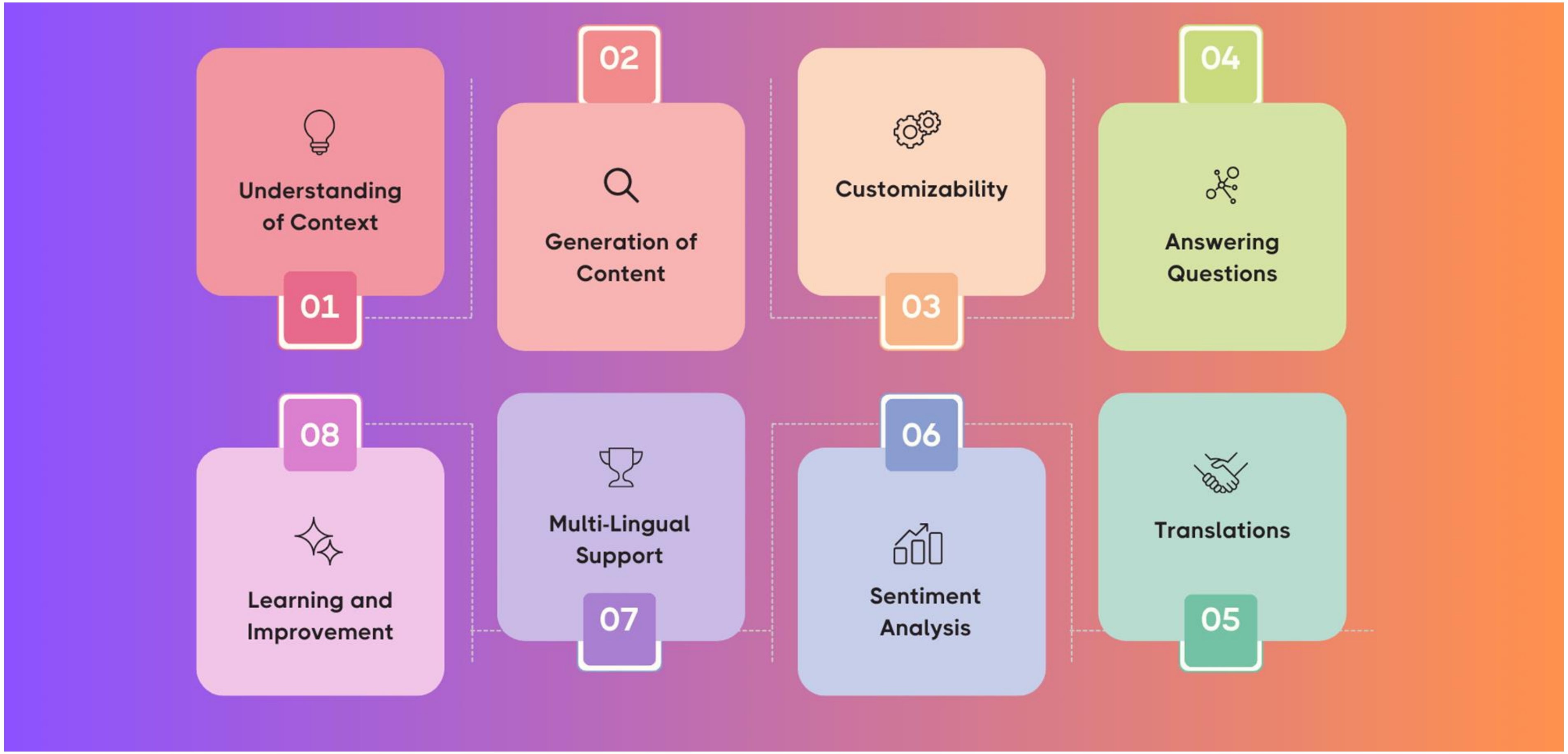
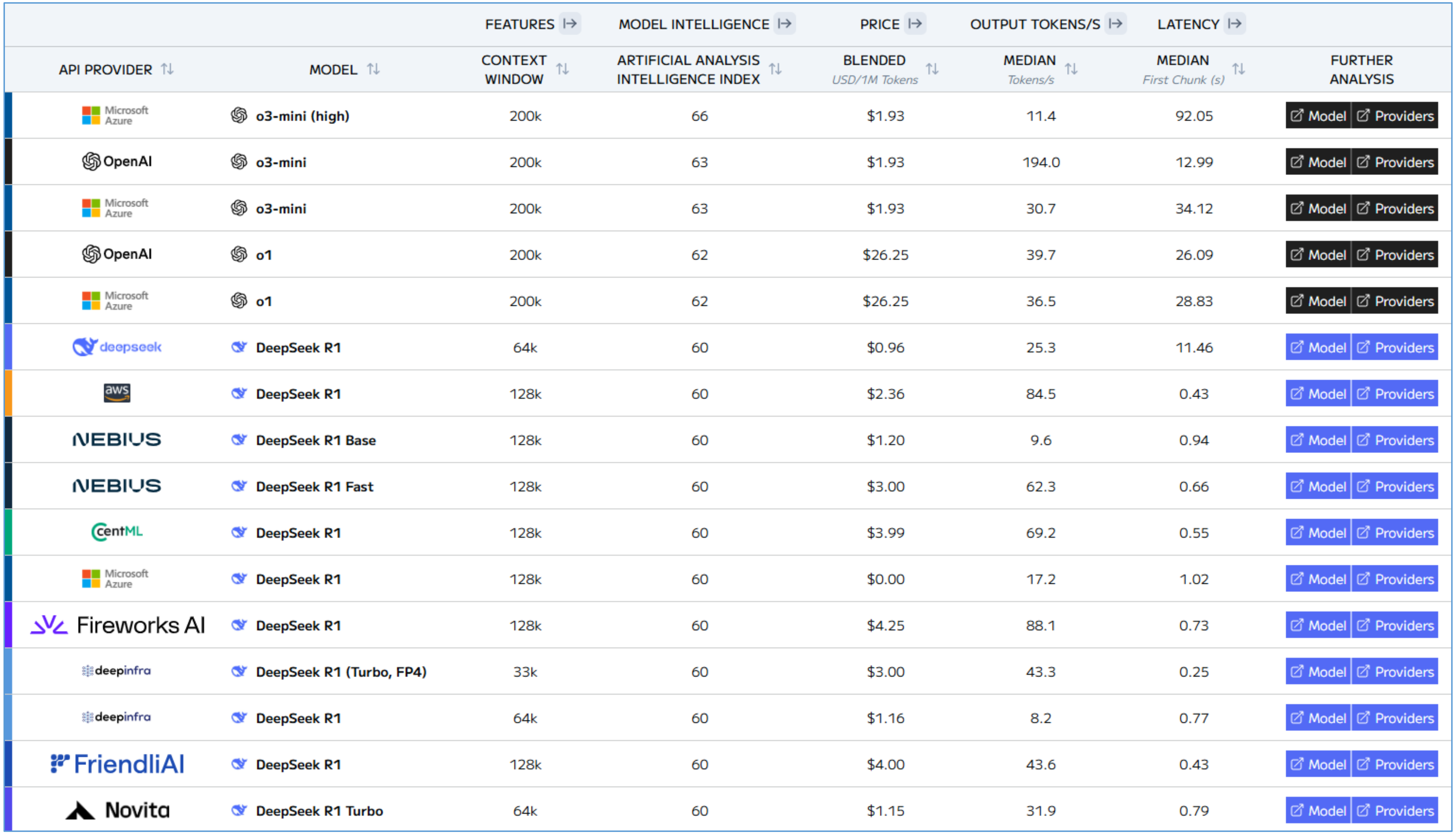
LLM API


01
Understanding of Context
02
Generation of Content
03
Customizability
04
Answering Questions
05
Translations
06
Sentiment Analysis
07
Multi-Lingual Support
08
Learning and Improvement

박경규

LLM API Providers Leaderboar



		FEATURES	MODEL INTELLIGENCE	PRICE	OUTPUT TOKENS/S	LATENCY	
API PROVIDER	MODEL	CONTEXT WINDOW	ARTIFICIAL ANALYSIS INTELLIGENCE INDEX	BLENDED *USD/1M Tokens*	MEDIAN *Tokens/s*	MEDIAN *First Chunk (s)*	FURTHER ANALYSIS
Microsoft Azure	o3-mini (high)	200k	66	$1.93	11.4	92.05	Model Providers
OpenAI	o3-mini	200k	63	$1.93	194.0	12.99	Model Providers
Microsoft Azure	o3-mini	200k	63	$1.93	30.7	34.12	Model Providers
OpenAI	o1	200k	62	$26.25	39.7	26.09	Model Providers
Microsoft Azure	o1	200k	62	$26.25	36.5	28.83	Model Providers
deepseek	DeepSeek R1	64k	60	$0.96	25.3	11.46	Model Providers
aws	DeepSeek R1	128k	60	$2.36	84.5	0.43	Model Providers
NEBIUS	DeepSeek R1 Base	128k	60	$1.20	9.6	0.94	Model Providers
NEBIUS	DeepSeek R1 Fast	128k	60	$3.00	62.3	0.66	Model Providers
CentML	DeepSeek R1	128k	60	$3.99	69.2	0.55	Model Providers
Microsoft Azure	DeepSeek R1	128k	60	$0.00	17.2	1.02	Model Providers
Fireworks AI	DeepSeek R1	128k	60	$4.25	88.1	0.73	Model Providers
deepinfra	DeepSeek R1 (Turbo, FP4)	33k	60	$3.00	43.3	0.25	Model Providers
deepinfra	DeepSeek R1	64k	60	$1.16	8.2	0.77	Model Providers
FriendliAI	DeepSeek R1	128k	60	$4.00	43.6	0.43	Model Providers
Novita	DeepSeek R1 Turbo	64k	60	$1.15	31.9	0.79	Model Providers

https://artificialanalysis.ai/leaderboards/providers

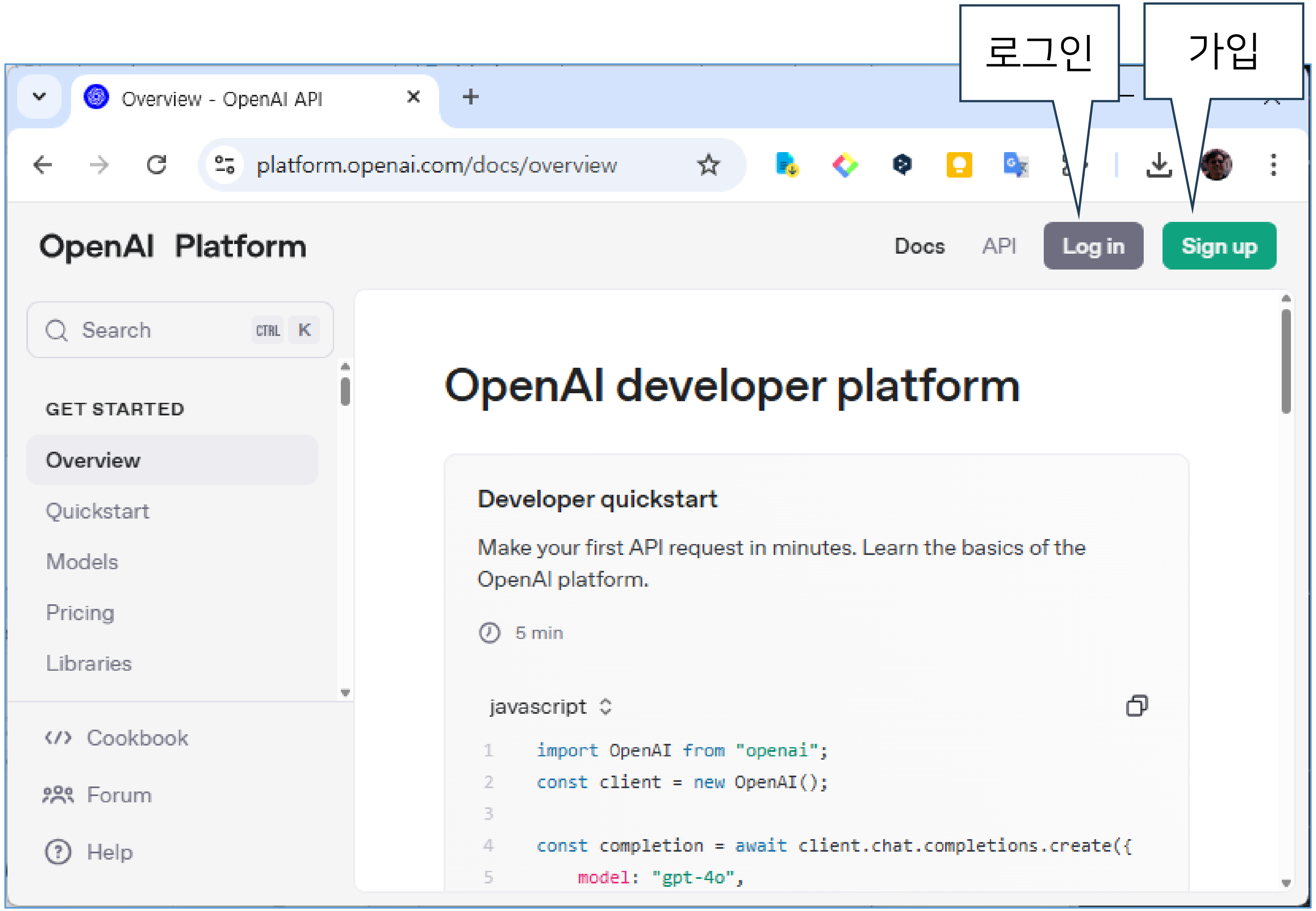
OpenAI API

OpenAI

OpenAI

https://platform.openai.com/

사이트 접속 및 회원가입



로그인

가입

OpenAI developer platform

Developer quickstart

Make your first API request in minutes. Learn the basics of the OpenAI platform.

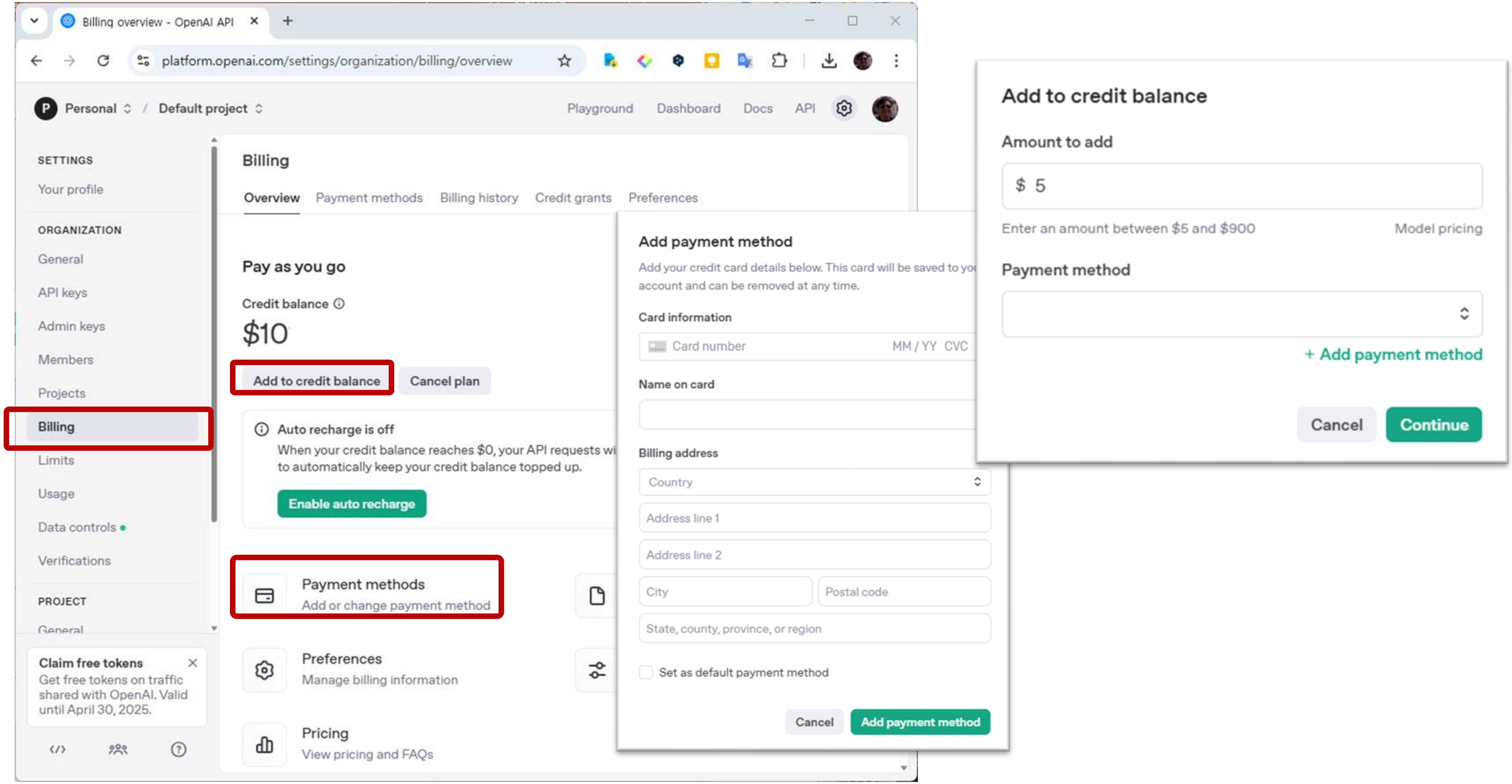
5 min

```javascript
import OpenAI from "openai";
const client = new OpenAI();

const completion = await client.chat.completions.create({
    model: "gpt-4o",
```

OpenAI API (유료)

https://platform.openai.com/settings/organization/billing/overview



Billing overview - OpenAI API

platform.openai.com/settings/organization/billing/overview

P Personal / Default project

Playground Dashboard Docs API

SETTINGS

Your profile

ORGANIZATION

General

API keys

Admin keys

Members

Projects

Billing

Limits

Usage

Data controls

Verifications

PROJECT

General

Claim free tokens

Get free tokens on traffic shared with OpenAI. Valid until April 30, 2025.

Billing

Overview Payment methods Billing history Credit grants Preferences

Pay as you go

Credit balance

$10

Add to credit balance Cancel plan

Auto recharge is off

When your credit balance reaches $0, your API requests wi to automatically keep your credit balance topped up.

Enable auto recharge

Payment methods

Add or change payment method

Preferences

Manage billing information

Pricing

View pricing and FAQs

Add payment method

Add your credit card details below. This card will be saved to yo account and can be removed at any time.

Card information

Card number MM / YY CVC

Name on card

Billing address

Country

Address line 1

Address line 2

City

Postal code

State, county, province, or region

□ Set as default payment method

Cancel Add payment method

Add to credit balance

Amount to add

$ 5

Enter an amount between $5 and $900

Model pricing

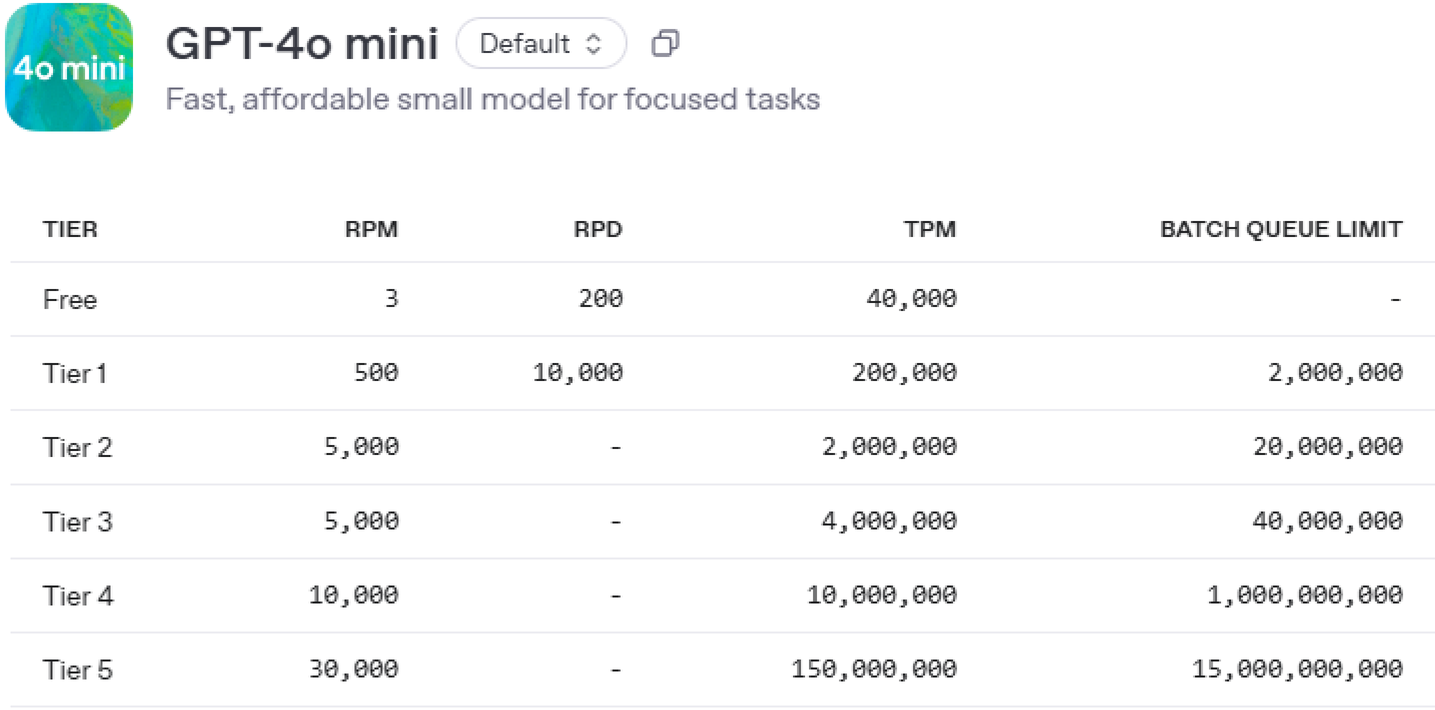
Payment method

+ Add payment method

Cancel Continue

AIPI 사용한도 https://platform.openai.com/docs/guides/rate-limits

https://platform.openai.com/docs/models/gpt-4o-mini



GPT-4o mini Default

Fast, affordable small model for focused tasks

TIER	RPM	RPD	TPM	BATCH QUEUE LIMIT
Free	3	200	40,000	-
Tier 1	500	10,000	200,000	2,000,000
Tier 2	5,000	-	2,000,000	20,000,000
Tier 3	5,000	-	4,000,000	40,000,000
Tier 4	10,000	-	10,000,000	1,000,000,000
Tier 5	30,000	-	150,000,000	15,000,000,000

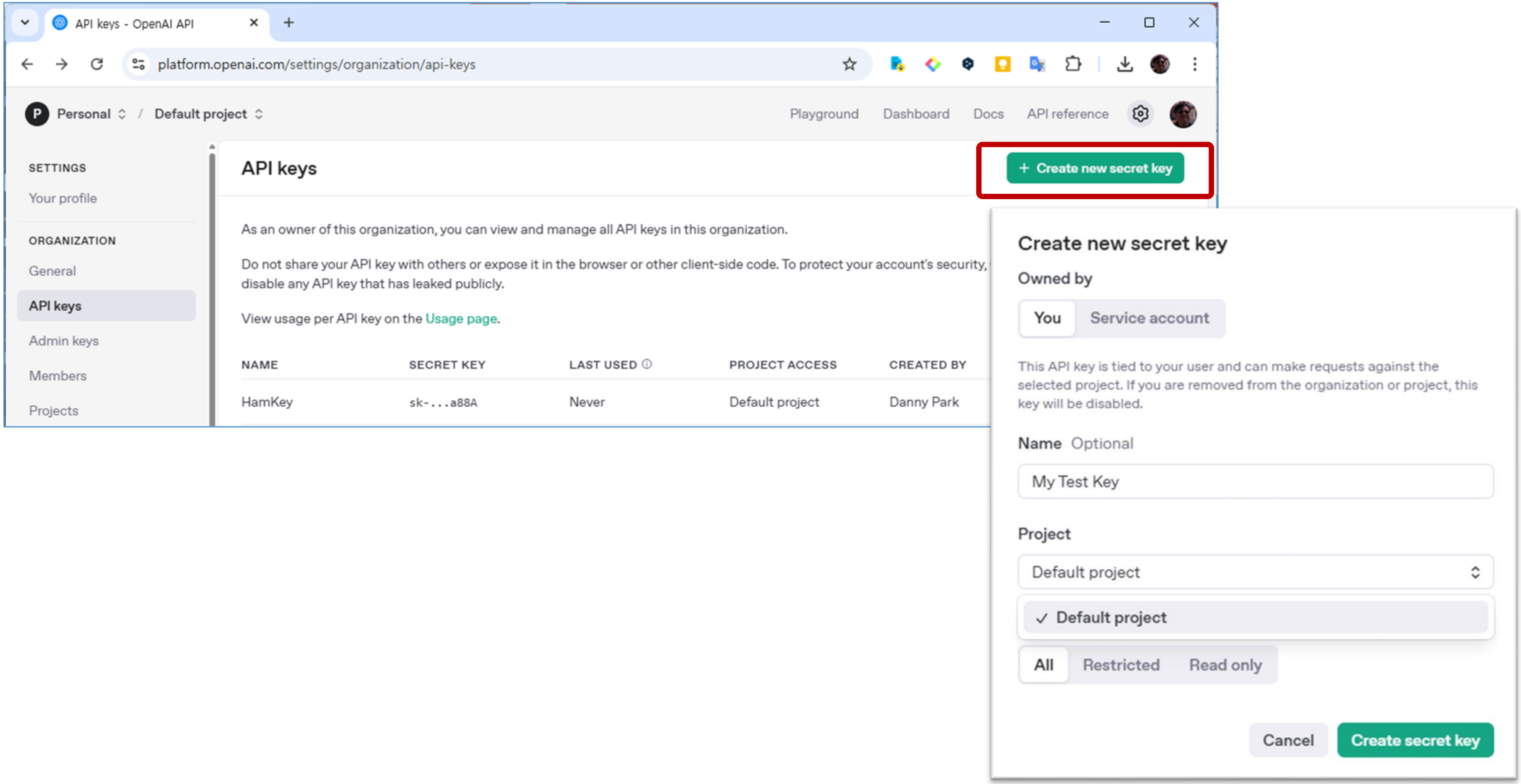
- TPM (tokens per minute)
- TPD (tokens per day)
- RPM (requests per minute)
- RPD (requests per day)
- IPM (images per minute)

- 1 token ~= 4 chars in English
- 1 token ~= ¾ words
- 100 tokens ~= 75 words

참고 :
https://help.openai.com/en/articles/4936856-what-are-tokens-and-how-to-count-them

OpenAI API Key 생성

https://platform.openai.com/settings/organization/api-keys



API keys

As an owner of this organization, you can view and manage all API keys in this organization.

Do not share your API key with others or expose it in the browser or other client-side code. To protect your account's security, disable any API key that has leaked publicly.

View usage per API key on the Usage page.

NAME	SECRET KEY	LAST USED ⓘ	PROJECT ACCESS	CREATED BY
HamKey	sk-...a88A	Never	Default project	Danny Park

Create new secret key

Owned by

You | Service account

This API key is tied to your user and can make requests against the selected project. If you are removed from the organization or project, this key will be disabled.

Name Optional

My Test Key

Project

Default project

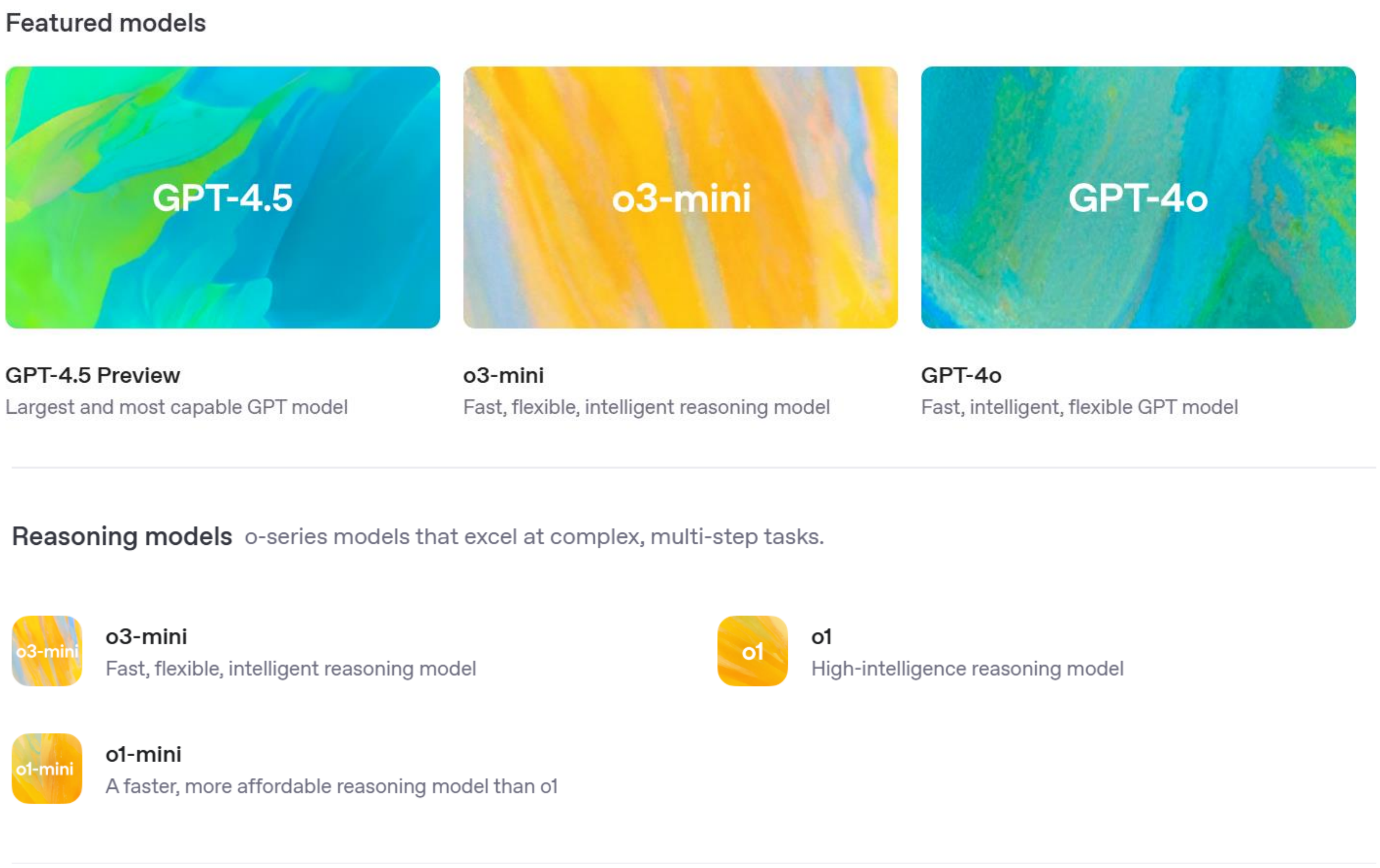
✓ Default project

All | Restricted | Read only

Cancel | Create secret key

OpenAI 모델

https://platform.openai.com/docs/models



Featured models

GPT-4.5 Preview
Largest and most capable GPT model

o3-mini
Fast, flexible, intelligent reasoning model

GPT-4o
Fast, intelligent, flexible GPT model

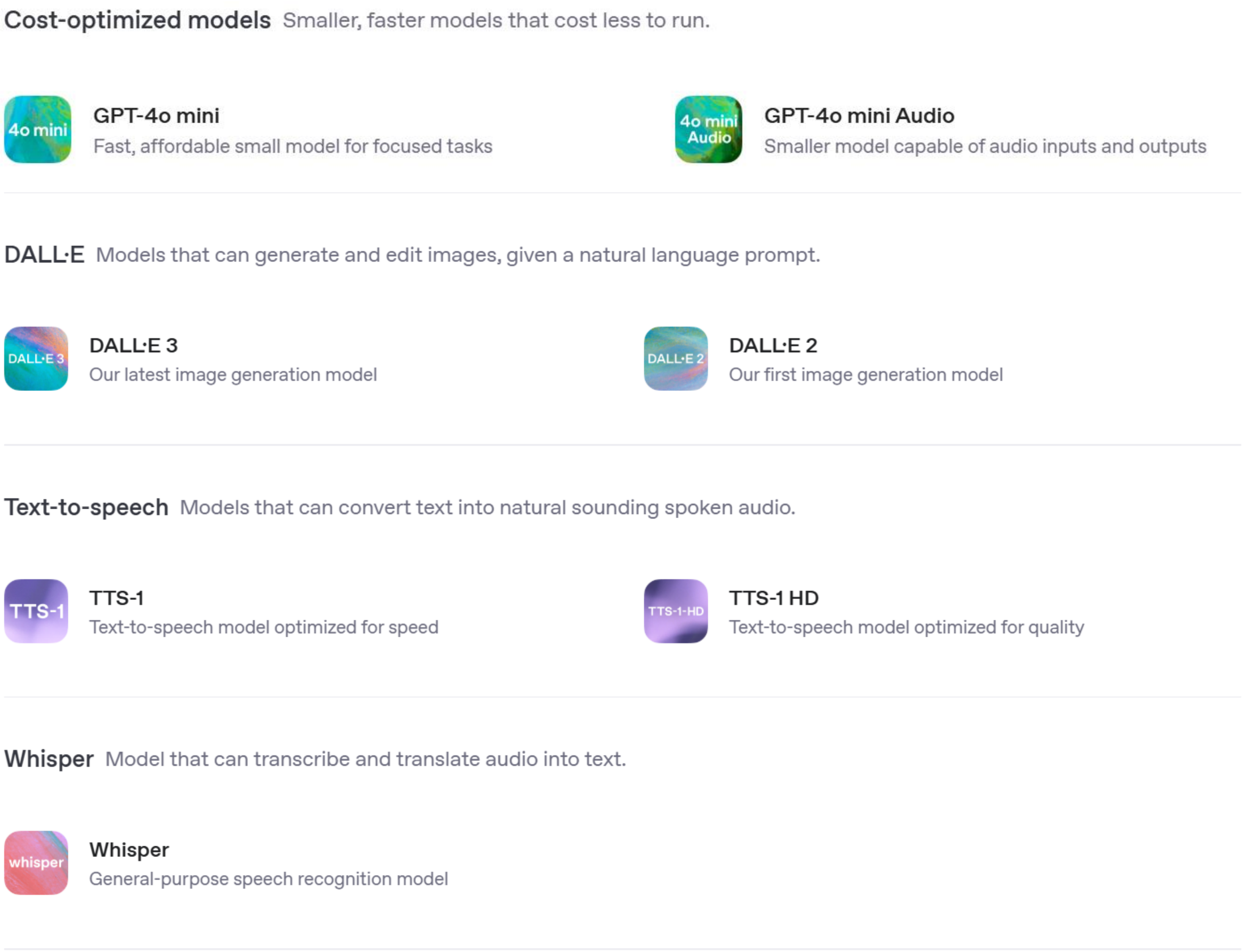
Reasoning models o-series models that excel at complex, multi-step tasks.

o3-mini
Fast, flexible, intelligent reasoning model

o1
High-intelligence reasoning model

o1-mini
A faster, more affordable reasoning model than o1

OpenAI 모델 https://platform.openai.com/docs/models



Cost-optimized models Smaller, faster models that cost less to run.

GPT-4o mini
Fast, affordable small model for focused tasks

GPT-4o mini Audio
Smaller model capable of audio inputs and outputs

DALL·E Models that can generate and edit images, given a natural language prompt.

DALL·E 3
Our latest image generation model

DALL·E 2
Our first image generation model

Text-to-speech Models that can convert text into natural sounding spoken audio.

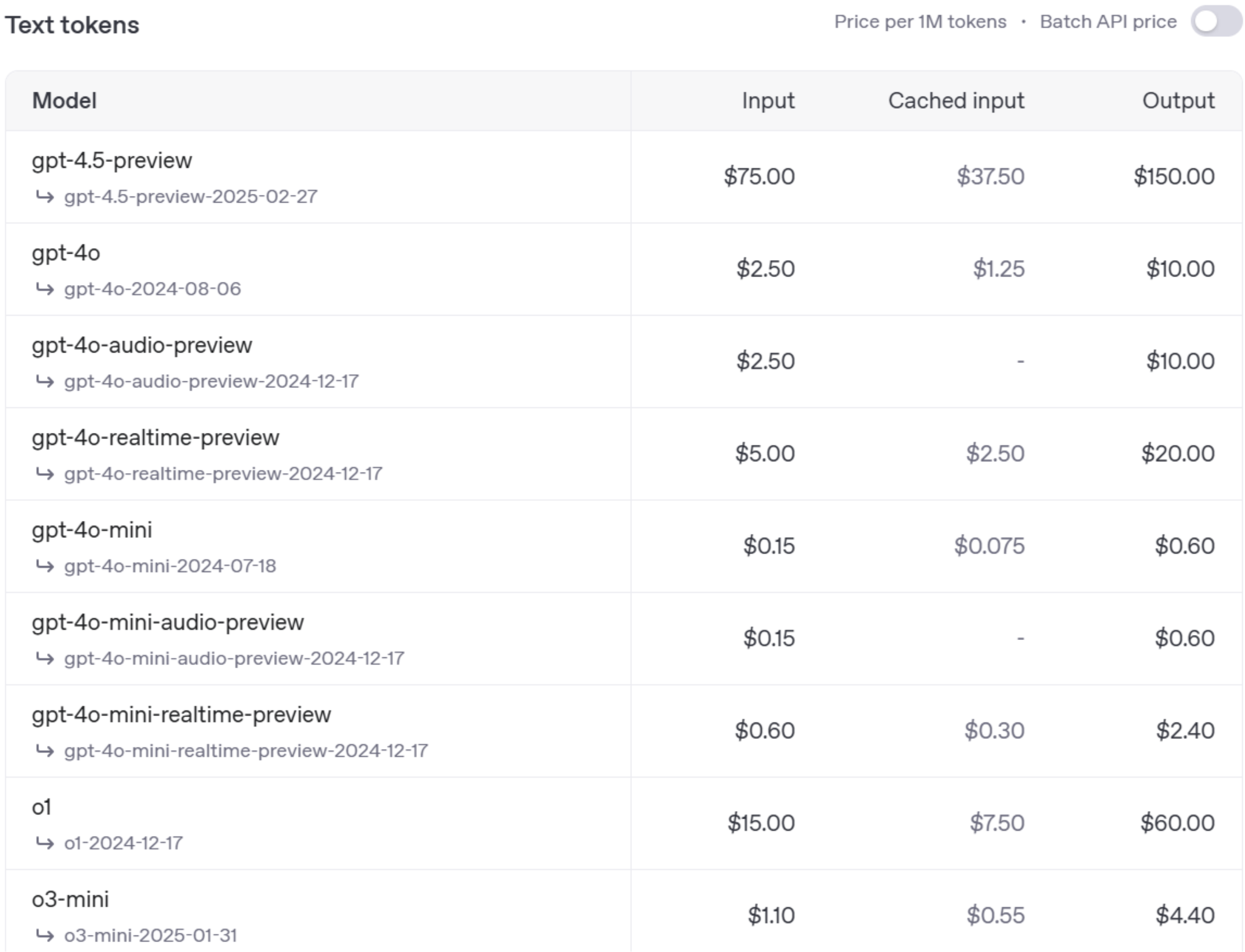
TTS-1
Text-to-speech model optimized for speed

TTS-1 HD
Text-to-speech model optimized for quality

Whisper Model that can transcribe and translate audio into text.

Whisper
General-purpose speech recognition model

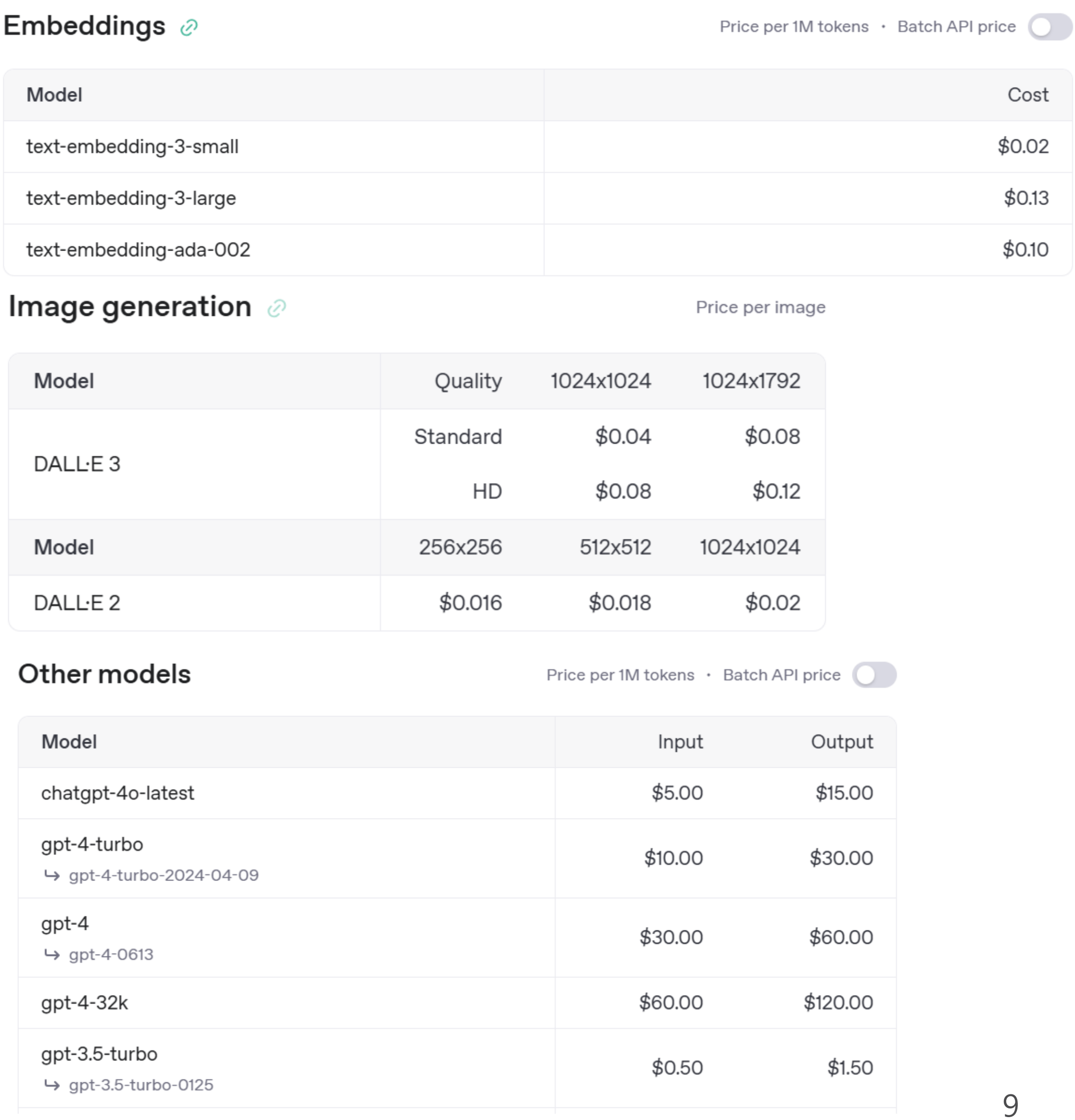
OpenAI 요금제 https://platform.openai.com/docs/pricing



Text tokens

Price per 1M tokens · Batch API price

Model	Input	Cached input	Output
gpt-4.5-preview ↳ gpt-4.5-preview-2025-02-27	$75.00	$37.50	$150.00
gpt-4o ↳ gpt-4o-2024-08-06	$2.50	$1.25	$10.00
gpt-4o-audio-preview ↳ gpt-4o-audio-preview-2024-12-17	$2.50	-	$10.00
gpt-4o-realtime-preview ↳ gpt-4o-realtime-preview-2024-12-17	$5.00	$2.50	$20.00
gpt-4o-mini ↳ gpt-4o-mini-2024-07-18	$0.15	$0.075	$0.60
gpt-4o-mini-audio-preview ↳ gpt-4o-mini-audio-preview-2024-12-17	$0.15	-	$0.60
gpt-4o-mini-realtime-preview ↳ gpt-4o-mini-realtime-preview-2024-12-17	$0.60	$0.30	$2.40
o1 ↳ o1-2024-12-17	$15.00	$7.50	$60.00
o3-mini ↳ o3-mini-2025-01-31	$1.10	$0.55	$4.40



Embeddings

Price per 1M tokens · Batch API price

Model	Cost
text-embedding-3-small	$0.02
text-embedding-3-large	$0.13
text-embedding-ada-002	$0.10

Image generation

Price per image

Model	Quality	1024x1024	1024x1792
DALL·E 3	Standard	$0.04	$0.08
	HD	$0.08	$0.12
Model	**256x256**	**512x512**	**1024x1024**
DALL·E 2	$0.016	$0.018	$0.02

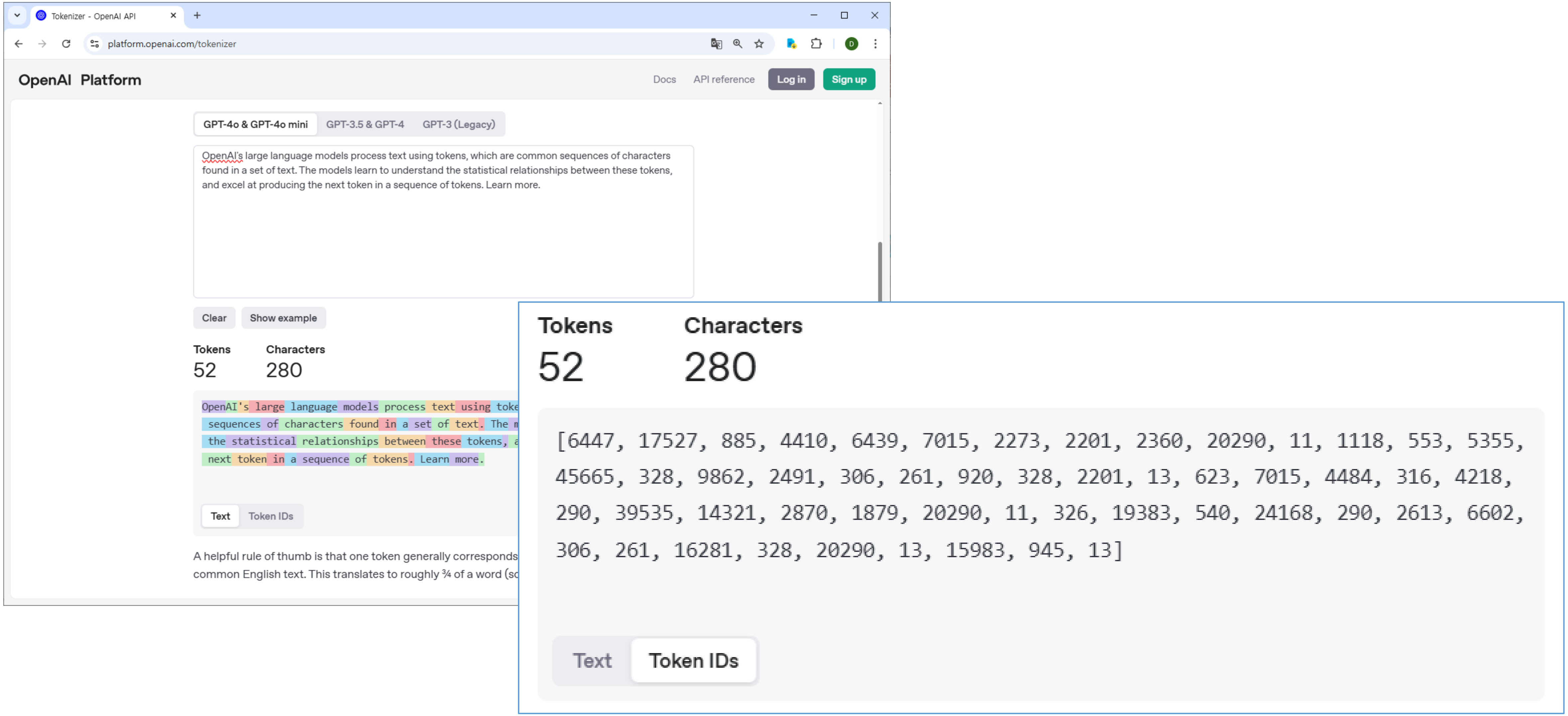
Other models

Price per 1M tokens · Batch API price

Model	Input	Output
chatgpt-4o-latest	$5.00	$15.00
gpt-4-turbo ↳ gpt-4-turbo-2024-04-09	$10.00	$30.00
gpt-4 ↳ gpt-4-0613	$30.00	$60.00
gpt-4-32k	$60.00	$120.00
gpt-3.5-turbo ↳ gpt-3.5-turbo-0125	$0.50	$1.50

토큰(Token)

https://platform.openai.com/tokenizer



OpenAI's large language models process text using tokens, which are common sequences of characters found in a set of text. The models learn to understand the statistical relationships between these tokens, and excel at producing the next token in a sequence of tokens. Learn more.

Tokens
52

Characters
280

OpenAI's large language models process text using toke
sequences of characters found in a set of text. The m
the statistical relationships between these tokens, a
next token in a sequence of tokens. Learn more.

A helpful rule of thumb is that one token generally corresponds
common English text. This translates to roughly ¾ of a word (sc

Tokens
52

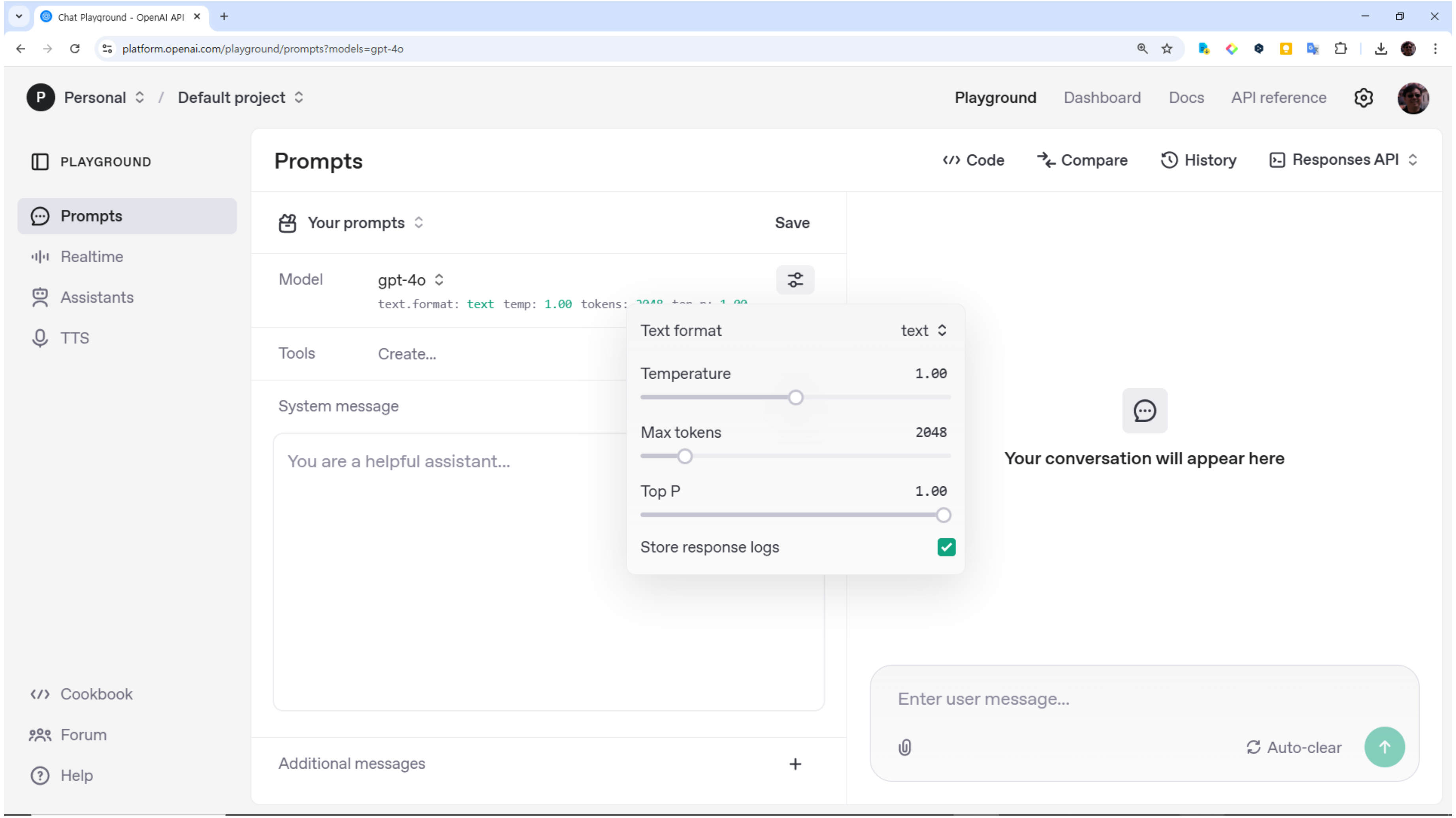
Characters
280

```
[6447, 17527, 885, 4410, 6439, 7015, 2273, 2201, 2360, 20290, 11, 1118, 553, 5355,
45665, 328, 9862, 2491, 306, 261, 920, 328, 2201, 13, 623, 7015, 4484, 316, 4218,
290, 39535, 14321, 2870, 1879, 20290, 11, 326, 19383, 540, 24168, 290, 2613, 6602,
306, 261, 16281, 328, 20290, 13, 15983, 945, 13]
```

⏳ tiktoken

플레이그라운드

https://platform.openai.com/playground



Model gpt-4o
text.format: text temp: 1.00 tokens: 2048 top_p: 1.00

Text format: text

Temperature: 1.00

Max tokens: 2048

Top P: 1.00

Store response logs ☑

- Temperature : 값이 낮을수록 가장 높은 확률의 다음 토큰을 선택하고, 값이 높아지면 무작위성이 높아짐
- Max Tokens
  모델이 생성하는 토큰 최대 길이
- Top P : 값이 높으면 모델이 가능성이 낮은 단어를 포함하여 더 다양한 출력을 얻을 수 있음

API 사용 방법

Step 1: Setup Python

Install Python

https://www.python.org/downloads/

Setup a virtual environment (optional)

python -m venv venv

Windows : venv₩Scripts₩activate

Unix or Mac : source venv/bin/activate

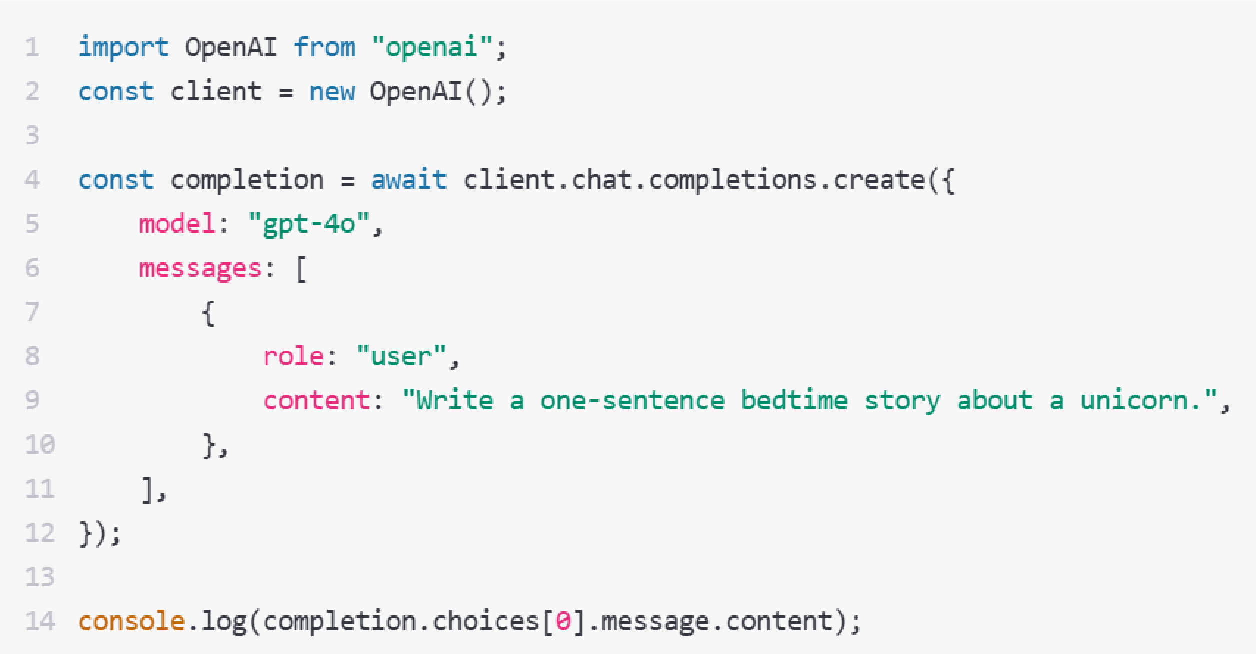
Install the OpenAI Python library

pip install openai

Step 2: Setup your API key

Windows : setx OPENAI_API_KEY "your-api-key-here"
Unix or Mac : export OPENAI_API_KEY='your-api-key-here”

Step 3: Sending your first API request



```
import OpenAI from "openai";
const client = new OpenAI();

const completion = await client.chat.completions.create({
    model: "gpt-4o",
    messages: [
        {
            role: "user",
            content: "Write a one-sentence bedtime story about a unicorn.",
        },
    ],
});

console.log(completion.choices[0].message.content);
```

https://platform.openai.com/docs/quickstart?ref=seongjin.me&context=python

OpenAI API 실습자료

openai_api.ipynb

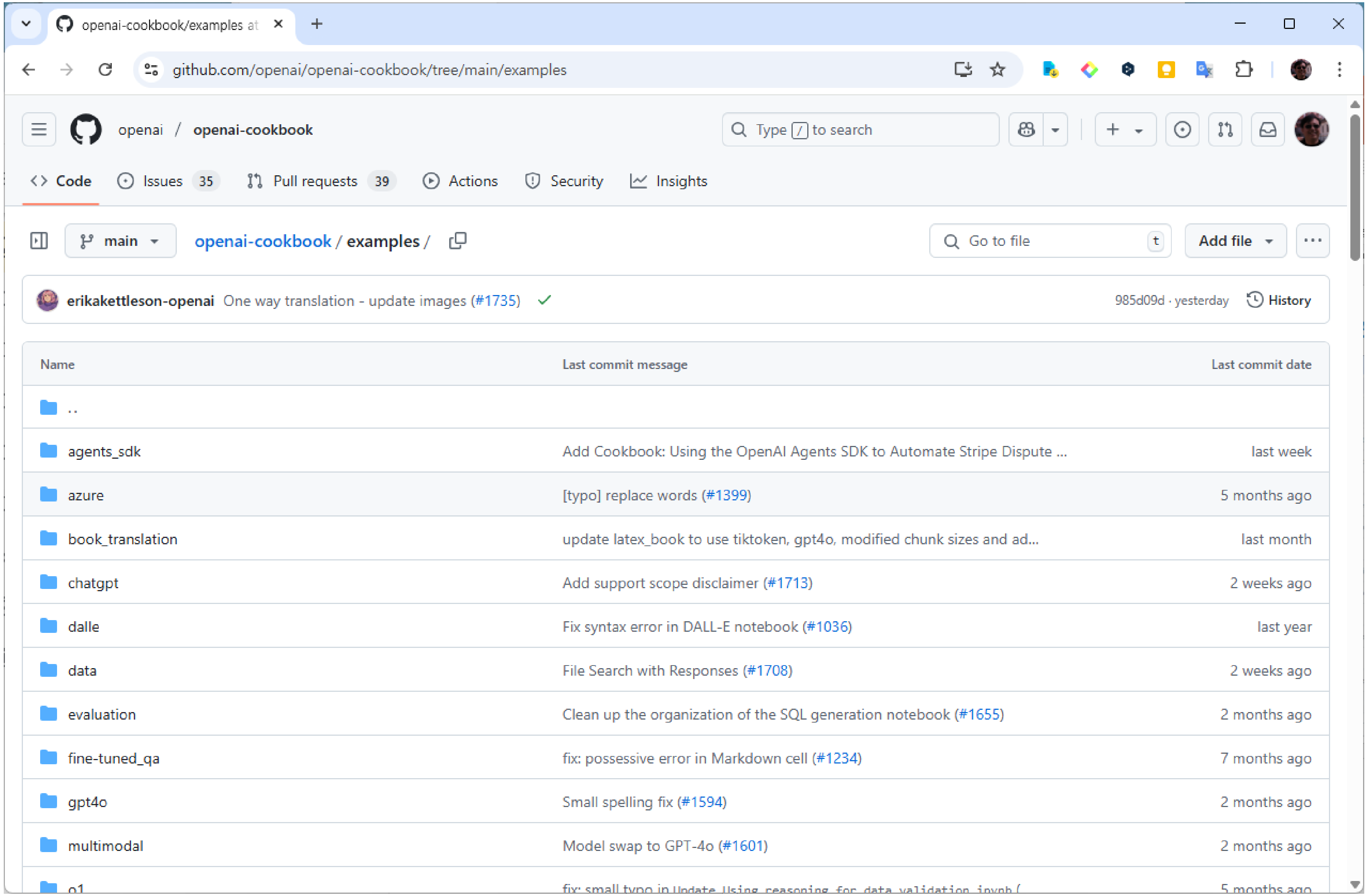
information_retrieval.ipynb

ReAct.ipynb

pe-lecture.ipynb

OpenAI Cookbook examples

https://github.com/openai/openai-cookbook/tree/main/examples



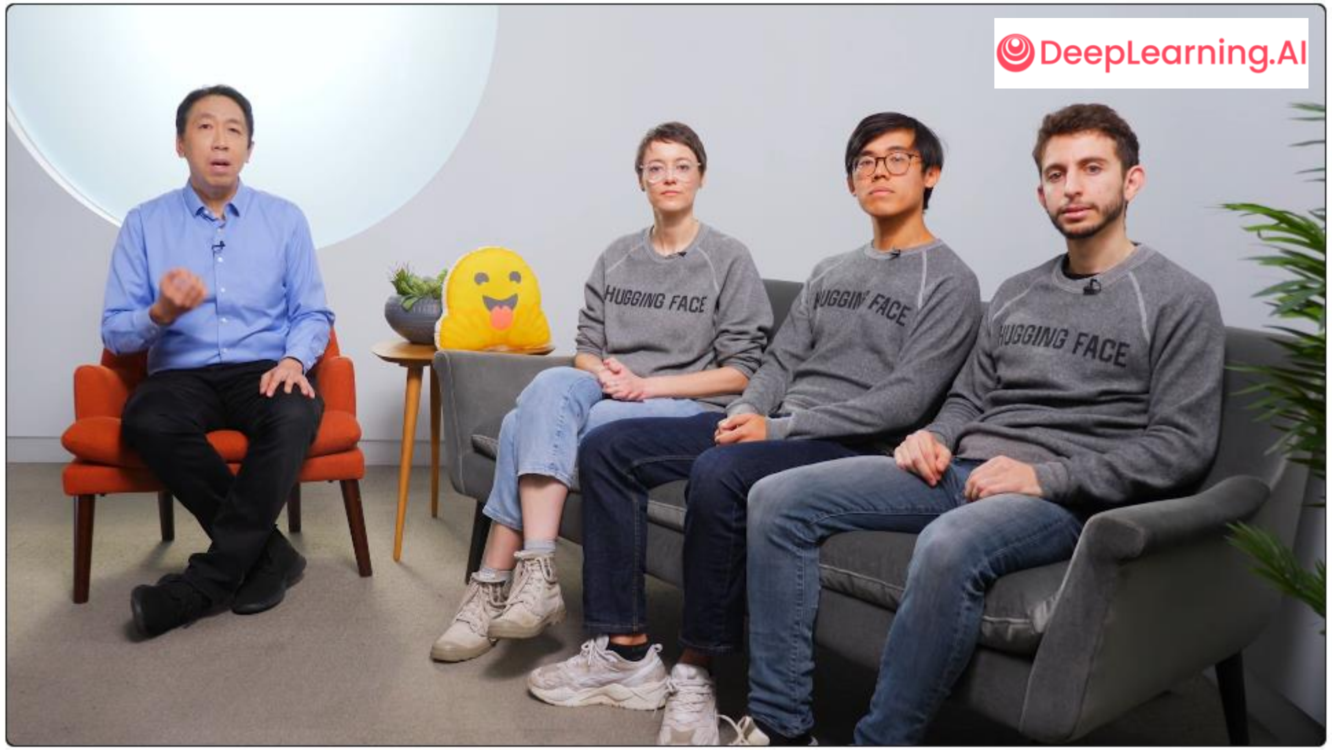
erikakettleson-openai One way translation - update images (#1735) ✓ 985d09d · yesterday History

Name	Last commit message	Last commit date
..		
agents_sdk	Add Cookbook: Using the OpenAI Agents SDK to Automate Stripe Dispute ...	last week
azure	[typo] replace words (#1399)	5 months ago
book_translation	update latex_book to use tiktoken, gpt4o, modified chunk sizes and ad...	last month
chatgpt	Add support scope disclaimer (#1713)	2 weeks ago
dalle	Fix syntax error in DALL-E notebook (#1036)	last year
data	File Search with Responses (#1708)	2 weeks ago
evaluation	Clean up the organization of the SQL generation notebook (#1655)	2 months ago
fine-tuned_qa	fix: possessive error in Markdown cell (#1234)	7 months ago
gpt4o	Small spelling fix (#1594)	2 months ago
multimodal	Model swap to GPT-4o (#1601)	2 months ago
o1	fix: small typo in `Update_Using_reasoning_for_data_validation.ipynb` (	5 months ago

Prompt Engineering with Llama 2&3

https://learn.deeplearning.ai/courses/prompt-engineering-with-llama-2/lesson/bg26k/introduction

허깅페이스(Hugging Face)
오픈소스 모델 사용



https://learn.deeplearning.ai/courses/open-source-models-hugging-face/

Streamlit으로 AI앱 만들기

https://streamlit.io/

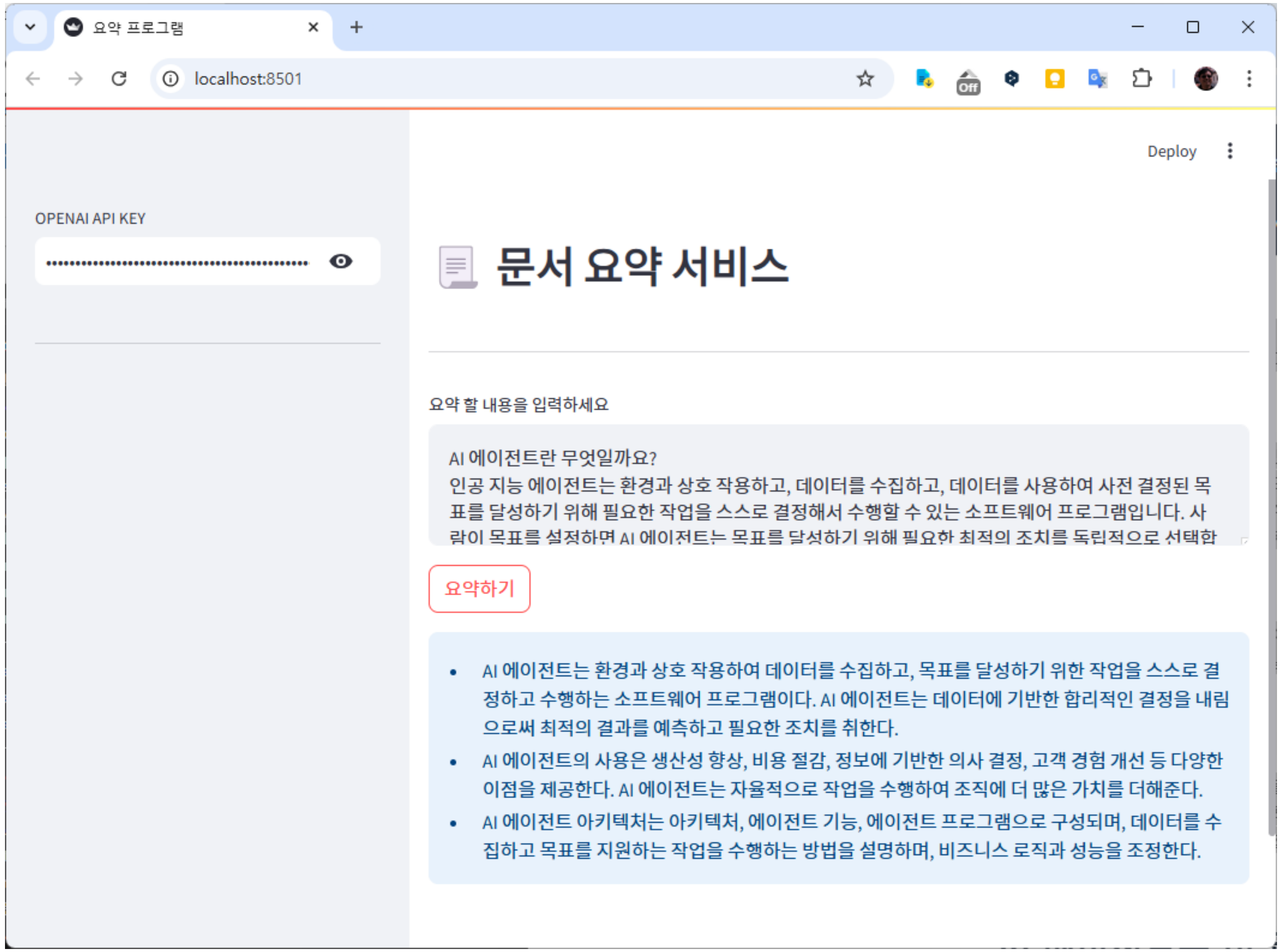
Streamlit은 데이터 과학, 머신러닝, 분석 프로젝트를 위한 웹 애플리케이션을 만드는 과정을 간소화하고, 신속하게 웹 애플리케이션을 만들 수 있게 설계된 오픈소스입니다.

■ 설치

```
pip install streamlit
```

■ 실행

```
streamlit run st_summerize_app.py
```



📃 문서 요약 서비스

요약 할 내용을 입력하세요

AI 에이전트란 무엇일까요?
인공 지능 에이전트는 환경과 상호 작용하고, 데이터를 수집하고, 데이터를 사용하여 사전 결정된 목표를 달성하기 위해 필요한 작업을 스스로 결정해서 수행할 수 있는 소프트웨어 프로그램입니다. 사람이 목표를 설정하면 AI 에이전트는 목표를 달성하기 위해 필요한 최적의 조치를 독립적으로 선택한

- AI 에이전트는 환경과 상호 작용하여 데이터를 수집하고, 목표를 달성하기 위한 작업을 스스로 결정하고 수행하는 소프트웨어 프로그램이다. AI 에이전트는 데이터에 기반한 합리적인 결정을 내림으로써 최적의 결과를 예측하고 필요한 조치를 취한다.
- AI 에이전트의 사용은 생산성 향상, 비용 절감, 정보에 기반한 의사 결정, 고객 경험 개선 등 다양한 이점을 제공한다. AI 에이전트는 자율적으로 작업을 수행하여 조직에 더 많은 가치를 더해준다.
- AI 에이전트 아키텍처는 아키텍처, 에이전트 기능, 에이전트 프로그램으로 구성되며, 데이터를 수집하고 목표를 지원하는 작업을 수행하는 방법을 설명하며, 비즈니스 로직과 성능을 조정한다.

Thank you