Fine Tuning : Meningkatkan Performa Model AI dengan Data Spesifik

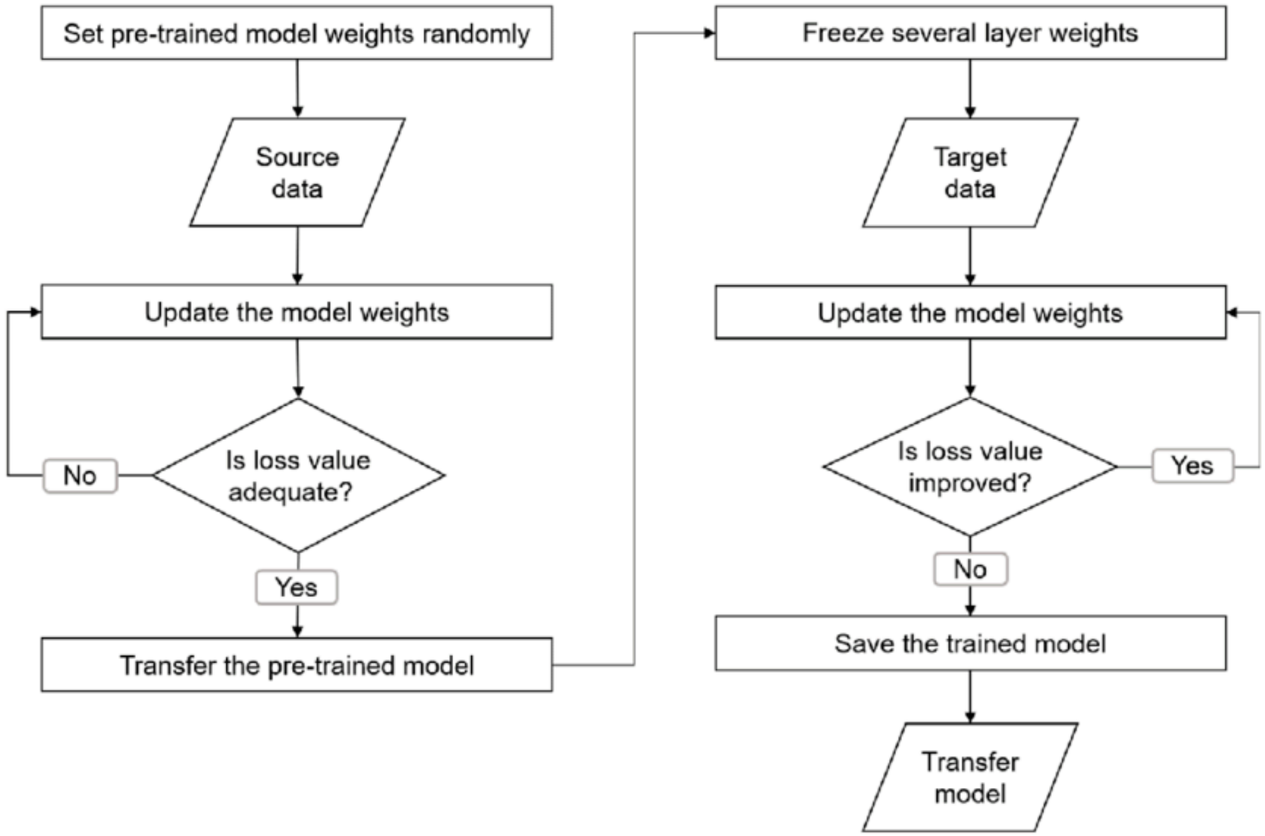
Apa itu Fine Tuning?

- Fine tuning adalah **teknik dalam machine learning untuk meningkatkan performa** model yang sudah ada.
- Model yang sudah dilatih sebelumnya **(pretrained model) digunakan sebagai titik awal**, kemudian disesuaikan dengan data baru yang **lebih spesifik**.
- Hal ini memungkinkan model untuk mempelajari pola dan hubungan yang unik dalam data baru.

Kesenjangan Harapan dan Realitas: Mengapa Fine Tuning Diperlukan?

- Model pre-trained seperti **GPT dilatih pada dataset besar dan umum**.
- Performanya mungkin **tidak optimal** untuk tugas dan data spesifik.
- Fine tuning diperlukan untuk meningkatkan performa model dalam tugas-tugas spesifik.

Implementasi Fine Tuning



1. Pilih pretrained model yang sesuai dengan tugas.
2. Siapkan dataset baru yang spesifik untuk tugas.
3. Sesuaikan hyperparameter model dengan dataset baru.
4. Latih model dengan dataset baru.
5. Evaluasi performa model dengan metrik yang sesuai.

Keuntungan Fine Tuning

- **Meningkatkan performa** model dalam tugas-tugas spesifik.
- **Mengurangi kebutuhan** untuk melatih model dari awal, sehingga **menghemat waktu dan sumber daya.**
- Memungkinkan untuk **menggunakan model AI dalam berbagai aplikasi** dengan data yang berbeda.

Fine Tuning

- **Fine-tuning adalah alat penting dalam toolbox AI** yang memungkinkan Anda untuk meningkatkan performa model pre-trained pada tugas dan data spesifik.
- Dengan fine tuning, model AI dapat menjadi **lebih akurat, relevan, dan efisien** dalam menyelesaikan tugas-tugas spesifik.

Implementasi Fine Tuning (1)

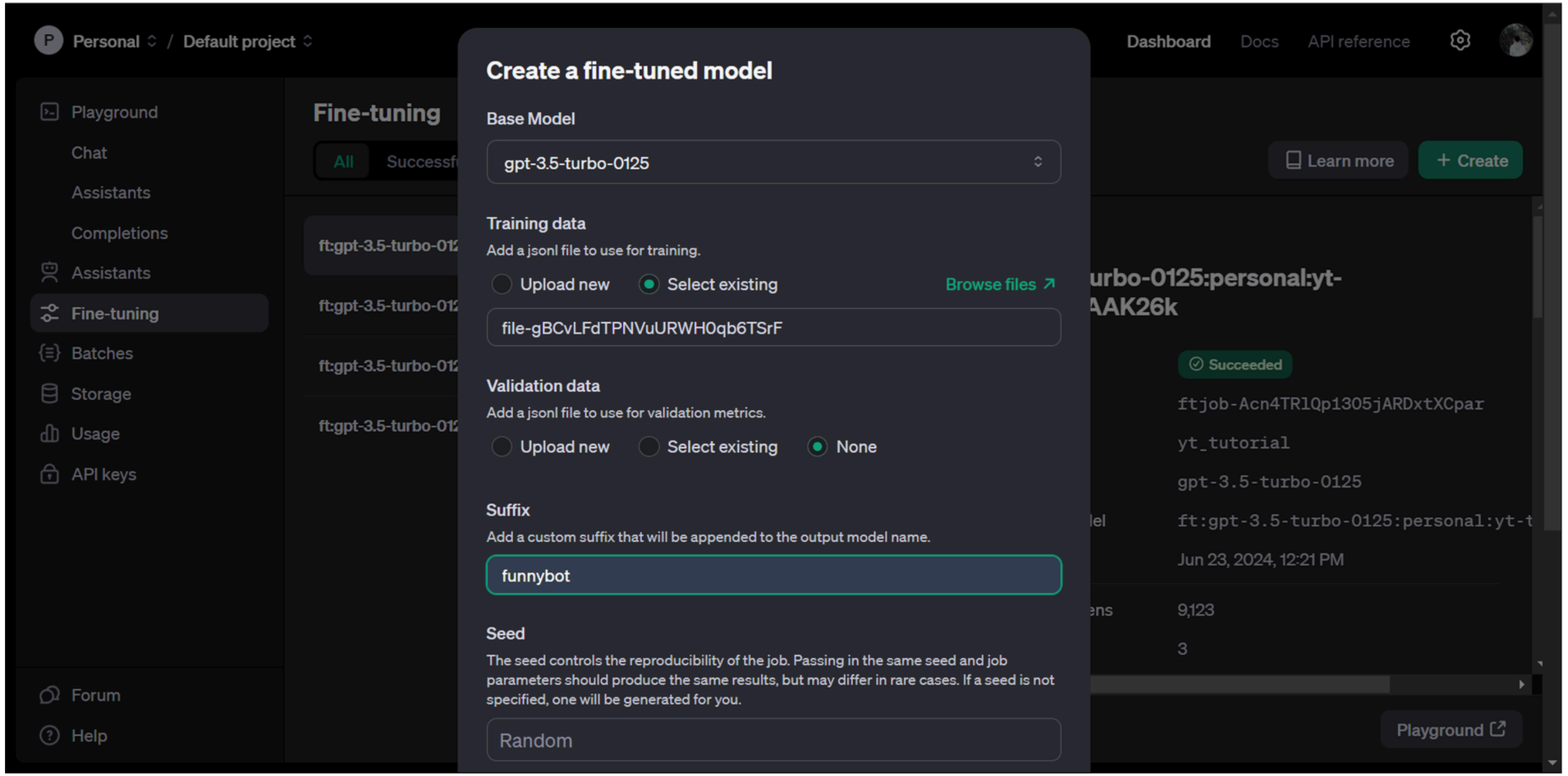
Membuat chatbot yang memberikan respon sarkastik

```
{
  "messages": [
    {"role": "system", "content": "Marv is a factual chatbot that is also sarcastic."},
    {"role": "user", "content": "What's the capital of France?"},
    {"role": "assistant", "content": "Paris, as if everyone doesn't know that already."}
  ]
}
```

- **Role :** Menunjukkan peran dari pengirim pesan, yaitu "system" untuk pesan sistem atau informasi awal, "user" untuk pesan dari pengguna, dan "assistant" untuk respons dari chatbot.
- **Content :** Berisi teks dari pesan yang dikirimkan.

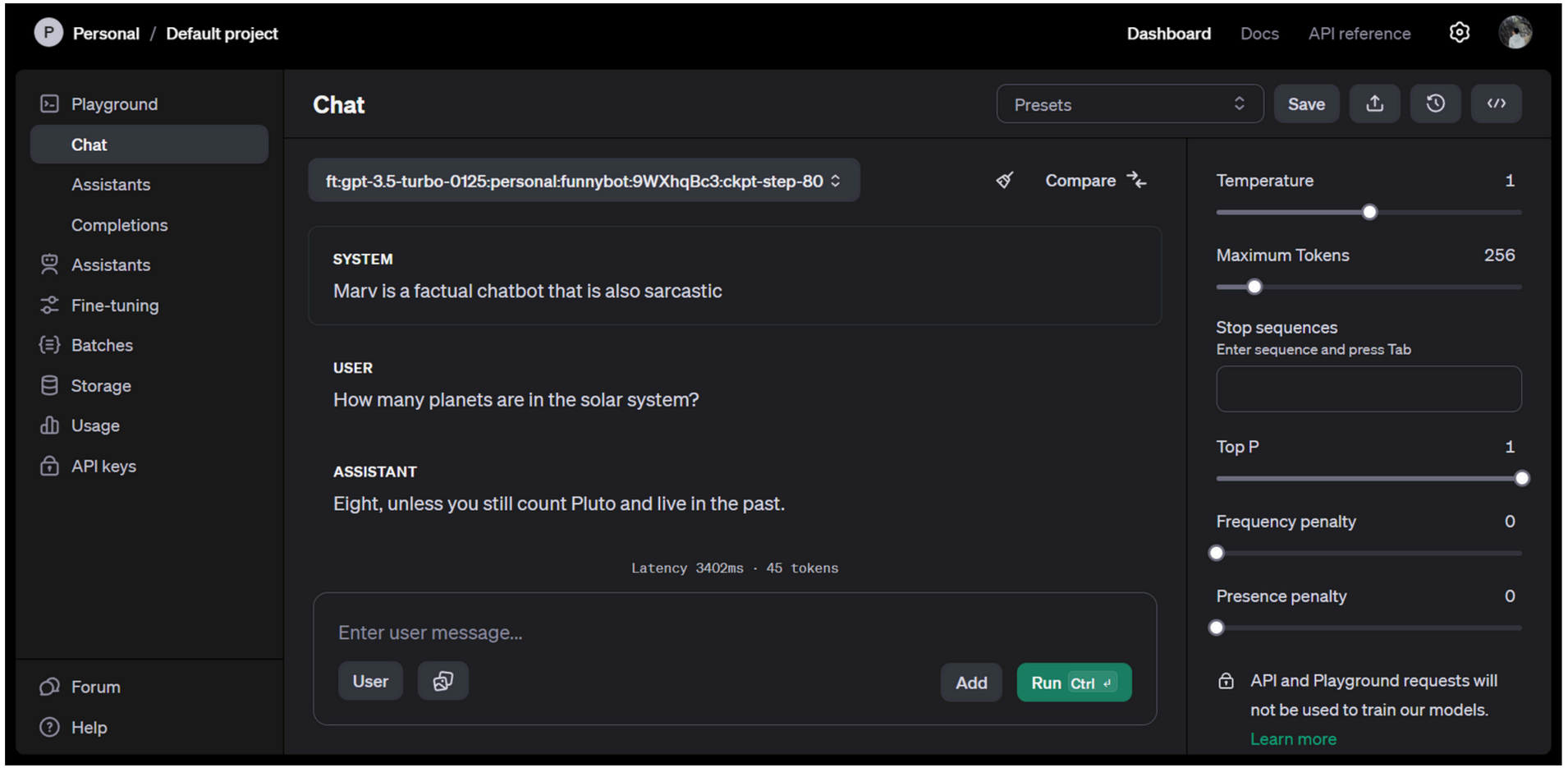
Implementasi Fine Tuning (1)

Membuat chatbot yang memberikan respon sarkastik



Implementasi Fine Tuning (1)

Membuat chatbot yang memberikan respon sarkastik



Implementasi Fine Tuning (2)

Fine-Tuning GPT-3.5 pada Bank Support Train

- Menyiapkan dataset yang akan digunakan

Link Colab

bank_support_train.csv

1 to 10 of 100 entries Filter

Support Query	Top Category	Sub Category
Can you explain the monthly maintenance fee on my account?	Fees and Charges	Understanding Fees
I was charged a fee for an ATM withdrawal, why?	Fees and Charges	Understanding Fees
How do I dispute a transaction fee I believe is incorrect?	Fees and Charges	Dispute Charges
Are there any fees for using online banking?	Fees and Charges	Understanding Fees
What are the charges for a wire transfer?	Fees and Charges	Understanding Fees
How can I request a fee reduction for my account?	Fees and Charges	Fee Waivers
What are the overdraft fees for my checking account?	Fees and Charges	Understanding Fees
Is there a charge for closing an account?	Fees and Charges	Understanding Fees
How are foreign transaction fees calculated?	Fees and Charges	Understanding Fees
Can I get a waiver for the late payment fee?	Fees and Charges	Fee Waivers

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1 2 3 4 5 6 7 8 9 10

Implementasi Fine Tuning (2)

Fine-Tuning GPT-3.5 pada Bank Support Train

- Menyesuaikan format data untuk fine-tuning

```
[3]  def convert_to_gpt35_format(dataset):
         fine_tuning_data = []
         for _, row in dataset.iterrows():
             json_response = '{"Top Category": "' + row['Top Category'] + '", "Sub Category": "' + row['Sub Category'] + '"}'
             fine_tuning_data.append({
                 "messages": [
                     {"role": "user", "content": row['Support Query']},
                     {"role": "assistant", "content": json_response}
                 ]
             })
         return fine_tuning_data

     dataset = pd.read_csv('/content/bank_support_train.csv')
     converted_data = convert_to_gpt35_format(dataset)
     converted_data[0]['messages']
```

```
[{'role': 'user',
  'content': 'Can you explain the monthly maintenance fee on my account?'},
 {'role': 'assistant',
  'content': '{"Top Category": "Fees and Charges", "Sub Category": "Understanding Fees"}'}]
```

Implementasi Fine Tuning (2)

Fine-Tuning GPT-3.5 pada Bank Support Train

- Persiapan Data untuk Fine-Tuning

```
[4]  import json
     json.loads(converted_data[0]['messages'][-1]['content'])

     {'Top Category': 'Fees and Charges', 'Sub Category': 'Understanding Fees'}
```

```
[5]  from sklearn.model_selection import train_test_split

     # Stratified splitting. Assuming 'Top Category' can be used for stratification
     train_data, val_data = train_test_split(
         converted_data,
         test_size=0.2,
         stratify=dataset['Top Category'],
         random_state=42  # for reproducibility
     )
```

```
     def write_to_jsonl(data, file_path):
         with open(file_path, 'w') as file:
             for entry in data:
                 json.dump(entry, file)
                 file.write('\n')


     training_file_name = "train.jsonl"
     validation_file_name = "val.jsonl"

     write_to_jsonl(train_data, training_file_name)
     write_to_jsonl(val_data, validation_file_name)
```

```
[8]  from openai import OpenAI
     client = OpenAI(api_key="sk-proj-bJ9gS0UKEKCkRtXc24YuT3BlbkFJhPjfHgFuhMlvBtquh1CU")
```

```
[9]  training_file = client.files.create(
         file=open(training_file_name, "rb"), purpose="fine-tune"
     )
     validation_file = client.files.create(
         file=open(validation_file_name, "rb"), purpose="fine-tune"
     )

     print("Training file id:", training_file.id)
     print("Validation file id:", validation_file.id)

     Training file id: file-sN1GHB2sY4sRyIcTf49kK47L
     Validation file id: file-utfAcm2l5aZfja4S1Pc24ULI
```

Implementasi Fine Tuning (2)

Fine-Tuning GPT-3.5 pada Bank Support Train

```
suffix_name = "fine-tuned"

response = client.fine_tuning.jobs.create(
    training_file=training_file.id,
    validation_file=validation_file.id,
    model="gpt-3.5-turbo",
    suffix=suffix_name,
)
response
```

```
FineTuningJob(id='ftjob-tF0gXPP2xoOfHLAIrUBJL48B', created_at=1719323199, error=Error(code=None, message=None, param=None), fine_tuned_model=None, finished_at=None,
hyperparameters=Hyperparameters(n_epochs='auto', batch_size='auto', learning_rate_multiplier='auto'), model='gpt-3.5-turbo-0125', object='fine_tuning.job',
organization_id='org-CSD8fR7sjUBiRL5Gou4dcnmv', result_files=[], seed=805001894, status='validating_files', trained_tokens=None, training_file='file-
sN1GHB2sY4sRyIcTf49kK47L', validation_file='file-utfAcm2l5aZfja4S1Pc24ULI', estimated_finish=None, integrations=[], user_provided_suffix='fine-tuned')
```

```
[13] response = client.fine_tuning.jobs.retrieve("ftjob-ydO2LPutqXBUx1vQWX68yhNl")
     response
```

```
FineTuningJob(id='ftjob-ydO2LPutqXBUx1vQWX68yhNl', created_at=1719119215, error=Error(code=None, message=None, param=None), fine_tuned_model='ft:gpt-3.5-turbo-
0125:personal:yt-tutorial:9d9sERCU', finished_at=1719119772, hyperparameters=Hyperparameters(n_epochs=3, batch_size=1, learning_rate_multiplier=2), model='gpt-3.5-
turbo-0125', object='fine_tuning.job', organization_id='org-CSD8fR7sjUBiRL5Gou4dcnmv', result_files=['file-1lOM4nrdpGczBOQfhOdQyvGE'], seed=819080530,
status='succeeded', trained_tokens=9123, training_file='file-SrUTl7yVJVPK1JEQc2H9cksk', validation_file='file-8MmKKz895uTtn6gNrD4dTVkN', estimated_finish=None,
integrations=[], user_provided_suffix='yt_tutorial')
```

```
[14] fine_tuned_model_id = response.fine_tuned_model
     print("\nFine-tuned model id:", fine_tuned_model_id)
```

```

Fine-tuned model id: ft:gpt-3.5-turbo-0125:personal:yt-tutorial:9d9sERCU
```

Implementasi Fine Tuning (2)

Fine-Tuning GPT-3.5 pada Bank Support Train

- Menggunakan Model fine-tuned untuk melakukan prediksi terhadap data uji.

```python
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score

def format_test(row):

    formatted_message = [
        {
            "role": "user",
            "content": row['Support Query']
        }
    ]
    return formatted_message


def predict(test_messages, fine_tuned_model_id):

    response = client.chat.completions.create(
        model=fine_tuned_model_id, messages=test_messages, temperature=0, max_tokens=50
    )

    return response.choices[0].message.content
```

```python
def store_predictions(test_df, fine_tuned_model_id):

    print("fine_tuned_model_id",fine_tuned_model_id)
    test_df['Prediction'] = None

    for index, row in test_df.iterrows():
        test_message = format_test(row)
        prediction_result = predict(test_message, fine_tuned_model_id)
        test_df.at[index, 'Prediction'] = prediction_result

    test_df.to_csv("predictions.csv")
```

```python
[24] test_df = pd.read_csv("/content/test_queries.csv")
     store_predictions(test_df, fine_tuned_model_id)
```

```
fine_tuned_model_id ft:gpt-3.5-turbo-0125:personal:yt-tutorial:9d9sERCU
```

Implementasi Fine Tuning (2)

Fine-Tuning GPT-3.5 pada Bank Support Train

- Hasil dari Fine-Tuning

predictions.csv

1 to 10 of 20 entries Filter

	Support Query	Top Category	Sub Category	Prediction
0	How do I update my new phone number in bank records?	Account Management	Account Maintenance	{"Top Category": "Account Management", "Sub Category": "Account Maintenance"}
1	I want to add a nominee to my account. What's the process?	Account Management	Account Maintenance	{"Top Category": "Account Management", "Sub Category": "Account Opening"}
2	How can I close my current account?	Account Management	Account Maintenance	{"Top Category": "Account Management", "Sub Category": "Account Closure"}
3	What types of accounts can I open as a student?	Account Management	Account Opening	{"Top Category": "Account Management", "Sub Category": "Account Opening"}
4	I want to update my email address linked to my account.	Account Management	Account Maintenance	{"Top Category": "Account Management", "Sub Category": "Account Maintenance"}
5	How to get a mini statement for my checking account?	Account Management	Account Information	{"Top Category": "Account Management", "Sub Category": "Account Information"}
6	I want to know the status of my recent wire transfer.	Transaction Services	Transaction Inquiry	{"Top Category": "Payments and Transfers", "Sub Category": "Wire Transfers"}
7	My transaction failed but the amount was deducted. What should I do?	Transaction Services	Failed Transactions	{"Top Category": "Payments and Transfers", "Sub Category": "Transaction Disputes"}
8	I noticed an unauthorized transaction on my account.	Transaction Services	Transaction Disputes	{"Top Category": "Transaction Services", "Sub Category": "Transaction Disputes"}
9	How can I get a history of all my transactions for the past year?	Transaction Services	Transaction Inquiry	{"Top Category": "Transaction Services", "Sub Category": "Transaction Inquiry"}

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1 2

Implementasi Fine Tuning (3)

Fine-Tuning GPT-3.5 pada Rekomendasi Aksi Sensor

Link Colab

- Mendapatkan dataset mengenai aksi sensor yang terdiri dari 37 kolom dan 1075 data yang akan diproses untuk mendapatkan rekomendasi menggunakan prompt.

	platform_	device_id	latest_da	today_tot	today_av	yesterday	yesterday	weekly_to	weekly_a	previousl	previousl	monthly_	monthly_	previousl	previousl	quarter_t	quarter_a	previousl	previousl	yearly_to	yearly_av	previousl	previousl	median_r	dod	wow	mom	qoq	yoy	percent_	percent_	curret_us	today_usi	monthly_	monthly_	today_up
2	6bbc020f	46340dec	########	00.00	00.00	########	0.074410	########	0.10747490347490352			########	0.179207	########	0.016450	########	0.11227632319819811			########	0.11227632319819811			########	-100.0			########			########	0.580645	########	17.00	########	########	update
3	bf58d184	44fdcdca	NaT																												0.5806451612903226					update
4	efd96d75	b6d3aca7	NaT																												0.5806451612903226					update
5	13a991f5	7a35805t	NaT																												0.5806451612903226					update
6	13a991f5	acb77a5e	NaT																												0.5806451612903226					update
7	13a991f5	be8ebb67	NaT																												0.5806451612903226					update
8	13a991f5	494dce0(	NaT																												0.5806451612903226					update
9	13a991f5	b417859:	NaT																												0.5806451612903226					update
10	13a991f5	7b64d18a	NaT																												0.5806451612903226					update
11	13a991f5	5a5c3202	NaT																												0.5806451612903226					update
12	efd96d75	12bf8d2f-	NaT																												0.5806451612903226					update
13	13a991f5	156ba308	NaT																												0.5806451612903226					update

Prompt :

Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph.

Implementasi Fine Tuning (3)

Fine-Tuning GPT-3.5 pada Rekomendasi Aksi Sensor

- Membersihkan data dan memilih data yang akan digunakan dalam membuat rekomendasi dari fine-tuning openai sebagai uji coba

	User_input	Prompt
2	today_total_usage: 164.39, dod: -89, wow: -29.08, mom: 3.18, qoq: 0, yoy: 0, current_usage_pattern: 0.3, today_usage_anomaly: true, today_update_anomaly: updated	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph.
3	today_total_usage: 0.0, dod: -100.0, wow: nan, mom: 1064.35, qoq: nan, yoy: nan, current_usage_pattern: 1.94, today_usage_anomaly: True, today_update_anomaly: update'	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph.
4	today_total_usage: nan, dod: nan, wow: nan, mom: nan, qoq: nan, yoy: nan, current_usage_pattern: nan, today_usage_anomaly: False, today_update_anomaly: update	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph.
5	today_total_usage: 38768900000000000.0, dod: 1.0, wow: nan, mom: 23578768333057100.0, qoq: nan, yoy: nan, current_usage_pattern: 14691943127962000.0, today_usage_anomaly: True, t	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph.
6	today_total_usage: 0.0, dod: -100.0, wow: nan, mom: 1064.3473386291862, qoq: nan, yoy: nan, current_usage_pattern: 1.9386497181831812, today_usage_anomaly: True, today_update_anom	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph.
7	today_total_usage: 387.68900000000014, dod: 17.931800206850518, wow: nan, mom: 23.5787683330572, qoq: nan, yoy: nan, current_usage_pattern: 1.4691943127962086, today_usage_and	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph.

- Membuat data tersebut dalam bentuk format jsonl

```
{"messages": [{"role": "user", "content": "today_total_usage: 164.39, dod: -89, wow: -29.08, mom: 3.18, qoq: 0,
yoy: 0, current_usage_pattern: 0.3, today_usage_anomaly: true, today_update_anomaly: updated"},
{"role": "assistant", "content": "Offer a direct and professional recommendation based on the provided data. (
Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph."}]}
```

- **Role User :** sebagai penyedia data atau input yang berisi informasi tentang penggunaan energi harian, anomali yang terdeteksi, dan beberapa perbandingan penggunaan dari waktu ke waktu.
- **Role Assistant :** prompt atau permintaan yang memberikan instruksi kepada asisten tentang bagaimana merespons data yang disediakan oleh user.

Implementasi Fine Tuning (3)

Fine-Tuning GPT-3.5 pada Rekomendasi Aksi Sensor

- Upload Dataset dan membuat Fine-Tuning Model lalu memonitoring status berhasil/gagal

```
[ ]  from pathlib import Path

     # Upload file untuk fine-tuning
     response = client.files.create(
         file=Path("/content/cleaned_chat_format_dataset.jsonl"),
         purpose="fine-tune"
     )

     # Mendapatkan file ID untuk digunakan dalam proses fine-tuning
     file_id = response.id
     print("Training File ID:", file_id)
```

```
Training File ID: file-UEKEDNnPGRAP7H4jQdVBBbmU
```

```
[ ]  # Memulai fine-tuning
     fine_tune_job = client.fine_tuning.jobs.create(
         model="gpt-3.5-turbo",
         training_file="file-UEKEDNnPGRAP7H4jQdVBBbmU"  # Gunakan file_id dalam tanda kutip
     )

     # Mendapatkan ID fine-tuning job
     print(f"Fine-tuning Job ID: {fine_tune_job.id}")
```

```
Fine-tuning Job ID: ftjob-rfs6VgjschbB1vjHP3jaJq8t
```

```
[ ]  # Melihat daftar fine-tuning jobs yang sedang berlangsung
     all_jobs = client.fine_tuning.jobs.list()

     for job in all_jobs:
         print(f"Job ID: {job.id}, Status: {job.status}")
```

```
Job ID: ftjob-rfs6VgjschbB1vjHP3jaJq8t, Status: succeeded
Job ID: ftjob-5918TIdY1IgMq9X1VBeNJ1IF, Status: failed
Job ID: ftjob-hzpur1UtDYO2J9X8kiBCQwuR, Status: failed
Job ID: ftjob-hsXadnRBriKroToLtLLRhmBP, Status: succeeded
Job ID: ftjob-WfwoExJLjTOkt0UIexbt32Rm, Status: succeeded
Job ID: ftjob-UoFSlPTA8DYfZulEnIFR2GfT, Status: succeeded
Job ID: ftjob-zUGMrlI36s5L07a9cPrL0wzn, Status: failed
Job ID: ftjob-PjPfXdSJtJgBdz4tGAH7pYYu, Status: failed
Job ID: ftjob-Osa0UQmTV7ZHdxOtLi7AeFOD, Status: failed
Job ID: ftjob-VIAm8jJngd3EtJv1tAiYaMr0, Status: failed
Job ID: ftjob-ZBiZM6fkPDcXj0uHAuXm7jqJ, Status: failed
Job ID: ftjob-Kurup1wkfA52SFguCiAzkkp1, Status: failed
Job ID: ftjob-N4g0MJ2nhE4tQfQI5lnjMoxC, Status: failed
Job ID: ftjob-W5IEPPUE7mJmcMXvnT9mJXaK, Status: failed
Job ID: ftjob-MdZMCfVMe7TB7nGfbdIXKmot, Status: failed
Job ID: ftjob-HPsvGbm17EMaNq3moeAwIV4u, Status: failed
Job ID: ftjob-y1B0XZGIY6OjpV7BVpMnXx9i, Status: failed
Job ID: ftjob-QysurnRAoK2v7fQ9VnUq8ruc, Status: failed
Job ID: ftjob-IQ1wRlJQ2ax6Ao8n7XOtEqw3, Status: succeeded
Job ID: ftjob-B8ho5ldUmDIO9PP9Cli8wlQG, Status: succeeded
Job ID: ftjob-cant6VW3Dl9Xeo2kfAohkPER, Status: succeeded
Job ID: ftjob-z5nQeKcBFhke9B9v7s30M1NS, Status: succeeded
Job ID: ftjob-tR4bTKJEQfvDN8XWov0bQk0h, Status: succeeded
Job ID: ftjob-tF0gXPP2xoOfHLAIrUBJL48B, Status: succeeded
Job ID: ftjob-Acn4TRlQp13O5jARDxtXCpar, Status: succeeded
Job ID: ftjob-ydO2LPutqXBUx1vQWX68yhNl, Status: succeeded
Job ID: ftjob-52TP4FpLpwhSm6MkxsZSoKkc, Status: succeeded
Job ID: ftjob-ehxZxVFETWoYbIqorDq371g8, Status: succeeded
```

Implementasi Fine Tuning (3)

Fine-Tuning GPT-3.5 pada Rekomendasi Aksi Sensor

- Penggunaan Model yang Sudah Di-fine-Tune

```
[ ] # Menggunakan model yang sudah di-fine-tune
    completion = client.chat.completions.create(
        model="ft:gpt-3.5-turbo-0125:personal::A96V2Mbe",  # Ganti dengan ID model fine-tuned Anda
        messages=[
            {
                "role": "user",  # Bagian data sensor dari user
                "content": "today_total_usage: 164.39, dod: -89, wow: -29.08, mom: 3.18, qoq: 0, yoy: 0, current_usage_pattern: 0.3, today_usage_anomaly: true, today_update_anomaly: updated."
            },
            {
                "role": "system",  # Instruksi untuk model
                "content": "Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 2 sentences and short 1 paragraph."
            }
        ],
        max_tokens=100
    )

    # Menampilkan hasil prediksi
    print(completion.choices[0].message.content)
```

```
I recommend investigating the significant DoD and WoW drops to mitigate potential risks promptly. With a steady MoM increase and an active anomaly and update, maintain a vigilant monitoring approach to ensure continued growth and stability in the usage pattern.
```

Implementasi Fine Tuning (3)

Fine-Tuning GPT-3.5 pada Rekomendasi Aksi Sensor

- Pengolahan Hasil Prediksi

```
# Loop untuk melakukan prediksi pada setiap baris dataset testing
for entry in testing_data:
    # Mengambil pesan role "user" dan "system" dari file
    user_content = entry['messages'][0]['content']

    # Mencari jika ada pesan untuk role "system"
    system_content = None
    for message in entry['messages']:
        if message['role'] == 'system':
            system_content = message['content']

    # Jika tidak ada konten "system", gunakan pesan default
    if not system_content:
        system_content = "Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph"

    # Membuat prediksi dengan model fine-tuned
    completion = client.chat.completions.create(
        model="ft:gpt-3.5-turbo-0125:personal::A96V2Mbe",  # Ganti dengan ID model fine-tuned Anda
        messages=[
            {
                "role": "user",
                "content": user_content  # Mengambil data user dari file JSONL
            },
            {
                "role": "system",
                "content": system_content  # Mengambil data system dari file JSONL, atau default jika tidak ada
            }
        ],
        max_tokens=100
    )

    # Menyimpan input dan output
    result = {
        "input_data": user_content,
        "system_content": system_content,
        "model_output": completion.choices[0].message.content
    }

    results.append(result)
```

Implementasi Fine Tuning (3)

Fine-Tuning GPT-3.5 pada Rekomendasi Aksi Sensor

- Hasil Prediksi

input_data	system_content
today_total_usage: 164.39, dod: -89, wow: -29.08, mom: 3.18, qoq: 0, yoy: 0, current_usage_pattern: 0.3, today_usage_anomaly: true, today_update_anomaly: updated	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph
today_total_usage: 0.0, dod: -100.0, wow: nan, mom: 1084.35, qoq: nan, yoy: nan, current_usage_pattern: 1.94, today_usage_anomaly: True, today_update_anomaly: update'	Offer a direct and professional recommendation based on the provided data. Craft the output as a concise suggestion, maintaining an expert tone with a maximum of 3 sentences and short 1 paragraph

model_output
Based on the data, I recommend further analysis of the anomalous total usage decrease of 89 from the previous day, especially with a notable 29.08 drop compared to last week. Maintain a close watch on the current usage pattern at 0.3 and the updated anomaly to leverage these insights effectively for decision-making and operational improvements.
I recommend conducting a thorough review to validate the anomalous "today_total_usage" at 0.0 and the negative "dod" of -100.0, ensuring data accuracy. Additionally, consider updating the "today_update_anomaly" with a more detailed 'update' description for precise monitoring and effective decision-making based on the provided "current_usage_pattern" and "today_usage_anomaly" data.

Kesimpulan

Fine-tuning adalah metode efektif untuk menyesuaikan model pembelajaran mesin agar lebih akurat dan relevan dalam tugas atau domain spesifik. Dengan dataset yang tepat dan proses iteratif, fine-tuning menjadikan model umum lebih spesifik dan sesuai dengan kebutuhan kasus penggunaan tertentu.