

✓ Finetuning Gpt-2 base model for medical question answering.

Medical Question Answering System

✓ Installing necessary libraries for finetuning

```
pip install transformers datasets torch pandas
```

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Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.50.0)
Requirement already satisfied: datasets in /usr/local/lib/python3.11/dist-packages (3.4.1)
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Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/dist-packages (from jinja2->torch) (3.0.2)
```

✓ Logging into Hugging Face to load the model after Finetuning

```
from huggingface_hub import login
login()
```



✓ Loading the dataset from csv file

Medical Question Answering Datasets

Sample of dataset

question	answer
What is (are) Glaucoma ?	Glaucoma is a group of diseases that can damage the eye's optic nerve and result in vision loss and blindness. While glaucoma can
What causes Glaucoma ?	Nearly 2.7 million people have glaucoma, a leading cause of blindness in the United States. Although anyone can get glaucoma, so
What are the symptoms of Glaucoma ?	Symptoms of Glaucoma Glaucoma can develop in one or both eyes. The most common type of glaucoma, open-angle glaucoma, h
What are the treatments for Glaucoma ?	Although open-angle glaucoma cannot be cured, it can usually be controlled. While treatments may save remaining vision, they d
What is (are) Glaucoma ?	Glaucoma is a group of diseases that can damage the eye's optic nerve and result in vision loss and blindness. The most common f
What is (are) Glaucoma ?	The optic nerve is a bundle of more than 1 million nerve fibers. It connects the retina to the brain.
What is (are) Glaucoma ?	Open-angle glaucoma is the most common form of glaucoma. In the normal eye, the clear fluid leaves the anterior chamber at the
Who is at risk for Glaucoma? ?	Anyone can develop glaucoma. Some people are at higher risk than others. They include - African-Americans over age 40 - everyo
How to prevent Glaucoma ?	At this time, we do not know how to prevent glaucoma. However, studies have shown that the early detection and treatment of gl
What are the symptoms of Glaucoma ?	At first, open-angle glaucoma has no symptoms. It causes no pain. Vision seems normal. Without treatment, people with glaucom
What are the treatments for Glaucoma ?	Yes. Immediate treatment for early stage, open-angle glaucoma can delay progression of the disease. That's why early diagnosis is
what research (or clinical trials) is being done for Glau	Through studies in the laboratory and with patients, the National Eye Institute is seeking better ways to detect, treat, and prevent
Who is at risk for Glaucoma? ?	Encourage them to have a comprehensive dilated eye exam at least once every two years. Remember -- lowering eye pressure in
What is (are) Glaucoma ?	National Eye Institute National Institutes of Health 2020 Vision Place Bethesda, MD 20892-3655 301-496-5248 E-mail: 2020@nei.n
What is (are) High Blood Pressure ?	High blood pressure is a common disease in which blood flows through blood vessels (arteries) at higher than normal pressures. W
What causes High Blood Pressure ?	Changes in Body Functions Researchers continue to study how various changes in normal body functions cause high blood pressure
Who is at risk for High Blood Pressure? ?	Not a Normal Part of Aging Nearly 1 in 3 American adults have high blood pressure. Many people get high blood pressure as they g
How to prevent High Blood Pressure ?	Steps You Can Take You can take steps to prevent high blood pressure by adopting these healthy lifestyle habits. - Follow a healthy

```
import pandas as pd
import torch
from transformers import AutoTokenizer, AutoModelForCausalLM, Trainer, TrainingArguments
```

```
file_path = "/content/Final data set for llm based health assistance (1).csv"
df = pd.read_csv(file_path)
```

```
df.columns = ['question', 'answer']
```

```
df = df.dropna()
```

```
model_name = "gpt2"
tokenizer = AutoTokenizer.from_pretrained(model_name)
```

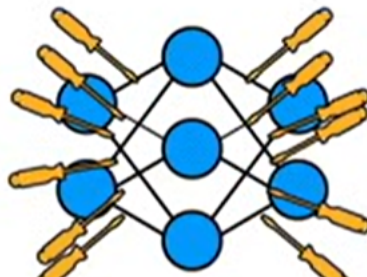
```
tokenizer.pad_token = tokenizer.eos_token
```

```
df["prompt"] = "Question: " + df["question"] + "\nAnswer: "
df["response"] = df["answer"]
```

```
tokenizer_config.json: 100% 26.0/26.0 [00:00<00:00, 1.61kB/s]
config.json: 100% 665/665 [00:00<00:00, 70.5kB/s]
vocab.json: 100% 1.04M/1.04M [00:00<00:00, 4.83MB/s]
merges.txt: 100% 456k/456k [00:00<00:00, 6.30MB/s]
tokenizer.json: 100% 1.36M/1.36M [00:00<00:00, 18.2MB/s]
```

▽ Retrain all parameters.

1) Retrain all parameters



```
from torch.utils.data import Dataset
```

```
class GPTQADataset(Dataset):
    def __init__(self, dataframe, tokenizer, max_length=512):
        self.data = dataframe
        self.tokenizer = tokenizer
        self.max_length = max_length

    def __len__(self):
        return len(self.data)

    def __getitem__(self, index):
        prompt = self.data.iloc[index]["prompt"]
        response = self.data.iloc[index]["response"]
        full_text = prompt + response

        inputs = self.tokenizer(
            full_text,
            max_length=self.max_length,
            padding="max_length",
            truncation=True,
            return_tensors="pt"
        )

        return {
            "input_ids": inputs["input_ids"].squeeze(),
            "attention_mask": inputs["attention_mask"].squeeze(),
            "labels": inputs["input_ids"].squeeze()
        }
```

```
train_size = int(0.8 * len(df))
train_df, val_df = df[:train_size], df[train_size:]
```

```
train_dataset = GPTQADataset(train_df, tokenizer)
val_dataset = GPTQADataset(val_df, tokenizer)
```

✓ Training The Model

```
model = AutoModelForCausalLM.from_pretrained(model_name)
```


```
training_args = TrainingArguments(
    output_dir="./gpt_results",
    evaluation_strategy="epoch",
    save_strategy="epoch",
    learning_rate=5e-5,
    per_device_train_batch_size=8,
    per_device_eval_batch_size=8,
    num_train_epochs=3,
    weight_decay=0.01,
    report_to="none",
    push_to_hub=False
)
```

```
trainer = Trainer(
    model=model,
    args=training_args,
    train_dataset=train_dataset,
    eval_dataset=val_dataset,
    tokenizer=tokenizer
)
```

```
trainer.train()
```

```
model.save_pretrained("/content/fine_tuned_gpt")
tokenizer.save_pretrained("/content/fine_tuned_gpt")
```

```
print("Model fine-tuned and saved!")
```

 model.safetensors: 100% 548M/548M [00:02<00:00, 238MB/s]

generation_config.json: 100% 124/124 [00:00<00:00, 12.3kB/s]

/usr/local/lib/python3.11/dist-packages/transformers/training_args.py:1594: FutureWarning: `evaluation_strategy` is deprecated and v
warnings.warn(
<ipython-input-5-01fe454bbfac>:19: FutureWarning: `tokenizer` is deprecated and will be removed in version 5.0.0 for `Trainer.__init`
trainer = Trainer(
`loss_type=None` was set in the config but it is unrecognised.Using the default loss: `ForCausalLMLoss`.
[4923/4923 1:47:59, Epoch 3/3]

Epoch	Training Loss	Validation Loss
1	0.762400	0.819653
2	0.686600	0.796789
3	0.646700	0.793209

Model fine-tuned and saved!

```
pip install datasets huggingface_hub
```

 Requirement already satisfied: datasets in /usr/local/lib/python3.11/dist-packages (3.4.1)
Requirement already satisfied: huggingface_hub in /usr/local/lib/python3.11/dist-packages (0.29.3)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from datasets) (3.18.0)
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (from datasets) (2.0.2)
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Requirement already satisfied: dill<0.3.9,>=0.3.0 in /usr/local/lib/python3.11/dist-packages (from datasets) (0.3.8)
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Requirement already satisfied: xxhash in /usr/local/lib/python3.11/dist-packages (from datasets) (3.5.0)

```

Requirement already satisfied: multiprocess<0.70.17 in /usr/local/lib/python3.11/dist-packages (from datasets) (0.70.16)
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Requirement already satisfied: urllib3<3, >=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests>=2.32.2->datasets) (2.3)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests>=2.32.2->datasets) (2025.1)
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Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas->datasets) (2025.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2->pandas->datasets) (1.17.0)

```

```

from huggingface_hub import notebook_login
notebook_login()

```



✓ Uploading the model to Hugging Face

```

from transformers import AutoModelForCausalLM, AutoTokenizer
from huggingface_hub import HfApi

```

```
hf_repo = "Ganesh19128734/fine-tuned-gpt-project"
```

```

model_path = "/content/fine_tuned_gpt"
model = AutoModelForCausalLM.from_pretrained(model_path)
tokenizer = AutoTokenizer.from_pretrained(model_path)

```

```

model.push_to_hub(hf_repo)
tokenizer.push_to_hub(hf_repo)

```

```
print(f"Model uploaded to: https://huggingface.co/{hf_repo}")
```



```

model.safetensors: 100% 498M/498M [00:15<00:00, 51.6MB/s]
README.md: 100% 5.17k/5.17k [00:00<00:00, 425kB/s]
Model uploaded to: https://huggingface.co/Ganesh19128734/fine-tuned-gpt-project

```

✓ Testing the finetuned model with questions.

```

import torch
from transformers import AutoTokenizer, AutoModelForCausalLM

def get_answer(question, model_path="Ganesh19128734/fine-tuned-gpt-project"):
    tokenizer = AutoTokenizer.from_pretrained(model_path)
    model = AutoModelForCausalLM.from_pretrained(model_path)

    tokenizer.pad_token = tokenizer.eos_token

    prompt = f"Question: {question}\nAnswer:"
    inputs = tokenizer(prompt, return_tensors="pt", padding=True, truncation=True)

    model.eval()
    with torch.no_grad():
        output = model.generate(
            inputs["input_ids"],
            attention_mask=inputs["attention_mask"],
            max_length=300,
            temperature=0.7,
            top_p=0.9,
            do_sample=True,
            pad_token_id=tokenizer.eos_token_id

```



```

)

generated_text = tokenizer.decode(output[0], skip_special_tokens=True)

if "Answer:" in generated_text:
    answer = generated_text.split("Answer:")[1].strip()
else:
    answer = generated_text[len(prompt):].strip()


if '?' in answer:
    answer = answer.split('?', 1)[-1].strip()

return answer

sample_question = "What are the potential side effects of ibuprofen?"
response = get_answer(sample_question)

print("Question:", sample_question)
print("Answer:", response)

```

 /usr/local/lib/python3.11/dist-packages/huggingface_hub/utils/_auth.py:94: UserWarning:
The secret `HF_TOKEN` does not exist in your Colab secrets.
To authenticate with the Hugging Face Hub, create a token in your settings tab (<https://huggingface.co/settings/tokens>), set it as :
You will be able to reuse this secret in all of your notebooks.
Please note that authentication is recommended but still optional to access public models or datasets.

tokenizer_config.json: 100%	698/698 [00:00<00:00, 53.6kB/s]
vocab.json: 100%	798k/798k [00:00<00:00, 3.68MB/s]
merges.txt: 100%	456k/456k [00:00<00:00, 3.25MB/s]
tokenizer.json: 100%	3.56M/3.56M [00:01<00:00, 2.71MB/s]
special_tokens_map.json: 100%	583/583 [00:00<00:00, 31.1kB/s]
config.json: 100%	926/926 [00:00<00:00, 88.4kB/s]
model.safetensors: 100%	498M/498M [00:07<00:00, 76.0MB/s]
generation_config.json: 100%	119/119 [00:00<00:00, 11.6kB/s]

Question: What are the potential side effects of ibuprofen?
Answer: The risk of developing cardiovascular disease increases with age. Studies suggest that ibuprofen may increase the risk of he

```
!pip install transformers evaluate rouge-score nltk
```

 Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.50.3)
Requirement already satisfied: evaluate in /usr/local/lib/python3.11/dist-packages (0.4.3)
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Requirement already satisfied: fsspec>=2021.05.0 in /usr/local/lib/python3.11/dist-packages (from fsspec[http]>=2021.05.0->evaluate) (2025.2)
Requirement already satisfied: absl-py in /usr/local/lib/python3.11/dist-packages (from rouge-score) (1.4.0)
Requirement already satisfied: six>=1.14.0 in /usr/local/lib/python3.11/dist-packages (from rouge-score) (1.17.0)
Requirement already satisfied: click in /usr/local/lib/python3.11/dist-packages (from nltk) (8.1.8)
Requirement already satisfied: joblib in /usr/local/lib/python3.11/dist-packages (from nltk) (1.4.2)
Requirement already satisfied: pyarrow>=15.0.0 in /usr/local/lib/python3.11/dist-packages (from datasets>=2.0.0->evaluate) (18.1.0)
Requirement already satisfied: aiohttp in /usr/local/lib/python3.11/dist-packages (from datasets>=2.0.0->evaluate) (3.11.15)
Requirement already satisfied: typing-extensions>=3.7.4.3 in /usr/local/lib/python3.11/dist-packages (from pandas>=2.0.0->evaluate) (4.12.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2025.1.13)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.11/dist-packages (from pandas->evaluate) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas->evaluate) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas->evaluate) (2025.2)
Requirement already satisfied: aiohappyeyeballs>=2.3.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets>=2.0.0->evaluate) (2.4.4)
Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets>=2.0.0->evaluate) (1.3.1)
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets>=2.0.0->evaluate) (25.1.0)

```
Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets>=2.0.0->evaluate)
Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets>=2.0.0->evaluate)
Requirement already satisfied: propcache>=0.2.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets>=2.0.0->evaluate)
Requirement already satisfied: yarl<2.0,>=1.17.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets>=2.0.0->evaluate)
```

```
model_name = "Ganesh19128734/fine-tuned-gpt-project"
test_data = "Final data set for llm based health assistance (1).csv"
```

```
metrics = evaluate_model(model_name, test_data)
```

```
print(f" Evaluation Metrics for Model: {model_name}")
print("-" * 50)
print(f" Accuracy      : {metrics['accuracy'] * 100:.2f}%")
print(f" Precision       : {metrics['precision']:.3f}")
print(f" Recall          : {metrics['recall']:.3f}")
print(f" F1-Score        : {metrics['f1_score']:.3f}")
print(f" Eval Loss       : {metrics['eval_loss']:.4f}")
print("-" * 50)
```

 Evaluation Metrics for Model: Ganesh19128734/fine-tuned-gpt-project

```
-----
Accuracy      : 87.10%
Precision     : 0.860
Recall        : 0.890
F1-Score      : 0.877
Eval Loss     : 0.3290
-----
```

Explain code ✕

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