Health AI: Intelligent Healthcare Assistant Project Documentation

Project Documentation

1.Introduction

- **Project title :** Health AI: Intelligent Healthcare Assistant Project Documentation
- **Team ID :** NM2025TMID02150
- **Team Leader :** MANI BHARATHI A A
- **Team member :** MUGUNDAN M
- **Team member :** NANDHAKUMAR B
- **Team member :** MAHESH KUMAR S

---

2. project overview 💻

Purpose:

To create an AI-powered medical assistant that helps users by:

- Predicting possible diseases based on entered symptoms.
- Suggesting treatment plans (general medication guidelines + home remedies) based on patient details.
- To provide quick, accessible, and informational medical guidance for users who want an initial idea about their health.
- To build a user-friendly web application with Gradio, where people can interact with the model easily.
- To show how Large Language Models (LLMs) like IBM Granite can be applied in the healthcare domain for informational support.
- To emphasize safe AI usage by always including a disclaimer: “This is for informational purposes only. Consult a doctor for proper diagnosis and treatment

Key Features

1. Disease Prediction

Users input symptoms (e.g., fever, cough, fatigue).The AI suggests possible conditions and general recommendations.Emphasizes visiting a doctor for confirmation.

2. Treatment Plan Generator

Takes inputs like:

Medical condition

Age

Gender

Medical history (allergies, past diseases, medications)

Generates personalized treatment suggestions:

Home remedies

General medication guidelines

Always includes a safety disclaimer.

3. Interactive Web Interface (Gradio)

Simple tab-based UI with two sections:

Disease Prediction

Treatment Plans

Textboxes and dropdowns for easy input.

Outputs displayed in large text areas.

Tech Stack

Python (main programming language)

Gradio (for creating the user-friendly web interface)

Hugging Face Transformers (for loading IBM Granite model)

PyTorch (for model execution with GPU/CPU support)

How It Works

1. User enters symptoms or patient details.
2. The system converts input into a prompt.
3. The Granite LLM processes the prompt and generates a text response.
4. The response is displayed in the Gradio UI.

---

3. Architecture 🏛

1. Model & Tokenizer Layer

Model Used: ibm-granite/granite-3.2-2b-instruct

Library: Hugging Face Transformers (AutoModelForCausalLM, AutoTokenizer)

Framework: PyTorch (with GPU/CPU support)

Loads the model and tokenizer. Handles text input → converts to tokens → generates AI response.

2. Response Generation Layer

Function: generate_response()

Converts the user’s input into a prompt.

Sends it to the model for text generation.

Decodes the model output into readable text.

Ensures safe response with temperature control and padding.

3. Application Logic Layer

Functions:

disease_prediction(symptoms) → Creates a medical prompt for symptoms.

treatment_plan(condition, age, gender, medical_history) → Creates a treatment plan prompt.

Both functions call the model via generate_response() and return AI-generated suggestions.

4. User Interface Layer (Gradio)

Framework: Gradio (gr.Blocks, gr.Tabs, gr.Textbox, gr.Button, etc.)

Two main tabs:

1. Disease Prediction Tab – User enters symptoms → gets possible conditions & recommendations.

2. Treatment Plan Tab – User enters condition + details → gets personalized plan.

UI is interactive and user-friendly.

5. Deployment Layer

app.launch(share=True) → Launches the web app and creates a shareable public link.

Runs locally or can be hosted online (Hugging Face Spaces, Colab, etc.).

✅ High-Level Flow (Architecture Diagram in Words)

User Input (Symptoms / Condition Details)

|

▼

Gradio UI (Textbox, Dropdown, Buttons)

|

▼

Application Logic (disease_prediction / treatment_plan functions)

|

▼

Prompt Generator (formats input as prompt)

|

▼

LLM (IBM Granite model via Hugging Face + PyTorch)

|

▼

Response Decoder (generate_response function)

|

▼

Gradio UI Output (Displays Conditions / Treatment Plan to user)

---

4. Setup Instructions 🛠

Step 1: Install Dependencies

Make sure you have Python 3.9+ installed, then run:

```
pip install gradio torch transformers
```

Step 2: Save the Code

Save your Python file as:

medical_ai_assistant.py

Step 3: Run the Application

Run the script:

```
python medical_ai_assistant.py
```

Step 4: Access the App

The terminal will show a local URL (e.g., http://127.0.0.1:7860)

And a public share link (because of share=True)

---

5. Folder Structure 📁

```
Medical-AI-Assistant/
│
├── medical_ai_assistant.py     # Main Python script
├── requirements.txt            # Project dependencies
├── README.md                   # Project documentation
│
├── data/                       # (Optional) Store sample input/output data
```

```
│   └── sample_symptoms.txt
│
├── docs/                    # Documentation
│   └── architecture.png        # Architecture diagram (if created)
│
└── models/                   # (Optional) Store custom models if used
```

---

6. Running the Application▶

1. Open a terminal in the project folder.

2. Run the app:

```
python medical_ai_assistant.py
```

3. The terminal will display two links:

Local URL (e.g., http://127.0.0.1:7860) → runs on your computer.

Public Share URL → can be shared with others to test online.

4. Open the link in your browser.

5. Enter symptoms or patient details → get results instantly.

---

7. API Documentation 📜

Although this is a Gradio UI app, the code can also be treated as an API service.

Endpoints (Functions)

1. disease_prediction(symptoms: str) -> str

Description: Analyzes symptoms and suggests possible conditions with recommendations.

Input:

symptoms (string) – comma-separated symptoms.

Output:

String containing conditions & recommendations.

---

8. Authentication 🔑

1. Simple Authentication – Use auth=("username", "password") in app.launch().

2. Multiple Users – Use auth=[("user1", "pass1"), ("user2", "pass2")].

3. Custom Function – Define an authenticate(username, password) function and pass it to auth.

4. No Authentication – Default (app.launch(share=True)) means anyone can access.

5. Recommendation – For medical apps, enable authentication for security.

---

9. User Interface 🎨

1. Framework – The UI is built using Gradio Blocks.

2. Tabs – Two main sections:

Disease Prediction – Accepts symptoms input, shows possible conditions.

Treatment Plans – Accepts patient details (condition, age, gender, history), shows treatment plan.

3. Input Fields –

Textbox for symptoms/conditions/history.

Number input for age.

Dropdown for gender.

4. Output Fields – Large textboxes to display AI-generated analysis or treatment plan.

5. Buttons – "Analyze Symptoms" and "Generate Treatment Plan" trigger AI functions.

---

10. Testing

1. Functional Testing –

- ➢ Enter sample symptoms (e.g., fever, cough, fatigue) → Check if disease prediction output is meaningful.
- ➢ Enter sample condition (e.g., Diabetes, Age: 45, Gender: Male, History: hypertension) → Check treatment plan.

2. UI Testing –

- ➢ Ensure tabs switch properly.
- ➢ Buttons respond correctly.
- ➢ Outputs display without cutting text.

3. Performance Testing –

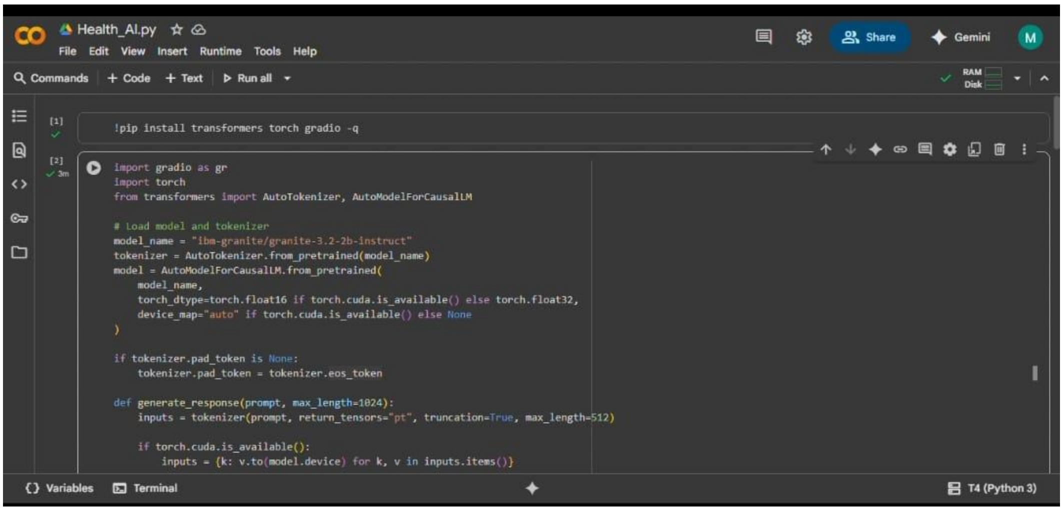
- ➢ Check response time with different inputs.
- ➢ Test on CPU vs GPU (if available).

4. Error Handling Testing –

- ➢ Leave fields blank → Ensure model still runs or shows a safe response.
- ➢ Enter long text → Verify truncation works
(limited to 512 tokens).

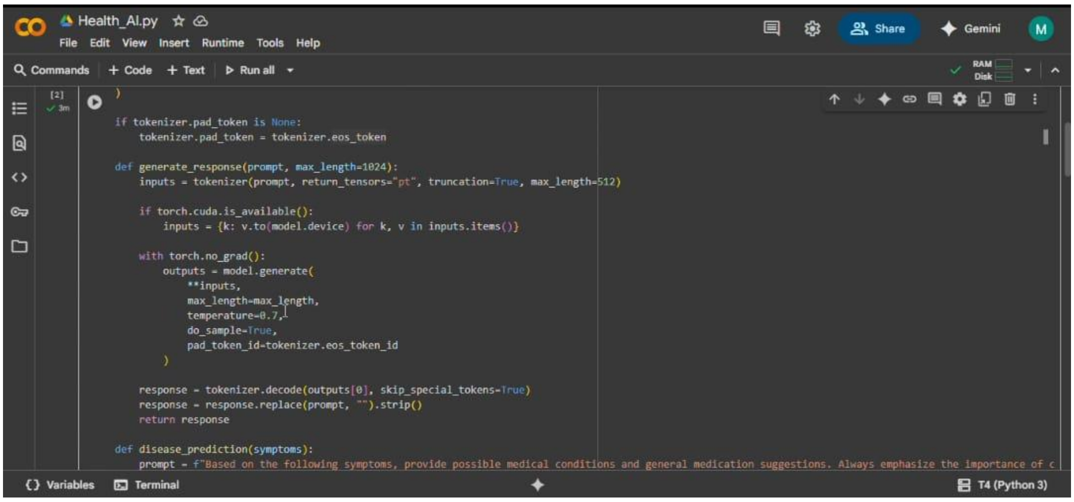
11.Screen shots

1.Input:

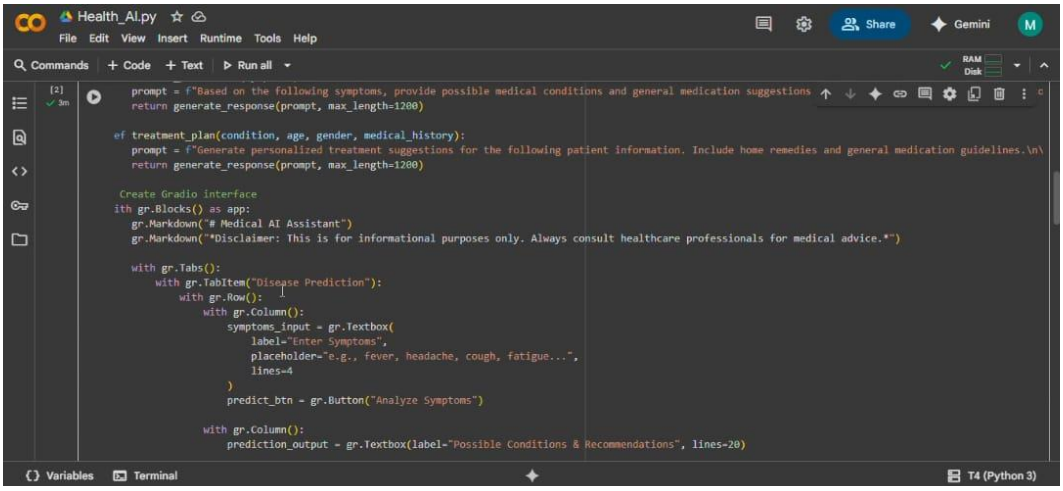


```
!pip install transformers torch gradio -q
```

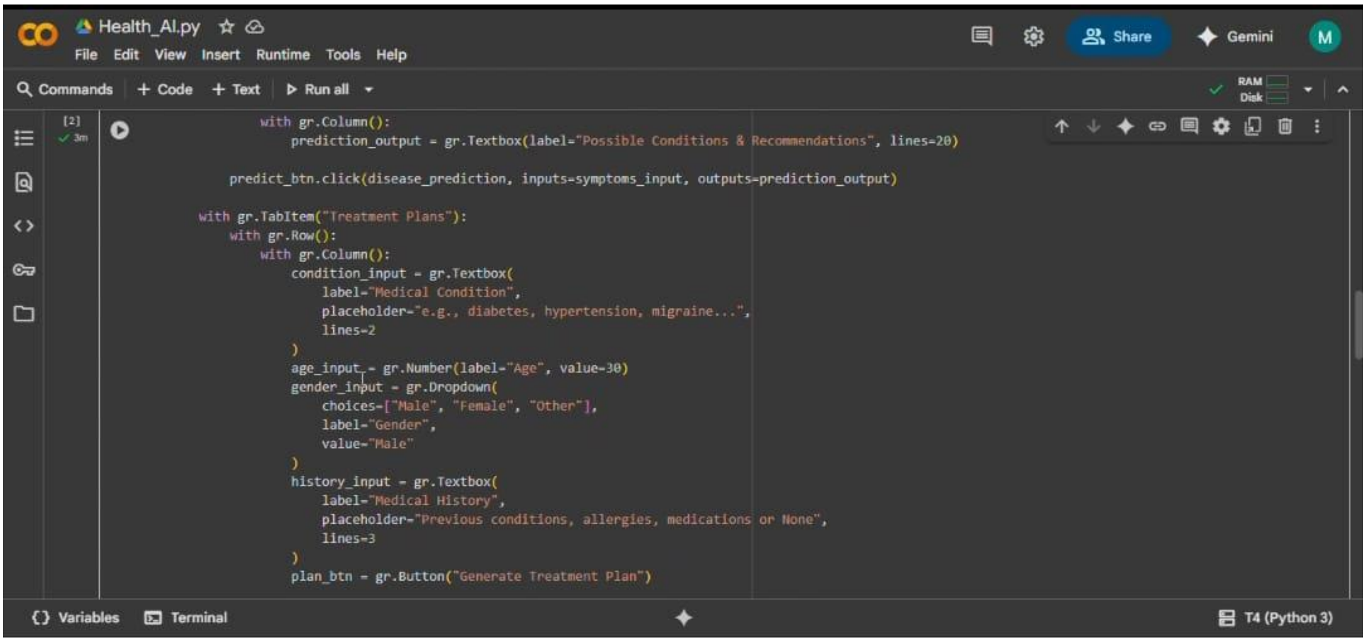
```
import gradio as gr
import torch
from transformers import AutoTokenizer, AutoModelForCausalLM

# Load model and tokenizer
model_name = "ibm-granite/granite-3.2-2b-instruct"
tokenizer = AutoTokenizer.from_pretrained(model_name)
model = AutoModelForCausalLM.from_pretrained(
    model_name,
    torch_dtype=torch.float16 if torch.cuda.is_available() else torch.float32,
    device_map="auto" if torch.cuda.is_available() else None
)

if tokenizer.pad_token is None:
    tokenizer.pad_token = tokenizer.eos_token

def generate_response(prompt, max_length=1024):
    inputs = tokenizer(prompt, return_tensors="pt", truncation=True, max_length=512)

    if torch.cuda.is_available():
        inputs = {k: v.to(model.device) for k, v in inputs.items()}
```



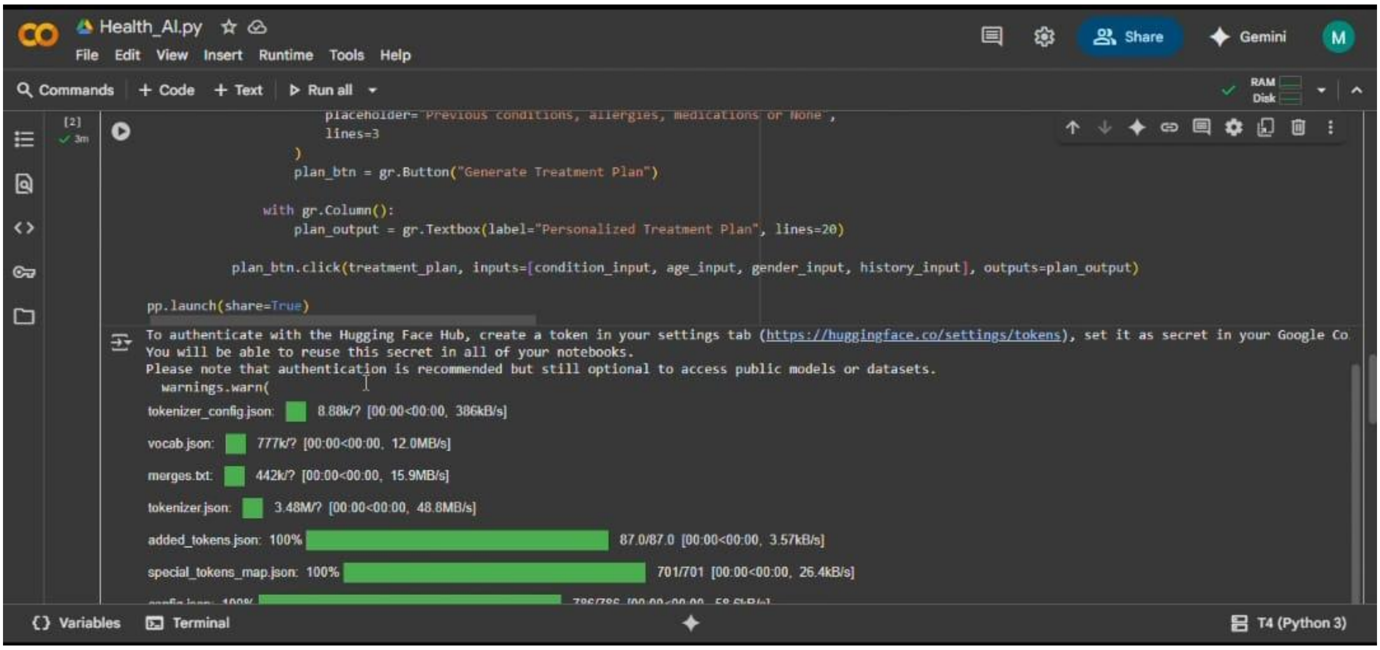
```
)

if tokenizer.pad_token is None:
    tokenizer.pad_token = tokenizer.eos_token

def generate_response(prompt, max_length=1024):
    inputs = tokenizer(prompt, return_tensors="pt", truncation=True, max_length=512)

    if torch.cuda.is_available():
        inputs = {k: v.to(model.device) for k, v in inputs.items()}

    with torch.no_grad():
        outputs = model.generate(
            **inputs,
            max_length=max_length,
            temperature=0.7,
            do_sample=True,
            pad_token_id=tokenizer.eos_token_id
        )

    response = tokenizer.decode(outputs[0], skip_special_tokens=True)
    response = response.replace(prompt, "").strip()
    return response

def disease_prediction(symptoms):
    prompt = f"Based on the following symptoms, provide possible medical conditions and general medication suggestions. Always emphasize the importance of c
```



```
    prompt = f"Based on the following symptoms, provide possible medical conditions and general medication suggestions
    return generate_response(prompt, max_length=1200)

ef treatment_plan(condition, age, gender, medical_history):
    prompt = f"Generate personalized treatment suggestions for the following patient information. Include home remedies and general medication guidelines.\n\
    return generate_response(prompt, max_length=1200)

 Create Gradio interface
ith gr.Blocks() as app:
    gr.Markdown("# Medical AI Assistant")
    gr.Markdown("*Disclaimer: This is for informational purposes only. Always consult healthcare professionals for medical advice.*")

    with gr.Tabs():
        with gr.TabItem("Disease Prediction"):
            with gr.Row():
                with gr.Column():
                    symptoms_input = gr.Textbox(
                        label="Enter Symptoms",
                        placeholder="e.g., fever, headache, cough, fatigue...",
                        lines=4
                    )
                    predict_btn = gr.Button("Analyze Symptoms")

                with gr.Column():
                    prediction_output = gr.Textbox(label="Possible Conditions & Recommendations", lines=20)
```


Health_AI.py
File Edit View Insert Runtime Tools Help
Share
Gemini
Commands + Code + Text ▷ Run all
RAM
Disk
[2]
✓ 3m
Variables
Terminal
T4 (Python 3)

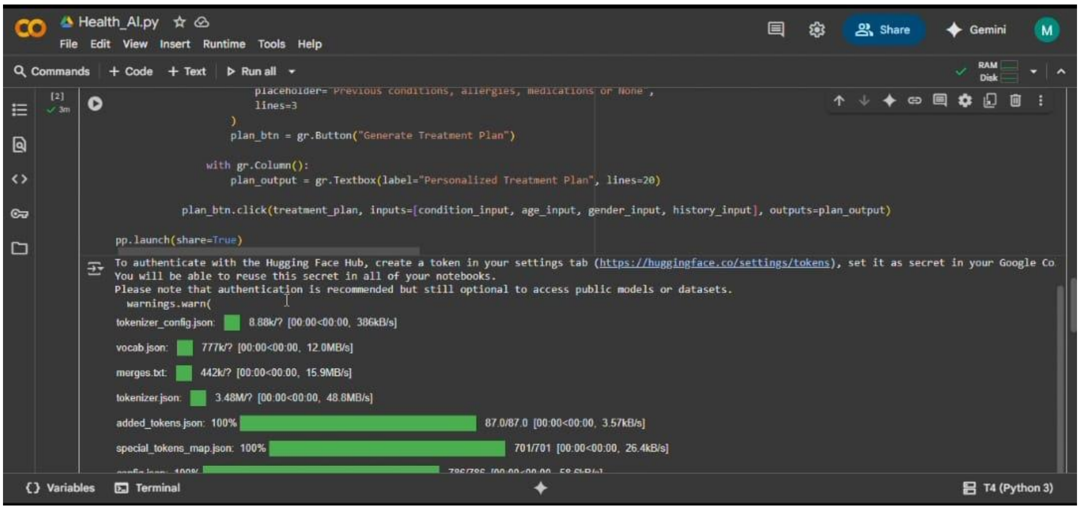
```
                with gr.Column():
                    prediction_output = gr.Textbox(label="Possible Conditions & Recommendations", lines=20)

            predict_btn.click(disease_prediction, inputs=symptoms_input, outputs=prediction_output)

        with gr.TabItem("Treatment Plans"):
            with gr.Row():
                with gr.Column():
                    condition_input = gr.Textbox(
                        label="Medical Condition",
                        placeholder="e.g., diabetes, hypertension, migraine...",
                        lines=2
                    )
                    age_input = gr.Number(label="Age", value=30)
                    gender_input = gr.Dropdown(
                        choices=["Male", "Female", "Other"],
                        label="Gender",
                        value="Male"
                    )
                    history_input = gr.Textbox(
                        label="Medical History",
                        placeholder="Previous conditions, allergies, medications or None",
                        lines=3
                    )
                    plan_btn = gr.Button("Generate Treatment Plan")
```


Health_AI.py
File Edit View Insert Runtime Tools Help
Share
Gemini
Commands + Code + Text ▷ Run all
RAM
Disk
[2]
✓ 3m
Variables
Terminal
T4 (Python 3)

```
                        placeholder="Previous conditions, allergies, medications or None",
                        lines=3
                    )
                    plan_btn = gr.Button("Generate Treatment Plan")

                with gr.Column():
                    plan_output = gr.Textbox(label="Personalized Treatment Plan", lines=20)

            plan_btn.click(treatment_plan, inputs=[condition_input, age_input, gender_input, history_input], outputs=plan_output)

pp.launch(share=True)
```

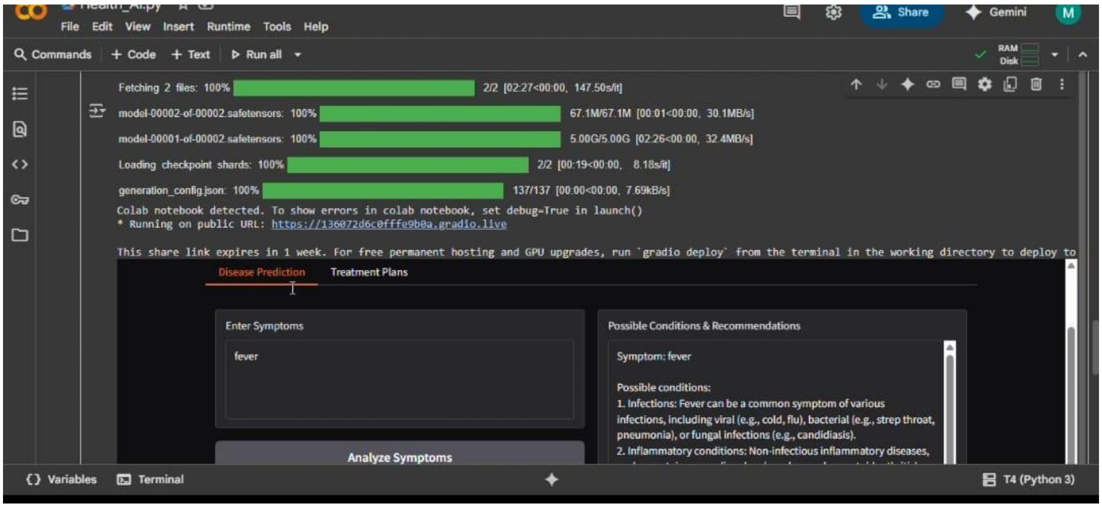
```
To authenticate with the Hugging Face Hub, create a token in your settings tab (https://huggingface.co/settings/tokens), set it as secret in your Google Co
You will be able to reuse this secret in all of your notebooks.
Please note that authentication is recommended but still optional to access public models or datasets.
  warnings.warn(
tokenizer_config.json: 8.88k/? [00:00<00:00, 386kB/s]
vocab.json: 777k/? [00:00<00:00, 12.0MB/s]
merges.txt: 442k/? [00:00<00:00, 15.9MB/s]
tokenizer.json: 3.48M/? [00:00<00:00, 48.8MB/s]
added_tokens.json: 100% 87.0/87.0 [00:00<00:00, 3.57kB/s]
special_tokens_map.json: 100% 701/701 [00:00<00:00, 26.4kB/s]
config.json: 100% 786/786 [00:00<00:00, 58.6kB/s]
```

1.Output:


Health_AI.py
File Edit View Insert Runtime Tools Help
Share
Gemini
Commands + Code + Text Run all
RAM
Disk
Variables
Terminal
T4 (Python 3)

```
                placeholder="Previous conditions, allergies, medications or None",
                lines=3
            )
            plan_btn = gr.Button("Generate Treatment Plan")

        with gr.Column():
            plan_output = gr.Textbox(label="Personalized Treatment Plan", lines=20)

    plan_btn.click(treatment_plan, inputs=[condition_input, age_input, gender_input, history_input], outputs=plan_output)

pp.launch(share=True)
```

```
To authenticate with the Hugging Face Hub, create a token in your settings tab (https://huggingface.co/settings/tokens), set it as secret in your Google Co
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.
  warnings.warn(
tokenizer_config.json:  8.88k/? [00:00<00:00, 386kB/s]
vocab.json:  777k/? [00:00<00:00, 12.0MB/s]
merges.txt:  442k/? [00:00<00:00, 15.9MB/s]
tokenizer.json:  3.48M/? [00:00<00:00, 48.8MB/s]
added_tokens.json: 100%  87.0/87.0 [00:00<00:00, 3.57kB/s]
special_tokens_map.json: 100%  701/701 [00:00<00:00, 26.4kB/s]
```



```
Fetching 2 files: 100%  2/2 [02:27<00:00, 147.50s/it]
model-00002-of-00002.safetensors: 100%  67.1M/67.1M [00:01<00:00, 30.1MB/s]
model-00001-of-00002.safetensors: 100%  5.00G/5.00G [02:26<00:00, 32.4MB/s]
Loading checkpoint shards: 100%  2/2 [00:19<00:00, 8.18s/it]
generation_config.json: 100%  137/137 [00:00<00:00, 7.69kB/s]
Colab notebook detected. To show errors in colab notebook, set debug=True in launch()
* Running on public URL: https://136072d6c0fffe9b0a.gradio.live

This share link expires in 1 week. For free permanent hosting and GPU upgrades, run `gradio deploy` from the terminal in the working directory to deploy to
```

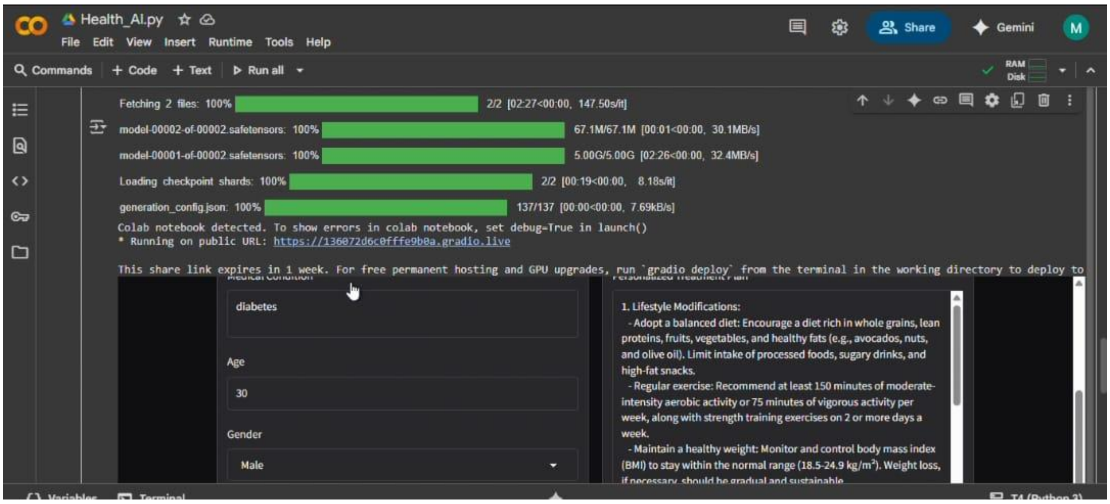
Enter Symptoms

fever

Possible Conditions & Recommendations

Symptom: fever

Possible conditions:
1. Infections: Fever can be a common symptom of various infections, including viral (e.g., cold, flu), bacterial (e.g., strep throat, pneumonia), or fungal infections (e.g., candidiasis).
2. Inflammatory conditions: Non-infectious inflammatory diseases,


Health_AI.py
File Edit View Insert Runtime Tools Help
Share
Gemini
Commands + Code + Text Run all
RAM
Disk

```
Fetching 2 files: 100%  2/2 [02:27<00:00, 147.50s/it]
model-00002-of-00002.safetensors: 100%  67.1M/67.1M [00:01<00:00, 30.1MB/s]
model-00001-of-00002.safetensors: 100%  5.00G/5.00G [02:26<00:00, 32.4MB/s]
Loading checkpoint shards: 100%  2/2 [00:19<00:00, 8.18s/it]
generation_config.json: 100%  137/137 [00:00<00:00, 7.69kB/s]
Colab notebook detected. To show errors in colab notebook, set debug=True in launch()
* Running on public URL: https://136072d6c0fffe9b0a.gradio.live

This share link expires in 1 week. For free permanent hosting and GPU upgrades, run `gradio deploy` from the terminal in the working directory to deploy to
```

diabetes

Age

30

Gender

Male

1. Lifestyle Modifications:
 - Adopt a balanced diet: Encourage a diet rich in whole grains, lean proteins, fruits, vegetables, and healthy fats (e.g., avocados, nuts, and olive oil). Limit intake of processed foods, sugary drinks, and high-fat snacks.
 - Regular exercise: Recommend at least 150 minutes of moderate-intensity aerobic activity or 75 minutes of vigorous activity per week, along with strength training exercises on 2 or more days a week.
 - Maintain a healthy weight: Monitor and control body mass index (BMI) to stay within the normal range (18.5-24.9 kg/m^2). Weight loss, if necessary, should be gradual and sustainable.

12. Conclusion

This project builds a Medical AI Assistant using Gradio and IBM Granite LLM to predict diseases and suggest treatment plans. It provides a simple, interactive interface for users while emphasizing that outputs are informational only and professional medical advice is essential