

HealthAI Project Documentation

1. Introduction

- Project Title: HealthAI: Intelligent Healthcare Assistant Using IBM Granite
- Team Members:
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2. Project Overview

- Purpose:

The purpose of HealthAI is to harness IBM Watson Machine Learning and Generative AI to provide intelligent healthcare assistance. The system delivers accurate medical insights, predicts diseases, recommends treatment plans, and visualizes patient health analytics. By leveraging IBM Granite-13B Instruct v2, the platform improves healthcare accessibility, empowers users to make informed decisions, and enhances the patient experience.

- Features:

Patient Chat

Key Point: Conversational healthcare guidance

Functionality: Provides natural language interaction for health-related questions with AI-generated responses.

Disease Prediction

Key Point: Symptom-based diagnosis

Functionality: Analyzes user symptoms and health data to suggest possible conditions with likelihoods and next steps.

Treatment Plans

Key Point: Personalized medical advice

Functionality: Generates tailored treatment recommendations including medications, lifestyle changes, and follow-up testing.

Health Analytics

Key Point: Data-driven insights

Functionality: Visualizes patient health metrics (vital signs, trends) and provides AI-generated insights.

Secure API Management

Key Point: Data safety

Functionality: Ensures responsible handling of healthcare data with API key protection.

3. Architecture

Frontend (Streamlit): Provides an interactive interface for chat, prediction, treatment, and analytics with intuitive dashboards and visualizations.

Backend (FastAPI): Manages requests, communicates with IBM Granite, and handles core healthcare functionalities.

LLM Integration (IBM Watsonx Granite): IBM Granite-13B Instruct v2 model processes natural language queries and generates medical insights.

Data Visualization (Plotly, Pandas): Displays patient metrics and trends in interactive graphs.

ML Modules: Support disease prediction and health analytics using patient-reported data.

4. Setup Instructions

Prerequisites:

- Python 3.9+
- pip & virtual environment
- IBM Watsonx API key
- Streamlit, Plotly, Pandas installed

Installation Process:

- Clone the repository
- Install dependencies from requirements.txt
- Configure credentials in .env file
- Run backend server (FastAPI)
- Launch frontend via Streamlit
- Upload health data and interact with modules

5. Folder Structure

app/ – FastAPI backend logic including chat, prediction, treatment, and analytics modules

ui/ – Streamlit frontend components for dashboards and health visualization

app.py – Entry script to run the main Streamlit interface

granite_llm.py – Handles IBM Granite model interactions

prediction_engine.py – Implements disease prediction logic

treatment_planner.py – Generates treatment recommendations

health_dashboard.py – Visualizes health data and insights

6. Running the Application

- Launch FastAPI server
- Run Streamlit dashboard
- Navigate via sidebar
- Input symptoms, request treatment plans, or view analytics
- Receive AI-generated responses in real-time

7. API Documentation

POST /chat/ask – Submit health-related queries

POST /disease/predict – Submit symptoms for disease prediction

POST /treatment/generate – Generate personalized treatment plan

GET /analytics/view – Retrieve health metrics and visualizations

POST /upload-data – Upload patient health data

8. Authentication

- Token-based authentication (JWT / API Keys)
- OAuth2 with IBM Cloud
- Role-based access (patient, doctor, researcher)
- Secure API credential handling via .env file

9. User Interface

- Sidebar navigation
- Chat interface for Patient Chat
- Symptom input and prediction display
- Treatment recommendation output
- Interactive health dashboard with visualizations

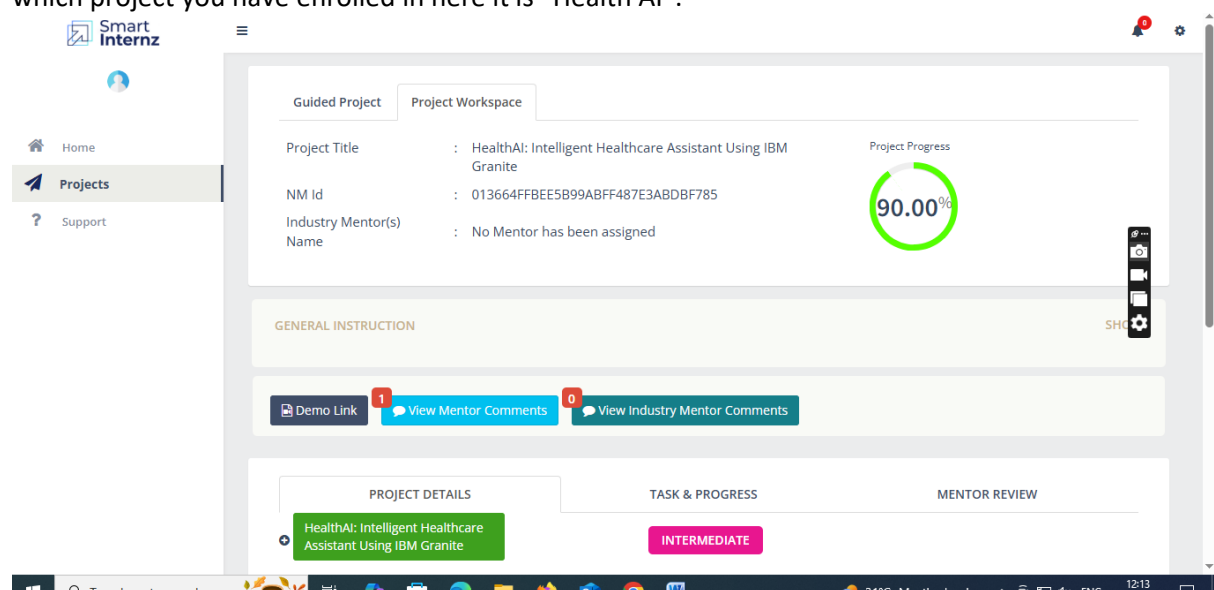
10. Testing

- Unit Testing: For AI prompting and data utilities
- API Testing: Swagger UI and Postman
- Manual Testing: For chat, prediction, and visualization consistency
- Edge Case Handling: Invalid inputs, missing symptoms, large datasets

11. Screenshot

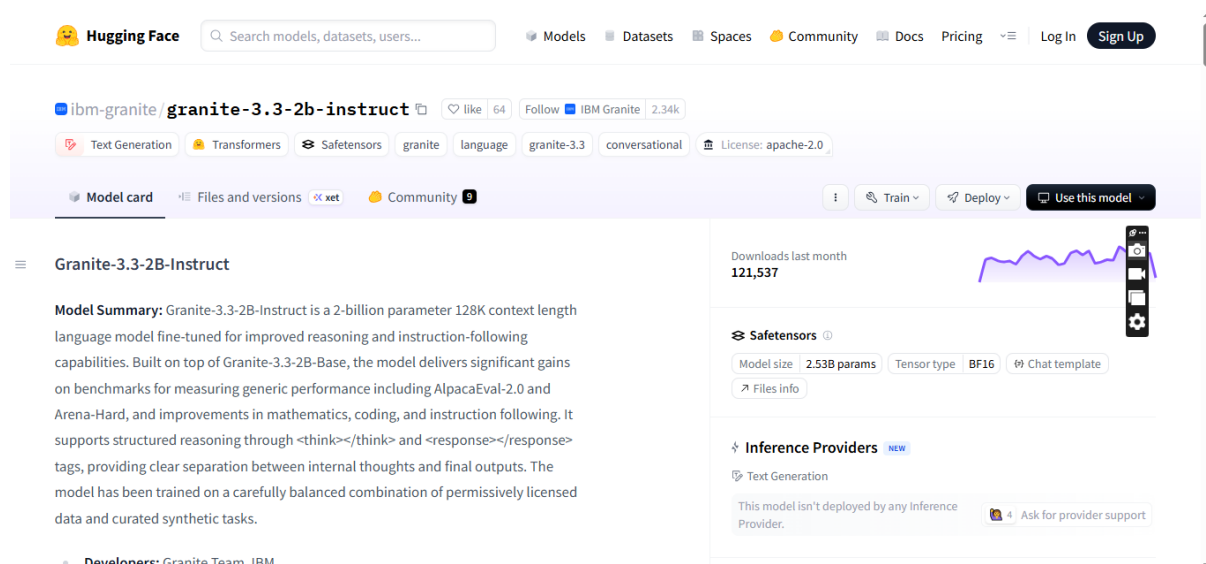
- Then Click (**Naanmudhalvan Smartinternz**) Then login with your details.

- Then you will be redirected to your account then click on “Projects” Section. There you can see which project you have enrolled in here it is “Health AI”.



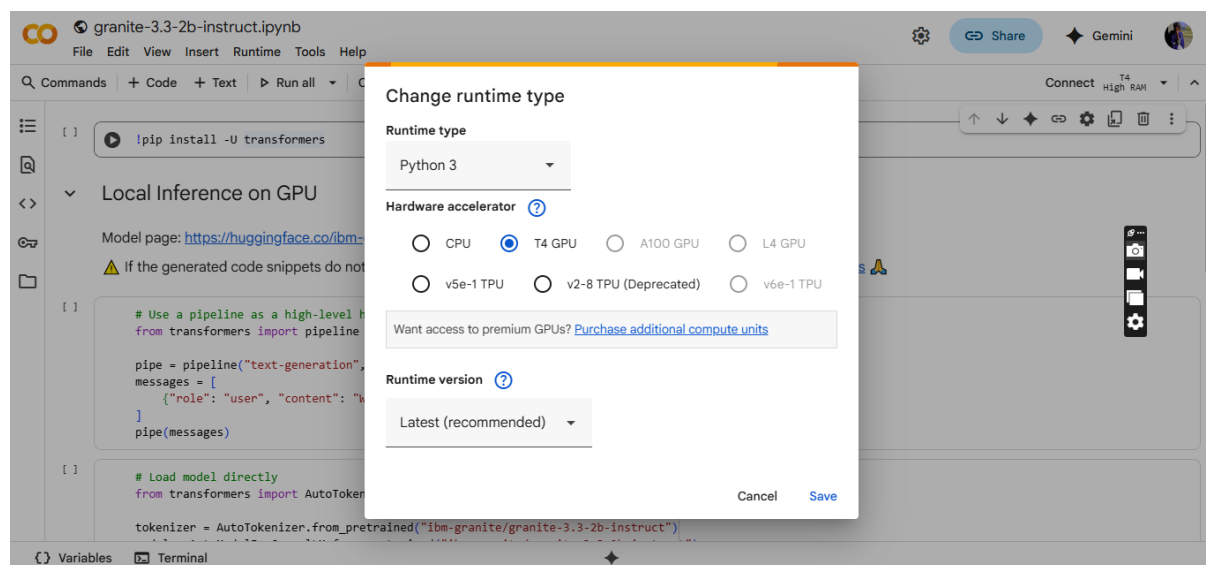
- Click on “Project Workspace”, there you can find your project progress and Place to upload “Demo link”.

IBM Granite model From Hugging Face.



- Then click (Hugging Face), then click on signup and create your own account in Hugging Face. Then search for “IBM-Granite models” and choose any model

- Here for this project we are using “granite-3.2-2b-instruct” which is compatible fast and light weight.



- Choose “T4 GPU” and click on “Save”

The screenshot shows a Jupyter Notebook titled "granite-3.3-2b-instruct.ipynb". The interface includes a top bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help" menus. Below the menu bar, there are tabs for "Commands", "Code", "Text", "Run all", and "Copy to Drive". The notebook content is as follows:

```
[ ] !pip install -U transformers
```

Local Inference on GPU

Model page: <https://huggingface.co/ibm-granite/granite-3.3-2b-instruct>

⚠ If the generated code snippets do not work, please open an issue on either the [model repo](#) and/or on [huggingface.js](#) 🙏

```
[ ] # Use a pipeline as a high-level helper
from transformers import pipeline

pipe = pipeline("text-generation", model="ibm-granite/granite-3.3-2b-instruct")
messages = [
    {"role": "user", "content": "Who are you?"},
]
pipe(messages)
```

```
[ ] # Load model directly
from transformers import AutoTokenizer, AutoModelForCausalLM

tokenizer = AutoTokenizer.from_pretrained("ibm-granite/granite-3.3-2b-instruct")
```

At the bottom, there are tabs for "Variables" and "Terminal".

- Then run the code in the next cell.
- You can View the Application is running in the other tab.

The screenshot shows the "Medical AI Assistant" web application. It features a "Disclaimer: This is for informational purposes only. Always consult healthcare professionals for medical advice." at the top. Below the disclaimer, there are two tabs: "Disease Prediction" (selected) and "Treatment Plans".

The "Disease Prediction" tab contains a form with the label "Enter Symptoms". The input field contains the text "heart pain, breast cancer,". Below the input field is a button labeled "Analyze Symptoms".

To the right of the input field is a section titled "Possible Conditions & Recommendations". It contains two numbered lists of conditions and recommendations:

1. Heart pain: This could indicate an acute coronary syndrome (ACS), such as unstable angina or acute myocardial infarction (heart attack). ACS requires immediate medical attention and treatment, which may include:
 - Aspirin (75-162 mg daily) for antiplatelet effects
 - Clopidogrel (75 mg daily) or a P2Y12 inhibitor for added platelet inhibition
 - Nitrates (sublingual, IV, or oral) for vasodilation and pain relief
 - Beta-blockers (e.g., metoprolol) for heart rate and blood pressure control
 - Statins (e.g., atorvastatin) to lower cholesterol levels and reduce plaque formation
 - Potential emergency procedures like percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) surgery
2. Breast cancer: This symptom is concerning as it's not typically associated with general heart pain. Breast cancer may present with:
 - Lump or mass in the breast
 - Changes in breast shape, size, or texture
 - Nipple discharge or retraction
 - Skin irritation or dimpling (tender "peau d'orange")
 - Swollen or tender axillary lymph nodes

Below the lists, there is a note: "If breast cancer is suspected, further diagnostic steps like mammography, ultrasound, MRI, or biopsy may be necessary. Treatment may include surgery, radiation therapy, hormone therapy, or chemotherapy." The text is partially cut off at the bottom.

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Disease Prediction

Treatment Plans

Medical Condition

heart pain

Age

20

Gender

Female

Medical History

Previous conditions, allergies, medications or None

Generate Treatment Plan

Personalized Treatment Plan

5. Regular Monitoring and Follow-up:

- Schedule regular check-ups with your cardiologist to monitor heart health and adjust treatments as needed.

- Track your symptoms and monitor any changes in your daily activities or overall well-being to share with your healthcare provider during appointments.

6. Lifestyle Changes:

- Quit smoking, if applicable, as it can cause and worsen heart conditions.

- Limit alcohol consumption to no more than one drink per day for women.

- Engage in regular physical activity, under the guidance of a fitness professional or your cardiologist, to improve cardiovascular fitness and overall health.

7. Stress Management:

- Incorporate stress-reducing practices such as yoga, meditation, or mindfulness techniques into your daily routine.

- Ensure adequate sleep and maintain a healthy stress balance.

Remember, this treatment plan is a general guideline, and individual responses may vary. Always consult a healthcare professional before making any changes to your treatment regimen.

Use via API

Built with Gradio

Settings

12. Known Issues

- Limited coverage of rare medical conditions
- Requires stable internet for real-time AI queries
- Dependent on IBM Watson API quota

13. Future Enhancements

- Integration with wearable health devices
- Expanded medical condition coverage
- Doctor-verified treatment plans
- Multi-language support
- Advanced anomaly detection in patient data