

MedEase

AI-Powered Prediction of Readmission Of Patients and Personal Health Tips using LLMs

Presented by Group 8

**Aashish IIITD
Abhinav Arvind
Ayush Prakash
Ayush Srivastava
Harsh Pandey
Sarvajeeth U K
Yash Dhiman
Yugayu Garg**

Problem Statement

Hospital readmissions within 30 days of discharge remain a critical challenge, burdening healthcare systems with increased costs, resource strain, and adverse patient outcomes. Identifying patients at high risk of readmission is crucial for enabling timely interventions and personalized care.

However, traditional methods struggle to:

- Utilizing standardized healthcare data effectively, leads to fragmented insights.
- Provide actionable recommendations tailored to individual patient needs.
- Integrate predictive modeling with real-time patient data for proactive care.

This gap necessitates a robust, data-driven approach that combines predictive analytics with standardized healthcare frameworks to improve readmission outcomes.



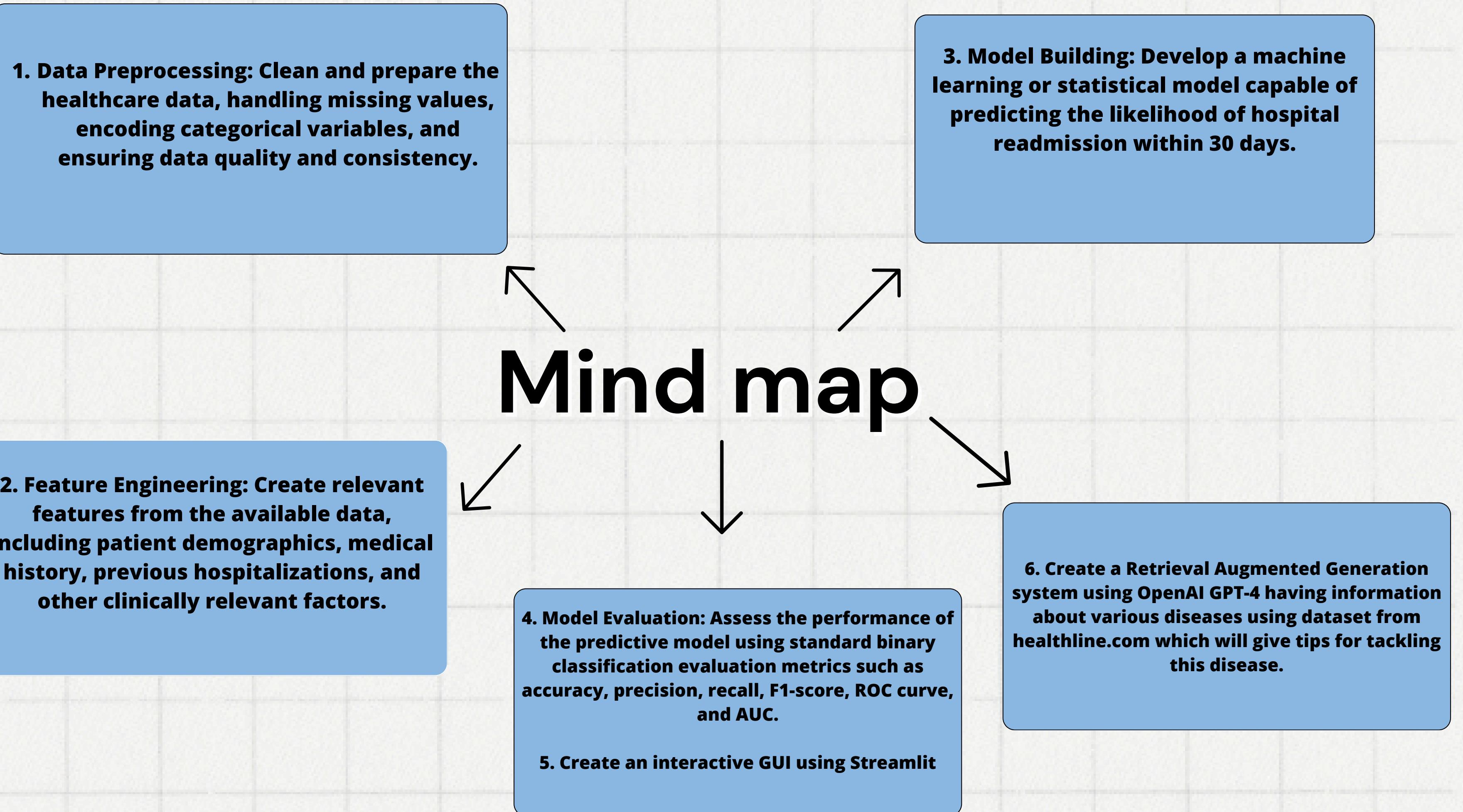
Hypothesis

Primary Hypothesis:

- Machine Learning models can accurately predict the likelihood of patient readmission using key healthcare features, enabling early intervention and better resource allocation in hospitals.

Supporting Hypotheses:

- FHIR-standardized patient data provides a consistent and efficient framework for retrieving critical patient metrics to improve prediction accuracy.
- AI-generated health summaries and personalized recommendations based on FHIR data will assist healthcare providers in making informed decisions and offering tailored care to patients.
- Combining predictive analytics with personalized insights will reduce readmission rates and enhance patient outcomes.



Data Description

Category	Features	Details
Data Sources	FHIR Server	Patient data retrieved in FHIR-compliant format, including demographics, observations, etc.
	hospital_with_actual_A1C.csv, hospital_with_predicted_A1C.csv	Combined into hospital_readmissions_final.csv for training and testing the ML model.
Demographic Info	- Gender	Encoded as categorical data (0 = Female, 1 = Male, 2 = Other).
Clinical Metrics	- A1C Result (Normal/Abnormal)	Captures blood sugar control.
	- Number of Lab Procedures	Total lab tests conducted during the encounter.
	- Number of Medications	Number of prescribed medications.
Encounters	- Admission Type (Emergency, Urgent, Elective)	Type of patient admission, encoded as 1 = Emergency, 2 = Urgent, 0 = Elective.
	- Number of Outpatient Visits, Inpatient Visits, Emergency Visits	Counts of respective patient visits.
	- Number of Diagnoses	Total diagnoses associated with the patient.
Preprocessing	Data Cleaning	Removed duplicates, handled null values, and treated outliers using IQR.

Patient_ID	Age	Gender	Admission Type	Diagnosis	Num_Lab Procedures	A1C_Result	Readmitted
P001	45	Male	Emergency	Heart Disease	12	Normal	Yes
P002	60	Female	Urgent	Diabetes	10	Abnormal	No

Disease Details

diverticulitis	diverticulitis symptoms	Diverticulitis can cause symptoms ranging from mild to sever
diverticulitis	diverticulitis causes	Diverticular disease develops when pouches form along your
diverticulitis	diverticulitis complications	More than 75 percent
diverticulitis	diverticulitis diagnosis	To diagnose diverticulitis, your doctor will likely ask about yo
diverticulitis	diverticulitis treatment	The treatment that your doctor prescribes for diverticulitis wi
diverticulitis	diverticulitis prevention	More research is needed to learn what causes diverticular dis
diverticulitis	diverticulitis risks	One of the main risk factors for diverticulitis is age. Older pec
osteomyelitis	osteomyelitis definition	What is a bone infection (osteomyelitis)?
osteomyelitis	osteomyelitis causes	Many organisms, most commonly <i>Staphylococcus aureus</i> , tra
osteomyelitis	osteomyelitis symptoms	Usually, the first symptom to appear is pain at the infection s
osteomyelitis	osteomyelitis diagnosis	Your doctor may use several methods to diagnose your cond
osteomyelitis	osteomyelitis treatment	There are several options your doctor may use to treat your k
osteomyelitis	osteomyelitis risks	There are a few conditions and circumstances that can increa

Scrapped from healthline.com

Results and Analysis - 1

Key Sections in the Application:

Encounter Data:

- Details fetched from the FHIR server:
- Admission Type
- Lab Procedures
- Medications
- Outpatient, Inpatient, Emergency Visits
- Number of Diagnoses
- AI-Generated Health Summary and Tips:

Patient Analysis:

- Summarizes health status based on clinical data.
- Recommendations:

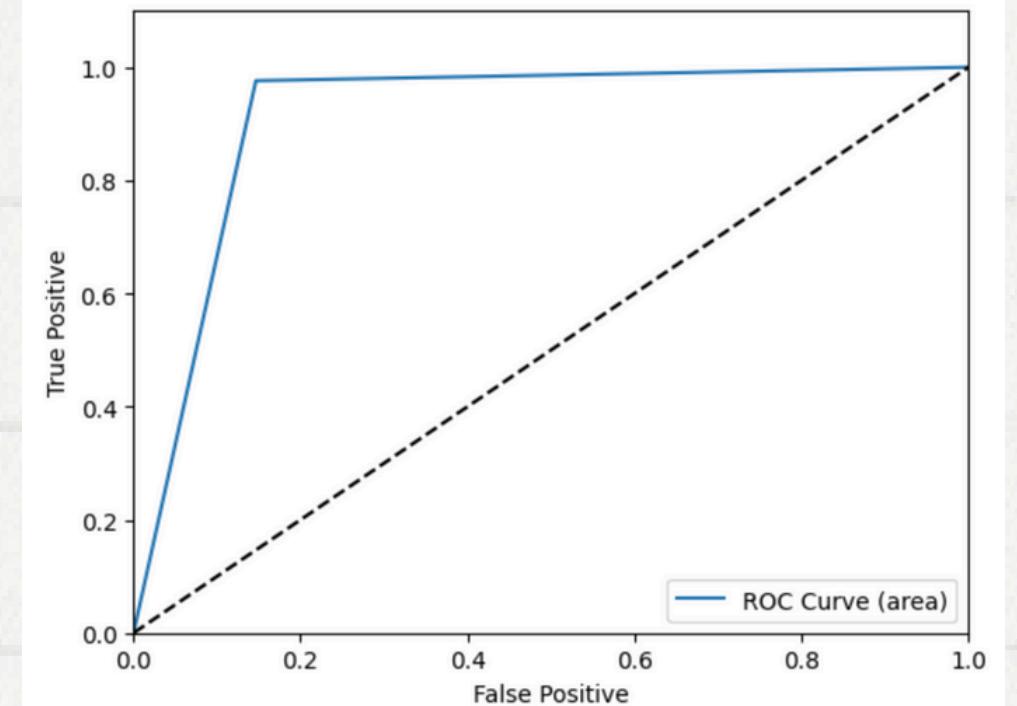
Personalized tips from OpenAI, including:

- Regular Checkups
- Healthy Lifestyle
- Medication Adherence
- Emergency Preparedness
- Preventive Care
- Prediction:
- **Result:** Indicates if readmission is required (e.g., "Not Required").
- **Probability:** Likelihood of readmission displayed as a percentage.

• ML Model Performance

Classification_report for Test				
	precision	recall	f1-score	support
0	0.98	0.85	0.91	116
1	0.83	0.98	0.90	84
accuracy			0.91	200
macro avg	0.90	0.91	0.90	200
weighted avg	0.92	0.91	0.91	200

• ROC Curve



https://drive.google.com/file/d/1bwzk_IWd85VFz6SiaT9sd84SJbEDBdyv/view?usp=sharing

Results and Analysis - 2

LLM Generation on past disease and personal details

Analysis:

Abhinav, a 20-year-old male, has recently been discharged from the hospital after being treated for asthma. Asthma is a chronic inflammatory condition that affects the airways, leading to symptoms such as wheezing, shortness of breath, coughing, and chest tightness. It is common for asthma to develop in childhood and persist into adulthood.

Recommendations:

1. **Monitor Symptoms:** Keep track of asthma symptoms like wheezing, coughing, shortness of breath, and chest tightness. Note any triggers that worsen symptoms such as allergies, smoke, or exercise.
2. **Create an Asthma Action Plan:** Work with a healthcare provider to develop a personalized asthma action plan. This plan should outline your daily management, medications, and steps to take in case of an asthma attack.
3. **Identify and Avoid Triggers:** Try to identify and avoid triggers that worsen asthma symptoms, such as pollen, dust mites, pet dander, smoke, and air pollution. Keep your living space clean and well-ventilated.
4. **Take Medications as Prescribed:** Use asthma medications as prescribed by your healthcare provider. This may include quick-relief inhalers for immediate symptom relief and long-term control medications to manage inflammation and prevent attacks.
5. **Stay Active:** Regular exercise can help improve lung function and overall health. Consult with your healthcare provider to determine the best types of physical activity that suit your condition.

Analysis:

Diagnosis: The patient, Abhinav, has been diagnosed with diabetes. It is likely that he may have Type 1 or Type 1.5 diabetes.

Health Summary: Abhinav has undergone multiple lab procedures, including blood tests, to monitor his diabetes. He has a history of several outpatient visits, inpatient admissions, and emergency room visits.

Recommendations for better management of diabetes:

Regular Monitoring:

- Monitor blood sugar levels regularly as advised by the healthcare provider. Blood sugar levels can fluctuate due to various factors, including diet, exercise, and different factors affect blood sugar levels.

Healthy Diet:

- Follow a balanced diet rich in fruits, vegetables, whole grains, lean proteins, and healthy fats.
- Limit the intake of sugary drinks, refined carbohydrates, and highly processed foods.

Physical Activity:

- Engage in regular physical activity such as walking, jogging, cycling, swimming, or strength training as recommended by the healthcare provider.
- Aim for at least 150 minutes of moderate-intensity exercise per week.

Contributions

- Integrate patient-reported outcomes for personalized risk assessment and used FHIR for fetching : **Sarvajeeth , Ayush Prakash**
- Building the Streamlit UI , and making it functional with the ML model : **Yugayu , Harsh**
- Building the ML model , and finding the dataset and preprocessing : **Abhinav , yash , Aashish**
- Personalized recommendation and integration with the code : **Ayush Srivastava**

Project Link: <https://github.com/Sarvajeet2003/MedEase>

Citations



Predicting Hospital Readmissions

Is diabetes a predictor of hospital readmission?

k kaggle.com

- "Application of machine learning in predicting hospital readmissions: a scoping review of the literature"
Binns, D. (2021). BMC Medical Research Methodology, 21(1), 1-10.
(<https://doi.org/10.1186/s12874-021-01284-z>)
- "An Interpretable Deep-Learning Framework for Predicting Hospital Readmissions From Electronic Health Records"
Liu, J., et al. (2023). arXiv preprint arXiv:2310.10187.
(<https://doi.org/10.48550/arXiv.2310.10187>)