



# Health AI Suite- Intelligent Analytics For Patient care

# INTRODUCTION

This project ,Health AI system demonstrates how multiple AI techniques can improve clinical decision support , patient engagement, and hospital efficiency.

We explored 10 use cases across healthcare :

1. Classification : Early disease detection
2. Regression : Hospital stay prediction
3. Clustering : Patient segmentation
4. Association Rules :Risk pattern discovery
5. CNN : Imaging diagnostics
6. RNN\LSTM : patient vitals forecasting
7. Pretrained Models : Clinical text analysis
8. Chatbot : Patient vitals forecasting
9. Translator : Multilingual doctor - patient support
10. Sentiment Analysis : patient feedback insights

All use cases are integrated into a streamlined AI platform with a chatbot interface for seamless interaction.'

## Risk stratification [ Classification]

Applied supervised machine learning classification models (Logistic Regression, Random Forest, XGBoost, K Neighbours, SVM)

OUTCOME :-

Best model achieved  = 98.7 % accuracy 

Strong predictive power for easily risk detection.

IMPACT  :-

Helps clinicians identify high-risk patients earlier, enabling faster treatment, optimised resource allocation, and improved patient outcomes.

# Length of stay prediction [Regression]

## APPROACH :-

Trained multiple regression model ( Linear regression, Ridge regression, Random forest , Gradient boosting, Lasso regression, kNN Regressor , SVM)

## OUTCOME :

Bestmodel 🤖 : Random Forest 📊

R2 score :- ~0.97

RMSE : ~0.58

MAE : ~0.17

IMPACT 📈 :- Better bed & staff allocation

Improved hospital efficiency

Reduced operational costs while maintaining patient care.

# Patient segmentation [Clustering]

APPROACH : -

K-means clustering on patient s into meaningful cohorts ( demographics , vitals, comorbidities).

OUTCOME :-

Identified 3-5 distinct patient clusters

Each cluster shows unique risk \ behaviour patterns

IMPACT :-

Enables personalized treatment, targeted resource allocation, and improved patient outcomes .

## Medical Association ( Association Rules )

APPROACH :-

Apriori algorithm + Association Rule Mining ( support , confidence , lift ).

OUTCOME :-

- Found frequent links like medication (infusion), Allergy (medication)
- Confidence upto 92% lift >1

IMPACT  :-

Helps clinicians anticipate co-occurring conditions, improve , treatment planning, and support preventive care.

# IMAGING DIAGNOSTICS (CNN)

## APPROACH :-

Applied Convolutional Neural Network (CNN) with VGG16 Transfer Learning and fine-tuning .

## OUTCOME :-

Achieved ~95% validation accuracy in distinguishing Normal vs Pneumonia cases.

## IMPACT :-

Supports radiologists by providing faster, reliable screening , improving early detection  
And patient care.

## Sequence Modelling (RNN \ LSTM)

APPROACH : -

Applied RNN \ LSTM on time - series data ( heart rate , BP , spo2 , labs)

OUTCOME : -

Model achieved AUC = 0.765 showing good ability to distinguish high-risk vs stable patients.

IMPACT  : -

Enables early warning systems - doctors can intervene sooner , reduce complications , and improve patient survival.



# PRETRAINED MODEL USING CLINICAL BERT / BIOBERT

## APPROACH :-

USE biobert \ clinical bert , pretrained on biomedical & clinical corpora, then fine - tuned for tasks like classification , entity recognition , and relation extraction .

## OUTCOME :-

15-20 % higher accuracy in clinical NLP tasks compared to general BERT .

Improved detection of diagnoses , medications and adverse events .

## IMPACT :-

Enables faster understanding of patient records , supports clinical decision- making , and improves patient safety.

# Health Care chatbot

## **APPROACH:**

Medical chatbot built using **DialoGPT**, fine-tuned on domain-specific data including medical FAQs and clinical guidelines to generate context-aware responses.

## **OUTCOME:**

Delivers relevant, conversational responses with <5% error rate and ~27s latency, evaluated using relevance and faithfulness metrics.

## **IMPACT** :

Enhances patient triage, reduces staff workload, and improves access to reliable healthcare information through automated dialogue.

# Translator

## APPROACH :-

Pretrained NLP Models (Helsinki - NLP Marian MT for English to regional languages )

OUTCOMES :- High - quality translations (BLEU~35-40 for many indian languages).

## IMPACT :-

Improves doctor - patient communication, ensures better treatment adherence , and reduces medical misunderstandings.

# Sentiment analysis

APPROACH :- NLP- based sentiment analysis using VADER (unsupervised sentiment analyzer) on patient notes .

Text preprocessing : cleaning, normalization, and tokenization.

Classified notes as positive, negative, or neutral.

OUTCOMES :-

Each note labeled with sentiment.

Distribution summary : eg: 45% positive, 35% neutral, 20% negative.

IMPACT :-

Provides actionable insights from patient feedback .

Helps hospitals identify strengths and areas needing improvement.

Improves patient experience and overall healthcare quality .

## Healthcare platform - Streamlit dashboard

### PURPOSES -

- Provides a single platform for all 10 AI- driven healthcare use cases.
- Enables interactive exploration of models and realtime healthcare insights.

### KEY FEATURES :

- Navigation sidebar : Easy access to all modules.
- Interactive inputs : Sliders , text boxes , file uploads for predictions.
- Dynamic outputs : Charts, tables, metrics, and embeddings.

# LIMITATIONS

- Rule-based logic for appointment scheduling
- Predefined FAQ responses for symptoms
- Safe fallback for out-of-scope queries

## **Questions the bot can answer:**

- Book, reschedule, or check appointments
- Common symptoms: fever, headache, cough

### **Questions the bot cannot answer:**

- Lab results, dietary advice, treatment instructions

### **Impact:**

- Provides fast, safe responses
- Improves patient engagement
- Ensures reliability in healthcare interactions

## CONCLUSION

Unified Platform: All 10 AI use cases are integrated in one Streamlit dashboard.

Scalable: Can expand to new use cases or datasets.

Practical Impact: Helps doctors, hospitals, and patients with decision support.

Future Scope: Improve accuracy with larger datasets and deploy for real-time use.



## IMPACT

- Demonstrates end to end integration of AI models.
- Supports clinical decision-making.
- Simplifies healthcare analytics for patients and providers