Healthcare Predictive Analysis

Using predictive modeling to reduce hospital readmissions for diabetic patients.

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Presenter Designation

Healthcare Predictive Analysis

1. **Introduction & Problem Statement**
   Overview of the issues surrounding hospital readmissions.
2. **Dataset Overview**
   Details about the dataset used for analysis.
3. **Methodology: Data Cleaning & EDA**
   Steps taken for data cleaning and exploratory data analysis.
4. **Machine Learning Models**
   Overview of the machine learning models utilized.
5. **Results & Dashboard**
   Presentation of results and the dashboard created.
6. **ML FLOW & API Deployment**
   using MLOPS and fast API
7. **Conclusion & Future Work**
   Summary of findings and future research directions.

Data Cleaning & Preprocessing

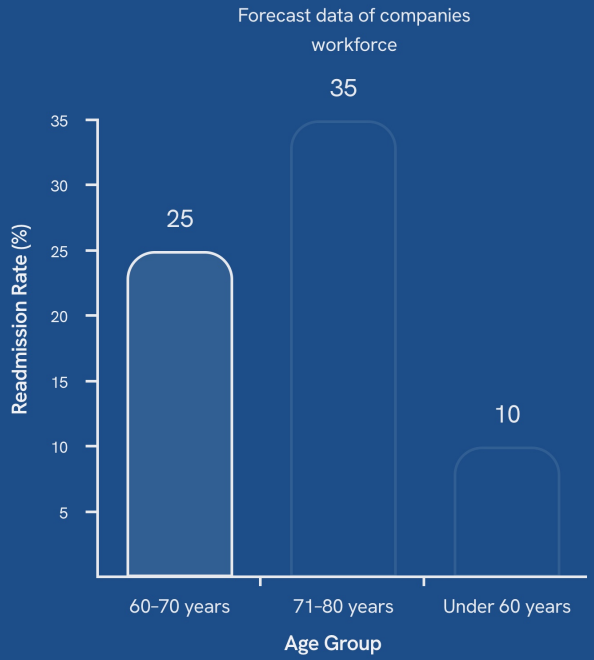
Before Data Cleaning

1. **Missing Values**: High incidence of missing lab results.
2. **Outliers**: Significant data anomalies detected.
3. **Cardinality**: Numerous unique values in categorical variables.

After Data Cleaning

1. **Missing Values**: Imputed using 'No Test' for lab results.
2. **Outliers**: Outliers removed or corrected.
3. **Cardinality**: Categorical variables encoded to 0/1.

Readmission Insights from EDA



35%

Readmission rate for 71–80 years

Patients aged 71 to 80 years have a **readmission rate** of **35%**, which is significantly higher than younger cohorts.

Patients undergoing more **lab procedures** tend to have **longer hospital stays**, highlighting a need for efficiency in lab processes.

Correlation with lab procedures

Longer stays with more labs

Source: Companies Market Cap

Model Performance Overview

Model	Accuracy
Random Forest	88.76% (Best)
XGBoost	88.03%
Neural Network	89% (without SMOTE)

ML Flow

-Set Up MLflow Experiment (readmission-prediction)

-Train and Log Multiple Models (gradient boosting , xgboost,...)

-Track Metrics, Hyperparameters, and Artifacts

-Visualize Confusion Matrix, ROC and Precision-Recall Curves

-Compare Model Performances

-Best Model for Deployment (gradient boosting , xgboost)

Production Models

-Gradient Boosting (Best performance)

-XGBoost (Competitive & fast)

-Random Forest (Staging)

-Logistic Regression, KNN, Decision Tree (Archived)

API Deployment

-Built with FastAPI and joblib for loading machine learning models.

-Handles POST requests for real-time predictions through an API.

-Runs locally on localhost:8000 with interactive documentation available at /docs (Swagger UI).

-Additionally, developed Streamlit and Dash applications for an easy-to-use web interface for predictions.

Interactive Dashboard Insights

Readmission Risk

Analyzes readmission risk based on patient demographics, enabling targeted interventions for high-risk groups.

Lab Procedures Trends

Tracks trends in lab procedures and medication usage, helping to identify patterns that affect patient care.

Predictions

Provides predictions on patient outcomes, allowing healthcare professionals to make informed decisions swiftly.

Data-Driven Decisions

Empowers healthcare teams to leverage data for improving patient outcomes and reducing unnecessary readmissions.

Future of Healthcare Analytics

1

Model Enhancement

Further improve prediction accuracy by experimenting with advanced machine learning algorithms such as LightGBM, and deep learning models.

2

Real-Time Data Integration

Integrate real-time hospital data streams to enable live predictions and dynamic updates.

3

Extending to Other Conditions

Expand the solution to predict readmissions for other chronic diseases beyond diabetes.

4

Deployment to Cloud

Deploy the FastAPI backend and the Streamlit/Dash applications to cloud platforms like AWS, Azure, or Heroku for broader accessibility

5

Expand Dataset

Incorporate additional patient data to improve model generalization across different hospitals.

6

User Authentication and Security

Implement authentication and authorization mechanisms to secure the API and web applications

7

Model Interpretability

Use explainable AI techniques to make model predictions more transparent to doctors and healthcare staff.

Questions & Feedback Welcome

Feel free to reach out for any inquiries or further discussions.

Acknowledgments and Thanks

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