Self Evaluation

ICU Mortality Prediction
&
Readmission Risk Prediction (30-Day Hospital Readmission)
using
Machine Learning & Deep Learning

Naveen Kilaru

Introduction

Title: Self-evaluation Tutorial Using MIMIC Data

Objective: Analyze patient admissions, patients , prescriptions, ICU Stays, and transfers to apply machine learning and Deep learning techniques

Key Takeaway:

- Covers dataset understanding, preprocessing , ML models, and evaluation.
- Predicting ICU mortality and 30-day readmission helps optimize hospital resources and improve patient care
- Machine Learning (ML) and Deep Learning (DL) models can identify high-risk patients

Mortality Prediction - Problem Statement

Goal: Predict ICU patient mortality using ML/DL.

Dataset: MIMIC ICU admissions, vitals, and demographics.

Why Important?

- Early risk stratification helps doctors prioritize care.
- Reduces preventable deaths through early intervention.

Mortality Prediction - Data Features

Data Tables:

1. Admissions
2. Patients
3. Prescriptions
4. ICU Stays
5. Transfers

Features Used:

- Age, Gender, ICU Length of Stay, Admission Type.
- Vital signs (Heart Rate, Blood Pressure, Oxygen Saturation).
- Target: Mortality status (Died = 1, Survived = 0).

Data Preprocessing:

- Handle missing values & outliers.
- Convert categorical data into numerical format.
- Merge data from different tables to create a feature set.
- Standardize numerical values to improve model accuracy.

Mortality Prediction - ML / DL Models

ML Model:

- Logistic Regression
- Random Forest
- XGBoost

DL Model:

- Neural Network (Dense Layers, ReLU, Dropout)

Evaluation Metrics:

- Accuracy
- Precision-Recall
- ROC-AUC

Deep Learning models provide better accuracy but require more data and training time.

Readmission Risk Prediction - Problem Statement

Goal: Predict 30 day readmission risk patient mortality using ML/DL.

Dataset: MIMIC ICU admissions and ICU Transfers

Why Important?

- Identifies high-risk patients before discharge.
- Helps optimize hospital resources and reduce readmission costs.

Mortality Prediction - Data Features

Data Tables:

1. Admissions
2. Patients
3. ICU Stays
4. Transfers

Features Used:

- Age, Gender, ICU Length of Stay, Admission Type and Gender.
- Previous hospitalizations and discharge location.
- Target: Readmitted within 30 days status (Yes = 1, No = 0).

Data Preprocessing:

- Handle missing values & outliers.
- Convert categorical data into numerical format.
- Merge data from different tables to create a feature set.
- Standardize numerical values to improve model accuracy.

Mortality Prediction - ML / DL Models

ML Model:

- Logistic Regression
- Random Forest

DL Model:

- Neural Network (64-32-1 Dense Layers, ReLU, Dropout)

Evaluation Metrics:

- Accuracy
- Precision-Recall
- ROC-AUC.

Deep Learning models showed better performance for complex relationships in the data

Model Comparison & Conclusion

Mortality Prediction:

- - Logistic Regression: 64.2% Accuracy
- - Neural Network: 67.8% Accuracy

Readmission Prediction:

- - Random Forest: 72.8% Accuracy
- - Neural Network: 83% Accuracy

Conclusion:

- ML & DL models can improve healthcare decision-making.
- Future Work: Hyperparameter tuning, additional patient data, ensemble learning