

# Predicting Hospital Admission from Emergency Department Data Using Machine Learning

Team Project Proposal

Course: BA878 E1 Machine Learning and Data Infrastructure in Health Care (Fall 2023)

Team Members: Prateek Naharia, Yutao Luo, Sam Zhang

## 1. Executive Summary:

We propose an innovative project that utilizes the MIMIC-IV-ED database to predict hospital admissions following a patient's stay in the Emergency Department (ED). By harnessing machine learning algorithms, we aim to create a predictive model that is both accurate and actionable, aiding healthcare providers in optimizing resource allocation and enhancing patient care.

## 2. Objectives:

- To develop a machine learning model capable of predicting the probability of hospital admissions from ED with high accuracy.
- To identify and analyze the key predictors and features that significantly influence hospital admissions.
- To implement a real-time, user-friendly predictive tool for healthcare providers.

## 3. Methodology:

### a. Data Utilization:

<https://physionet.org/content/mimic-iv-ed/2.2/>

Utilize the MIMIC-IV-ED database, extracting relevant data from:

- edstays, triage, vital sign, diagnosis, medrecon, pyxis

### b. Data Preprocessing:

- Clean, preprocess, and normalize the dataset.
- Handle missing values and outliers.

### c. Feature Engineering:

Extract the time spent in ED and develop features capturing changes in vital signs over time.

### d. Model Development:

Begin with Logistic Regression for its interpretability.

Explore ensemble methods, like Random Forest and Gradient Boosted Trees, to improve accuracy.

### e. Model Evaluation:

Utilize metrics like ROC-AUC, precision, recall, and F1-score.

Implement cross-validation to ensure model robustness.

#### 4. Expected Outcomes:

- An accurate, validated predictive model for estimating hospital admissions post-ED stay.
- A comprehensive analysis of key features influencing admissions, providing actionable insights.
- A web-based tool for real-time predictions, enhancing decision-making processes for healthcare providers.

#### 6. Conclusion:

Our project is poised to make a significant contribution to emergency care by providing a reliable predictive model for hospital admissions from ED data. By leveraging the rich MIMIC-IV-ED database, we will offer actionable insights and a real-time predictive tool, ultimately enhancing resource allocation, patient management, and overall quality of care in emergency departments.