Patient Appointment No-Show Prediction and Scheduling Optimization

Abstract

This project focuses on predicting patient appointment no-shows using machine learning and visualization techniques. A decision tree classifier model is built in Python to identify key patterns influencing attendance, such as appointment day, time, and reason for visit. An interactive Power BI dashboard visualizes insights to help healthcare providers reduce missed appointments and optimize scheduling.

Introduction

Healthcare institutions face significant operational challenges due to missed appointments. Understanding patient behavior and appointment trends can help minimize resource wastage and improve patient care. This project leverages data analytics and predictive modeling to identify high-risk appointments likely to result in no-shows.

Tools Used

1. Python (Pandas, Scikit-learn): For data preprocessing and building the decision tree prediction model.
2. Power BI: For designing interactive dashboards and data storytelling.
3. Microsoft Excel: For dataset inspection and basic data structuring.

Steps Involved in Building the Project

1. Data Collection: Imported appointment dataset containing details like patient ID, doctor ID, appointment date, and status.
2. Data Cleaning: Removed missing values, formatted date/time columns, and encoded categorical features.
3. Feature Engineering: Created new fields such as weekday and appointment slot to capture behavioral patterns.
4. Model Training: Used a decision tree classifier to predict whether a patient would attend or miss their appointment.
5. Visualization: Built Power BI dashboards highlighting attendance rates, weekday trends, and no-show predictions.
6. Insights and Recommendations: Proposed data-driven scheduling strategies and patient reminder optimizations.

Conclusion

The analysis successfully demonstrated that predictive analytics and visualization can enhance hospital scheduling efficiency. By identifying factors leading to patient no-shows, hospitals can take preventive measures like targeted reminders and better time-slot allocations. Integrating machine learning models with Power BI dashboards provides an effective decision-support system for healthcare management.