LITERATURE SURVEY

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ABSTRACT

According to the World Health Organization (WHO), patient Length of Stay (LOS) in hospitals is an important performance measurement and monitoring indicator. Prolonged LOS in the Intensive Care Unit (ICU) may lead to consuming hospital resources, manpower, and equipment. Therefore, accurate prediction of patient LOS may aid the healthcare specialists to take medical decisions and allocate medical team and resources. As well, the patient and insurance companies may use this prediction to manage their budget. In this paper, a framework for predicting patient LOS in the ICU using Data analytics is proposed. Unlike most of the previous studies, this study relies on general medical features collected on patient admission regardless of the patient diagnosis. This provide a broad scope and cover all patients making this approach general and easy to use. The prediction accuracy of the proposed approach was recorded to be very high. For example, the best prediction accuracy was achieved by fuzzy with accuracy reach 92%, while classification tree managed to achieve a prediction accuracy of 90% coming in the second place.

INTRODUCTION

Hospital length of stay (LOS) is a quality metric health systems use as a proxy of efficient hospital management. Reduction in LOS improves bed turnover, allowing hospitals to match demand with capacity for elective and emergent admissions, intensive care unit (ICU) care, and interhospital transfers. When demand exceeds capacity, emergency department crowding, ICU strain, and ward strain occur, all of which are associated with worse outcomes, including mortality. Classifying patient hospital stays into diagnosis-related groups with fixed reimbursements further incentivizes hospitals to improve LOS to maintain operating margins.

Many strategies to reduce hospital LOS have been developed, including some targeting different aspects of patient management, such as clinical care (eg, enhanced recovery programs and early mobility programs), and others focusing on staffing models and logistics of care coordination.

EXISTING SYSTEM

The expected outcome of this project is to develop a model that will be better at predicting hospital LOS than the industry standards of median and average LOS. The median LOS is simply the median LOS of past admissions to a hospital. Similarly, a second commonly used metric in healthcare is the average, or mean LOS. To measure performance, I'll compare the prediction model against the median and average LOS using the root-mean-square error (RMSE). The RMSE is a commonly used measure of the differences between values predicted by a model and the values observed, where a lower score implies better accuracy. For example, a perfect prediction model would have an RMSE of 0. The RMSE equation for this work is given as follows, where (n) is the number of hospital admission records, (y-hat) the prediction LOS, and (y) is the actual LOS.

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n}(\hat{y}_i - y_i)^2}{n}}$$

The ultimate goal is to develop a prediction model that results in a lower RMSE than the average or median models.

PROBLEM STATEMENT

"The goal of this project is to create a model that predicts the length-of-stay for each patient at time of admission."

In order to predict hospital LOS, the data needed to be separated into terms of a dependent target variable (length-of-stay in this case) and independent variables (features) to be used as inputs to the model.

PROPOSED SYSTEM

Predictive analytics is an increasingly important tool in the healthcare field since modern machine learning (ML) methods can use large amounts of available data to predict individual outcomes for patients. For example, ML predictions can help healthcare providers determine the likelihoods of disease, aid in the diagnosis, recommend treatment, and predict future wellness. For this project, I chose to focus on a more logistical metric of healthcare, hospital length-of-stay (LOS). LOS is defined as the time between hospital admission and discharge measured in days.

This incentivizes hospitals to identify patients of high LOS risk at the time of admission. Once identified, patients with high LOS risk can have their treatment plan optimized to minimize LOS and lower the chance of getting a hospital-acquired condition such as

staph infection. Another benefit is that prior knowledge of LOS can aid in logistics such as room and bed allocation planning.

ADVANTAGES

- Risk Prediction
- Better Treatment Targeting
- High Quality and Patient-Centered Services
- Determine Overall Cohort Health

CONCLUSION

The ability to predict LoS can provide a clinical indicator of the health status of a patient as well as assist in predicting the level of care that is required. It also aids hospital staff with improved prediction of bed and ward utilisation. LoS varies with respect to many factors including severity of illness, diagnosis and a variety of patient factors.

REFERENCES

1.Bueno H, Ross JS, Wang Y, et al. Trends in length of stay and short-term outcomes among Medicare patients hospitalized for heart failure, 1993-2006.   JAMA. 2010;303(21):2141-2147. doi:10.1001/jama.2010.748

2.McDermott KW, Elixhauser A, Sun R. Trends in hospital inpatient stays in the United States, 2005–2014. HCUP Statistical Brief #225. Agency for Healthcare Research and Quality; 2017:18.

3.Halpern SD. ICU capacity strain and the quality and allocation of critical care. Curr Opin Crit Care. 2011;17(6):648-657. doi:10.1097/MCC.0b013e32834c7a53

4.Gabler NB, Ratcliffe SJ, Wagner J, et al. Mortality among patients admitted to strained intensive care units. Am J Respir Crit Care Med. 2013;188(7):800-806. doi:10.1164/rccm.201304-0622OC

5.Gilman M, Adams EK, Hockenberry JM, Milstein AS, Wilson IB, Becker ER. Safety-net hospitals more likely than other hospitals to fare poorly under Medicare's value-based purchasing.