

Enhancing Predictive Disease Management: A Machine Learning Approach for Healthcare Resource Utilization in Inpatient Cases

Pi-Yu Chang^{* 1}, Su-Ling Huang¹, Deng-Chiung Shih², Pi Wen Su³
¹Operation Management Center, Kaohsiung Municipal Siaogang Hospital, Kaohsiung Medical University Hospital, Kaohsiung Medical University, ²Project Management Office for Intelligence Healthcare, Kaohsiung medical university chung-ho memorial hospital, Kaohsiung Medical University, ³Operation Management Center, SHIN HUEY SHIN HOSPITAL, Kaohsiung, Taiwan

Isqua2024
11001f6

INTRODUCTION

The implementation of Taiwan’s diagnosis-related group payment system (Tw-DRGs) by the National Health Insurance Administration for hospital inpatient expenses necessitates the use of big data analytics in health-care resource management.

AIM

This study was conducted to develop a machine learning–based predictive model for inpatient resource utilization, aiming to provide decision support for managing Tw-DRGs.

METHOD

Relevant data (January 2019 to July 2023; 65,446 patients) were collected from a regional hospital in Kaohsiung City. The data were randomly allocated to a training set (80%), a validation set (10%), and a testing set (10%). A machine learning algorithm and 33 features were used to construct the Tw-DRGs Medical Resource Utilization Predictive Model.

CONCLUSIONS

The development of a machine learning–based predictive model for inpatient medical resource utilization markedly advances the management of diseases within the Tw-DRGs framework.

ACKNOWLEDGEMENT

This study was supported by grant funds (kmhk-111-25) from the Kaohsiung Municipal Siaogang Hospital in 2022 to accomplish the research.

REFERENCES

Islam, M. M., Li, G. H., Poly, T. N., & Li, Y. J. (2021). Deep DRG: Performance of Artificial Intelligence Model for Real-Time Prediction of Diagnosis-Related Groups. *Healthcare (Basel, Switzerland)*, 9(12), 1632.
Suo-Wei Wu, Qi Pan, Tong Chen(2020). Research on diagnosis-related group grouping of inpatient medical expenditure in colorectal cancer patients based on a decision tree model.*World J Clin Cases*, 8(12), 2484-93
Xiaoting Liu1, Chenhao Fang, Chao Wu1, Jianxing Yu1, Qi Zhao1(2021), DRG grouping by machine learning: from expert-oriented to data-based method. *BMC Medical Informatics and Decision Making*, 21:312

CONTACT INFORMATION

Chang Pi-Yu
No. 482, Shanming Rd., Xiaogang Dist., Kaohsiung City 812015, Taiwan (R.O.C.)
+886 0975357273
bychang@kmu.edu.tw

RESULTS

The use of the deep learning algorithm XGBoost ensured outstanding performance by the predictive model. The model achieved an area under the curve value of 91.09%, an accuracy score of 83.83, a precision score of 82.61%, a recall score of 80.84%, and an F1 score of 81.59%. Key predictive features included age, sex, major diagnostic category, primary diagnosis, main procedure, and hospitalization duration.

	Training Set	Validation Set	Testing Set	
Accuracy Score	0.8738	0.8458	0.8383	
Precision Score	0.8688	0.8346	0.8261	
Recall Score	0.8524	0.8226	0.8084	
F1 score	0.8594	0.8279	0.8159	
AUC	0.9428	0.9149	0.9109	

	XGBoost	LGBM	Random forest	Logistic
Accuracy Score	0.8383	0.8332	0.8289	0.7407
Precision Score	0.8261	0.8218	0.8144	0.7120
Recall Score	0.8084	0.7998	0.7989	0.6939
F1 score	0.8159	0.8087	0.8055	0.7004
AUC	0.9109	0.8988	0.8955	0.7783