

Documents

Kartiwi, M.^a, Gunawan, T.S.^b, Yusoff, N.M.^c

Predictive Analytics for Learning Performance in First-Year University Programming Course

(2024) *Proceeding of the IEEE International Conference on Smart Instrumentation, Measurement and Applications, ICSIMA*, (2024), pp. 267-270.

DOI: 10.1109/ICSIMA62563.2024.10675540

^a International Islamic University Malaysia, Department of Information Systems, Kuala Lumpur, 53100, Malaysia

^b International Islamic University Malaysia, Electrical and Computer Engineering Dept., Kuala Lumpur, 53100, Malaysia

^c Universiti Teknologi Malaysia, Faculty of Artificial Intelligence, Kuala Lumpur, 51400, Malaysia

Abstract

The increasing demand for programming skills has highlighted the need for effective teaching strategies to support student success in programming courses. Despite significant advancements in learning analytics, predictive models explicitly tailored to programming courses remain underexplored. This research aims to develop a machine learning model to predict student performance in programming courses offered within IT programs by analyzing gender, type of activity (readings, coding exercises, assignments), and frequency of access to different activities. Our study utilizes log data of the asynchronous learning activities in the learning management systems of the students enrolled in programming courses. We employ machine learning techniques, decision trees, gradient boosting machines (GBM), and logistic regression to build robust predictive models. In this study, the decision tree model outperformed logistic regression (77.77%) and gradient boosting machine (GBM) (86.57%) by achieving the highest accuracy of 89.09% and excelling in predicting 'Poor' student performance with a recall of 90.67%, establishing it as the most effective model for this predictive analysis. The findings from this research offer actionable insights for educators, enabling early intervention for at-risk students and developing tailored teaching strategies to enhance student performance through strategically provisioning the learning materials in programming courses. This study contributes to the growing knowledge of learning analytics and provides a foundation for future research in predictive modeling for diverse educational contexts. © 2024 IEEE.

Author Keywords

course; e-learning; predictive; programming; university

Index Keywords

Adversarial machine learning, Contrastive Learning, Curricula, Federated learning, Logistic regression, Students; Course, E-learning, Gradient boosting, Predictive, Predictive models, Programming, Programming course, Student performance, Teaching strategy, University; Predictive analytics

References

- Medeiros, R., Ramalho, G., Falcão, T.P.
A Systematic Literature Review on Teaching and Learning Introductory Programming in Higher Education
(2019),
- Eranki, K., Moudgalya, K.
Evaluation of Programming Competency Using Student Error Patterns
(2015) *2015 International Conference on Learning and Teaching in Computing and Engineering*,
- Elmaleh, J., Shankararaman, V.
Improving student learning in an introductory programming course using flipped classroom and competency framework
(2017) *2017 IEEE Global Engineering Education Conference (EDUCON)*,
- Lockyer, L., Dawson, S.
Learning designs and learning analytics
(2011) *LAK*,
- Mwalumbwe, I., Mtebe, J.
Using learning analytics to predict students' performance in moodle learning

management system: A case of mbeya university of science and technology
(2017) *Electron. J. Inf. Syst. Dev. Ctries*,

- Huang, A.Y.Q., Lu, O.H.T., Huang, J.C.H., Yin, C., Yang, S.J.H.
Predicting students' academic performance by using educational big data and learning analytics: Evaluation of classification methods and learning logs
(2020) *Interactive Learning Environments*,
- Yildirim, D., Gölbahar, Y.
(2022) *Implementation of Learning Analytics Indicators for Increasing Learners' Final Performance*,
- Kumar, V., Garg, M.L.
Comparison of Machine Learning Models in Student Result Prediction
(2019) *Advances in Intelligent Systems and Computing*,

Correspondence Address

Kartiwi M.; International Islamic University Malaysia, Malaysia; email: mira@iiium.edu.my

Publisher: Institute of Electrical and Electronics Engineers Inc.

Conference name: 10th IEEE International Conference on Smart Instrumentation, Measurement and Applications, ICSIMA 2024

Conference date: 30 July 2024 through 31 July 2024

Conference code: 202737

ISSN: 26406543

Language of Original Document: English

Abbreviated Source Title: Proceeding IEEE Int. Conf. Smart Instrum., Meas. Appl., ICSIMA
2-s2.0-85208454150

Document Type: Conference Paper

Publication Stage: Final

Source: Scopus

ELSEVIER

Copyright © 2024 Elsevier B.V. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

 RELX Group™