

RESEARCH

Open Access



Prediction of delayed postgraduate graduation using machine learning in Ugandan higher education

Musoke Robert Lubelenga^{1,2*}, Florence Nameere Kivunike², Halimu Chongomweru² and Emmanuel Ahishakiye³

*Correspondence:

Musoke Robert Lubelenga

robertmusoke21@gmail.com

¹Department of Computer Science,
Kyambogo University, Kampala,
Uganda

²Department of Information
Technology, Makerere University,
Kampala, Uganda

³Department of Data Science and
Artificial Intelligence, Kyambogo
University, Kampala, Uganda

Abstract

Delayed postgraduate graduation is a major challenge to higher education institutions in Uganda in terms of student progression, institutional planning and human capital development. Identifying students at risk of delayed completion early can inform timely academic interventions and improve post-graduate outcomes. This study developed and compared machine learning models for delayed postgraduate graduation prediction using institutional administrative records from Makerere University. A retrospective predictive modelling study was performed using anonymised data from 500 postgraduate students registered from 2017 to 2023. 29% of them graduated on time and 71% graduated late. We developed and evaluated a number of supervised machine learning classifiers such as Random Forest, XGBoost, K-Nearest Neighbours, Logistic Regression and a stacking ensemble model. The model performance was evaluated using accuracy, precision, recall, F1-score and ROC-AUC. All trained models were found to have high and similar predictive performance in terms of accuracy (between ~94% and 95%) and ROC-AUC (between 0.94 and 0.95). Logistic Regression gave the numerically highest ROC-AUC (0.950) although differences in classifier performance were not statistically meaningful. Employment status and age at admission were positively related to delayed graduation whereas higher undergraduate CGPA decreased the likelihood of delayed completion. The results indicate that interpretable machine learning models can match the performance of complex ensemble methods on structured educational datasets. Apart from predictive performance, the study offers context-specific evidence on the use of predictive analytics in postgraduate education in Uganda, which is often characterised by patterns of progression affected by research-intensive study requirements, employment responsibilities, and long thesis completion processes. The proposed framework can assist in early identification of at-risk postgraduate students and directing institutional interventions in order to improve graduation outcomes.

Keywords Machine learning, Graduation prediction, Postgraduate education, Educational analytics, Uganda, Delayed completion



© The Author(s) 2026. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.