GRADGROOM: AN INTEGRATED FRAMEWORK FOR AN EDUCATIONAL EARLY WARNING SYSTEM WITH MENTOR MATCHING

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Master of Science in Computer Science, Specialization in Cloud Computing

Department of Computer Science Engineering

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Thesis submitted in partial fulfillment of the requirements for the degree

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Declaration

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

Signature: Date: 27/06/2024

DVDS Abeysinghe

The above candidate has carried out research for the Masters thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Prof. Shantha Fernando

Signature of the Supervisor: Date: 2024-06-28

Dedication

My academic journey has been propelled by the unfailing support, encouragement, and sacrifices of my parents, husband, and all of my teachers and lecturers, to whom I dedicate my thesis. My biggest source of inspiration has been your confidence in me, and I will always be appreciative of your love, wisdom, and sacrifices, which have enabled me to do this.

Thank you.

Dharani Abeysinghe

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Last but not least, I extend my heartfelt thankfulness to all the participants for their generous contribution with their time and insights to this research project.

This thesis would not have been conducted to this success without the support and encouragement of all those mentioned above, and for that, I am profoundly grateful.

Dharani Abeysinghe

Abstract

"Education is the key to success", one of the most heard motivational statements by all of us. People engage in education at different phases of our lives in different ways. Among them, university education plays a vital role in our academic and professional lives. During university education many undergraduates will be facing several challenges demanding from educational matters to socio-economic problems. In many such situations undergraduates tend to abandon the degree programs halfway leaving them incomplete. Hence creating an Educational Early Warning Systems (EEWS) to predict and identify at-risk undergraduate students in the early stages of the degree programs will improve the graduating ratio against the dropouts. Further, mentoring is another aspect in education where it can be used greatly in the undergraduate studies to speak closer to the students addressing their curiosity and guiding them in the correct direction. There exists many separate frameworks for EEWS and mentoring. Despite an integrated framework that would be capable of identifying students at-risk and then match with the most matched mentor would be impactful and effective to handle by the universities. This study has proposed an integrated framework namely as "GRADGROOM" as a solution to the identified lacuna by extending EEWS framework with mentor matching which perform at-risk undergraduate student prediction and mentor-mentee matching for the identified at-risk undergraduate students. In the study, the proposed framework has been evaluated with two case studies. The framework has compared the use of KNN, SVM and RF algorithms while merging them to a stacking ensemble model with decision tree classifier as the base classifier in at-risk undergraduate student prediction. Further, from the predictions, the framework has extended the work up to logic based mentor-mentee matching and has conducted a successful mentoring program to validate the results. In the study the algorithms KNN, SVM, RF and the stacking ensemble model have given accuracies of 96%, 100%, 92% and 96% respectively proving the success of the prediction at-risk in the EEWS framework. Overall through the case studies and feedback gatherings, study has emphasized the importance of extending the at-risk prediction through EEWS followed with a mentoring process. Moreover, the study has concluded that a proper mentoring process conducted immediately after being identified as at-risk undergraduate students will be highly beneficial to reshape their study patterns to align with the correct route of studying.

Keywords: At-risk undergraduate student prediction, Educational Early Warning Systems (EEWS), Mentor-mentee matching, Virtual mentoring.

Table of Contents

List of Figures

Figure **Description** **Page**

List of Tables

Table **Description** **Page**

List of Abbreviations

Abbreviation	Description
ALM	Additive Logistic Model
CRRNN	Convolution Residual Recurrent Neural Network
CV	Cross-Validation
DA	Deferred Acceptance
DT	Decision Tree
EEWS	Educational Early Warning Systems
EWS	Early Warning Systems
FN	False Negative
FP	False Positive
GPA	Graded Point Average
LM	Logistic Model
LMS	Learning Management System
ML	Machine Learning
NLP	Natural Language Processing
RF	Random Forest
STEM	Science, Technology, Engineering, and Mathematics
SVM	Support Vector Machines
TE	Technology and Engineering
TN	True Negative
TP	True Positive
UTAUT	The Unified Theory of Acceptance and Use Of Technology