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# Analysis and Prediction of Students' Academic Performance based on Educational Data Mining

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**ABSTRACT:** Education plays a pivotal role in producing qualified human power that accelerates economic development and solves the real problems of a community. Students are also expected to spend much of their time on their education and need to graduate with good academic results. However, the trend of graduating students is not proportional to the trend of enrolled students and an increasing number of students commit readmission, suggesting that they did not perform well in their academics. Thus, the study aimed to identify the determinants of academic performance among university students.

**KEYWORDS:** Data mining, Performance analysis, Machine Learning.

## I. INTRODUCTION

Education is regarded as a promoter of human development and seen by many to be in the centre of any society's life and concern. It is a social artifact embodying aspirations about the welfare and development of the society it deems to serve. To Botswana, education is expected to contribute towards the social, cultural, political and economic welfare and development of citizens (RNPE, 1994). According to Botswana educational goals, children who complete secondary education are expected to have acquired lifelong skills and be competitive in the global village when it comes to their employability (RNPE, 1994). This therefore, calls for students to excel academically or hopefully perform to the satisfaction of the nation. In Botswana basic education is free to all children. The government is the sole sponsor for the education of the students from primary to secondary school levels. To some they receive government sponsorship at tertiary level. Since government committed itself to provide basic education for all, the Ministry of Education and Skill Development has been receiving a lion's share in both recurrent and development budget. Since 2007/2008 budget the Ministry of Education and Skill Development has been allocated over P5 billion of the recurrent budget. The 2013/2014 budget the Ministry of Education and Skill development is allocated P7.93 billion or 22.98 per cent of the ministerial recurrent budget. Considering government hefty investment in education, its output with regard to the quality of students has not been commensurate with the expenditure. The students' academic performance has been declining at an alarming rate since 2010. Table 1 below shows yearly students' academic performance for 2010, 2011 and 2012, which indicate a serious decline. This has caused a concern for both the government and the public.

## II. MOTIVATION

The major purpose of the study was to investigate the teachers' and students' views, ideas and experiences concerning factors which contribute towards students' low academic performance. It also explored strategies needed to alleviate the problem if any.

## III. LITERATURE SURVEY

Student's performance in the educational process can literally be defined as something that is obtained from changes in the behavior of students based on their experiences, besides that learning outcomes are also a realization of the potential or capacity possessed by students [1]. These learning outcomes from students can be seen from their behavior, both behavior in the form of understanding knowledge, thinking skills, or motor skills [2]; an outcome of the process of changing student behavior after attending lessons [3]. The concrete form of student's performance can be seen from their understanding of the knowledge being studied, their expertise in processing information and making decisions based on certain thoughts or motor skills [4]. Based on those understandings, student's performance can be observed and measured in the realm of students' knowledge, attitudes and skills after following a series of lessons. Student's performance depends on the teaching and learning process they go through, so that learning outcomes can be used as

considerations in improving the quality of the learning process. On the other hand, a similar terminology is learning achievement which is a measure of student achievement after participating in learning activities in the form of an assessment scale (either letters, numbers or certain symbols [5]. Giving a weight or rating for student's achievement in learning requires the preparation of suitable assessment indicators, and needs to be ensured of the validity and the reliability [6]. This value can then be used as a description of student's performance in a certain period of time [7]. Student's performance is obtained after passing various measurements (in various forms of assessment) after students carry out several learning processes.

#### IV. PROPOSED SYSTEM

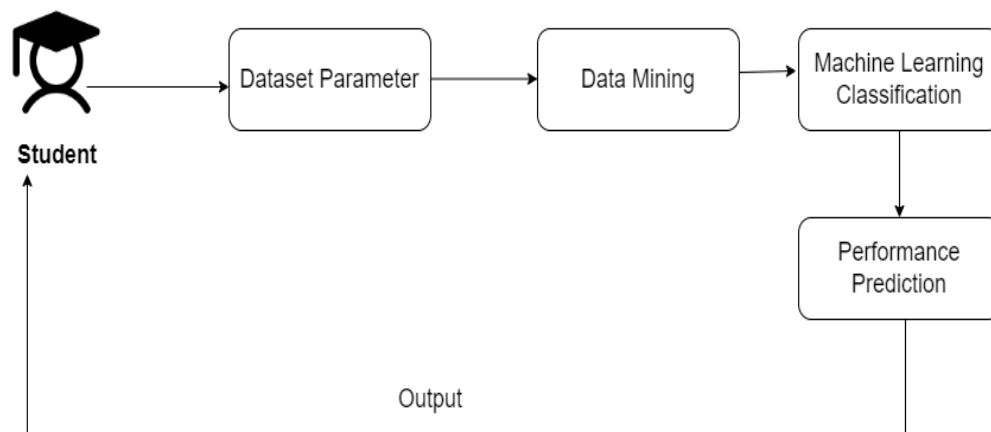


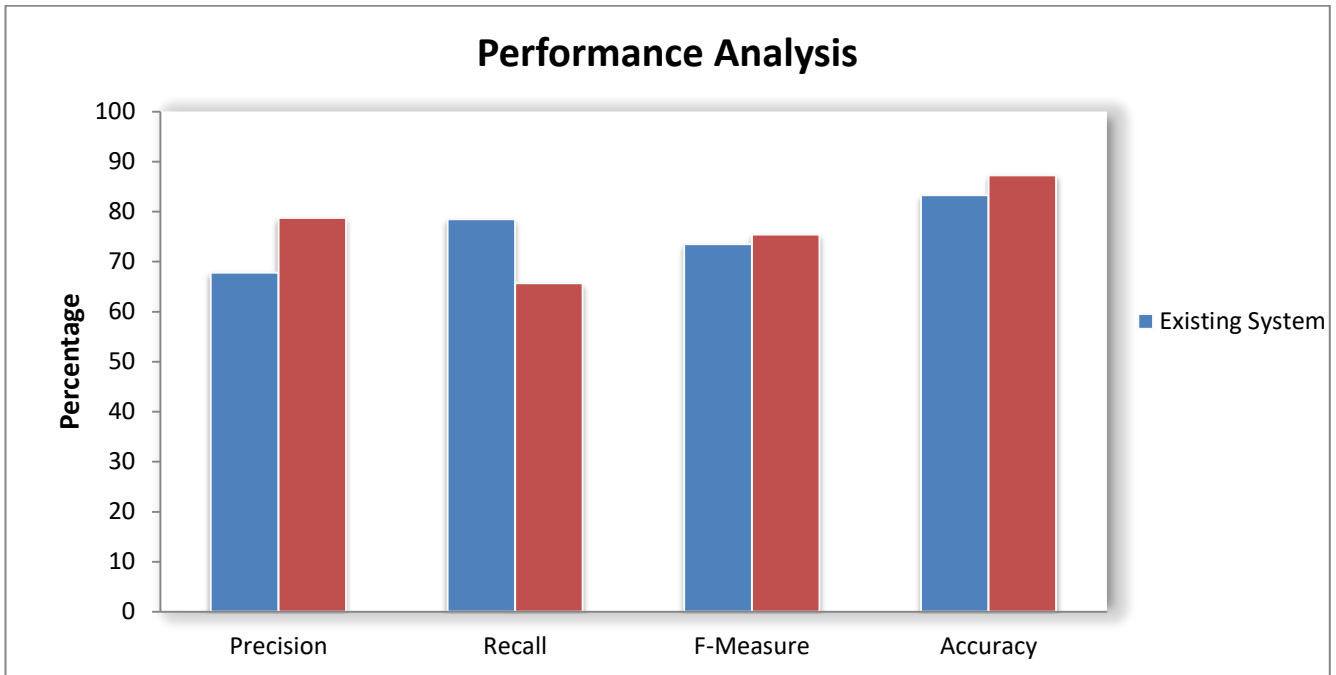
Figure 1. System Architecture

#### V. ALGORITHM

##### Random Forest

- The algorithm used here is Random Forest. Random Forest is the most popular and powerful algorithm of machine learning.
- Step 1: Assume  $N$  as number of training samples and  $M$  as number of variables within the classifier.
- Step 2: The number  $m$  as input variables to decide the decision at each node of the tree;  $m$  should be much less than  $M$ .
- Step 3: Consider training set by picking  $n$  times with replacement from all  $N$  available training samples. Use the remaining of the cases to estimate the error of the tree, by forecasting their classes.
- Step 4: Randomly select  $m$  variables for each node on which to base the choice at that node. Evaluate the best split based on these  $m$  variables in the training set.
- Step 5: Each tree is fully grown and not pruned (as may be done in constructing a normal tree classifier). For forecasting, a new sample is pushed down the tree. It is assigned the label of the training sample in the terminal node it ends up in. This procedure is repeated over all trees in the ensemble, and the average vote of all trees is reported as random forest prediction. i.e. classifier having most votes.

**VI. RESULTS AND DISCUSSION**



	Existing System	Proposed System
Precision	67.78	78.70
Recall	79.84	65.64
F-Measure	73.11	74.31
Accuracy	83.29	87.26

**VII. CONCLUSION**

The system focuses on the student academic growth analysis using machine learning techniques. For analysis Decision tree and random forest classifier are used. This process can help the instructor to decide easily about performance of the students and schedule better method for improving their academics. In future additional features are added to our dataset to acquire better accuracy.

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