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Artificial Intelligence (AI) to Predict Dental Student Academic Performance Based on Pre University Results

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The dental school admission process involves establishing criteria for evaluating applicants, weighing the various admission criteria, and then comparing applicants based on selected criteria and weighting. In the Kulliyyah of Dentistry, International Islamic University Malaysia (IIUM), admission is mainly based on matriculation cumulative grade point assessment (CGPA) results. Successful graduation from the Bachelor of Dental Surgery programme is assessed through four Professional Exams. This study aims to predict the academic performance of dental students based on their admission results using Artificial Intelligence. Machine Learning Algorithm is applied using academic result samples of graduates of the Kulliyyah of Dentistry, IIUM from 2016-2021. The dataset input variables will include student's gender, age during admission, scholarship, parents' level of education, pre-university result, Professional Exams result, and final CGPA. Dataset output variables include the number of repeat papers, repeat years, distinctions, and graduation on time. Exploratory Data Analysis will be performed with training and testing data. For modeling, several prediction models will be trained using neural networks. For evaluation, accuracy and prediction error will be calculated. Data will be analyzed statistically for each variable, visualized into graphical format, and the correlation coefficients computed. The expected result is accuracy in prediction of academic performance of students from Kulliyyah of Dentistry IIUM students based on admission results.

Keywords: dental admission, students' performance, artificial intelligence

ARTIFICIAL INTELLIGENCE

TO PREDICT DENTAL STUDENT ACADEMIC PERFORMANCE BASED ON PRE-UNIVERSITY RESULTS

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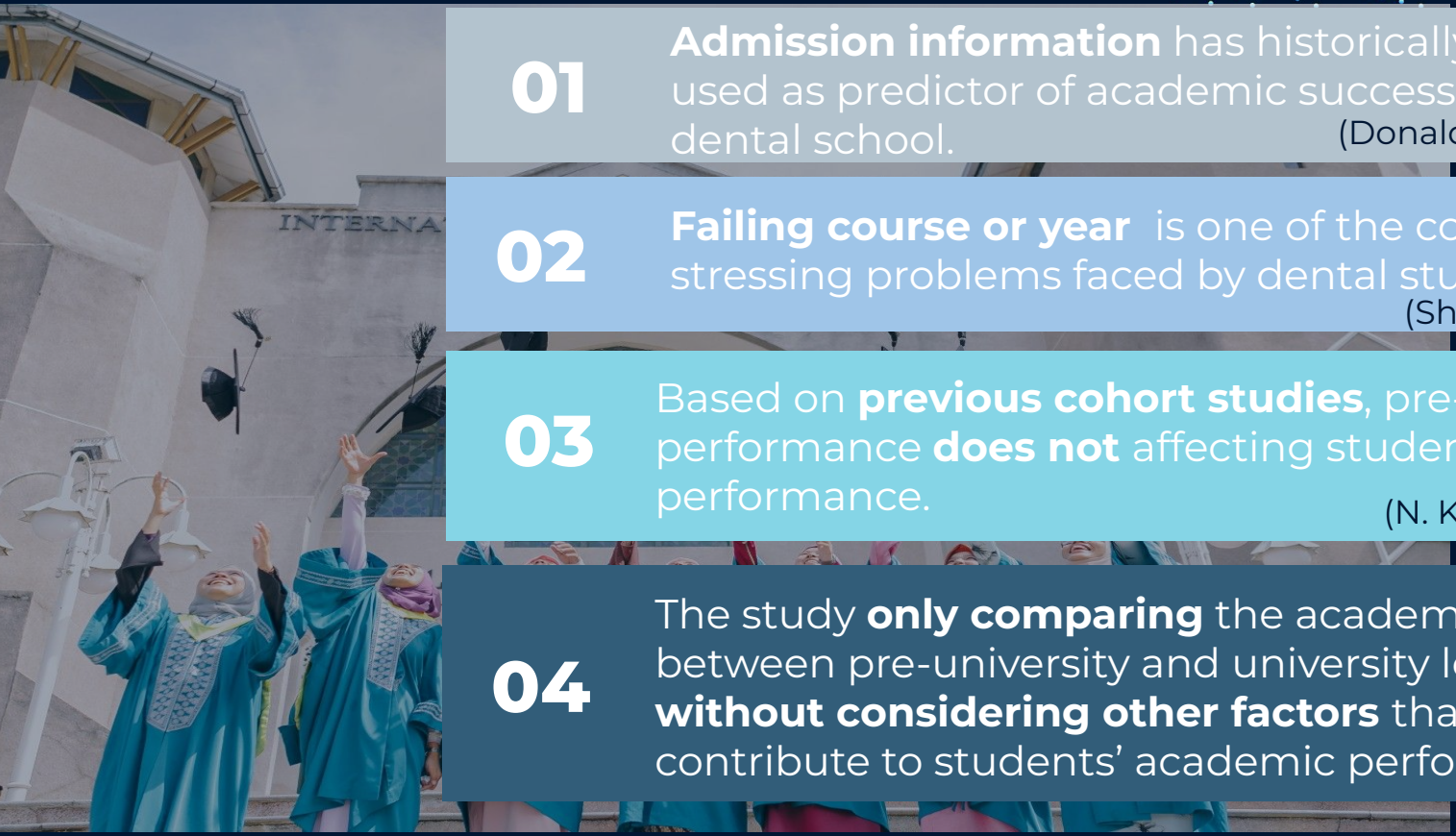
INTRODUCTION



01 **Admission information** has historically been used as predictor of academic success in dental school. (Donald, A. C. et al, 2007)

02 **Failing course or year** is one of the common stressing problems faced by dental students. (Shashidhar A., 2003)

03 Based on **previous cohort studies**, pre-university performance **does not** affecting students' university performance. (N. Kamal et al, 2015)

04 The study **only comparing** the academic results between pre-university and university level **without considering other factors** that may contribute to students' academic performance.

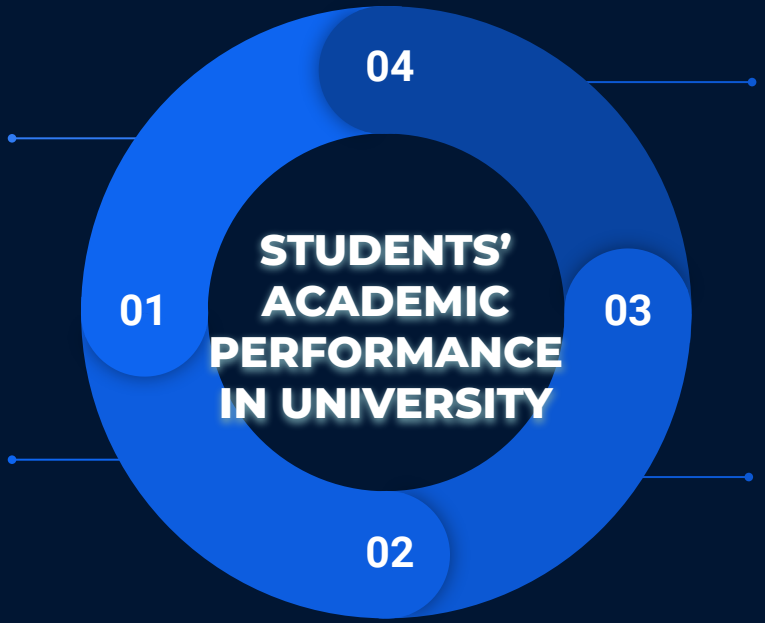
FACTORS CONTRIBUTING TO STUDENTS' ACADEMIC PERFORMANCE

STUDENTS' ABILITY

- Soft skills
- Language proficiency

PRIOR ACADEMIC PERFORMANCES

- Pre-university results



PSYCHOLOGICAL FACTORS

- Motivation, attitude, self-viability

DEMOGRAPHIC FACTORS

- Age, Gender, Nationality, Marital & Economic status
- Parents' occupation & level of education

(Florah K. Karimi, 2008 and S. Valli Jayanthi et al, 2014)

LITERATURE REVIEW

Previously, many **observational studies** had been conducted to discuss the comparison and correlation of pre-admission results with academic results at university level.

In a study by Asmar et al (2021)

- **Objective**: Investigating the correlation between high school GPA and graduating academic achievement for dental students.
- **Result**: Significant positive correlation between high school GPA and graduating cumulative academic achievement GPA of dental students.
- **Limitation**: Incapability to study other factors that could affect dental student's GPA.

However, there is limited number of **experimental study** on predicting academic performance of dental students based on pre-university results using **artificial intelligence**.

DENTAL PROGRAMME ADMISSION CRITERIA IN MALAYSIA

Set up by Malaysian Dental Council

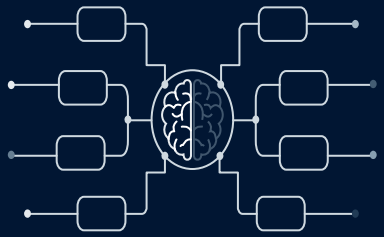
Pre- Tertiary Academic Qualifications

- Matriculation Certificate/ Foundation in Science
- GCE A level
- Malaysian Higher School Certificate (STPM)
- Other international pre-university certificates

ARTIFICIAL INTELLIGENCE (AI)

MACHINE LEARNING (ML)

A branch of computer science concerned with building smart machines that can perform tasks which typically require human intelligence.



The ability for machines to 'learn' information and patterns directly from data without being programmed explicitly.

Supervised & Unsupervised Learning

(H. Mahmood et al, 2020)

OBJECTIVES

To predict the academic performance of dental students based on their admission result using Artificial Intelligence (AI)

GENERAL

SPECIFIC

To provide dataset as input from socio-demographic, pre-university CGPA, professional exam results and final CGPA. (2016-2021)

To build a model that matches input data into the expected target values.

To give a training set containing where input consists of a vector variable representing a student and output indicates whether the student : pass, fail, pass with distinction, repeat paper, repeat year or graduate on time.

To predict the potential of academic performance based on given input.

RESEARCH QUESTIONS

Can **pre-university results be a good predictor for dental students' academic performance**?

What are the **dataset other than pre-university results** that are needed to predict dental students 'academic performance?

Can **Artificial Intelligence be an accurate predictor** for students' success in dental school?

What are the **suitable input data to create training set** for the prediction model?

How to **build a model** that can match input data with expected target values?

MATERIALS AND METHODS

01 ETHICS APPROVAL

IIUM Research Ethics Committee

02 STUDY DESIGN

Machine Learning Algorithm

Experimental Research

Study Participants: Dental Graduates Kulliyyah of Dentistry, IIUM (2016-2021)

03 DATA COLLECTION

INPUT VARIABLES	
VARIABLES	DESCRIPTIONS
X_0	Student's gender
X_1	Student's age during admission
X_2	Scholarship
X_3	Parents' level of education
X_4	Parents' occupation
X_5	Pre-university CGPA
X_6	Professional Exam I, II, III, IV result
X_7	Final CGPA

Demographic Data

EXAM GRADING SYSTEM

PERCENTAGE SCORE	GRADE	STATUS
80-100	A	PASS
75-79	A-	
70-74	B+	
65-69	B	
60-64	B-	
55-59	C+	
50-54	C	
45-49	D	FAIL
40-44	D-	
35-39	E	
0-34	F	

PERCENTAGE SCORE	STATUS
85-100	DISTINCTION

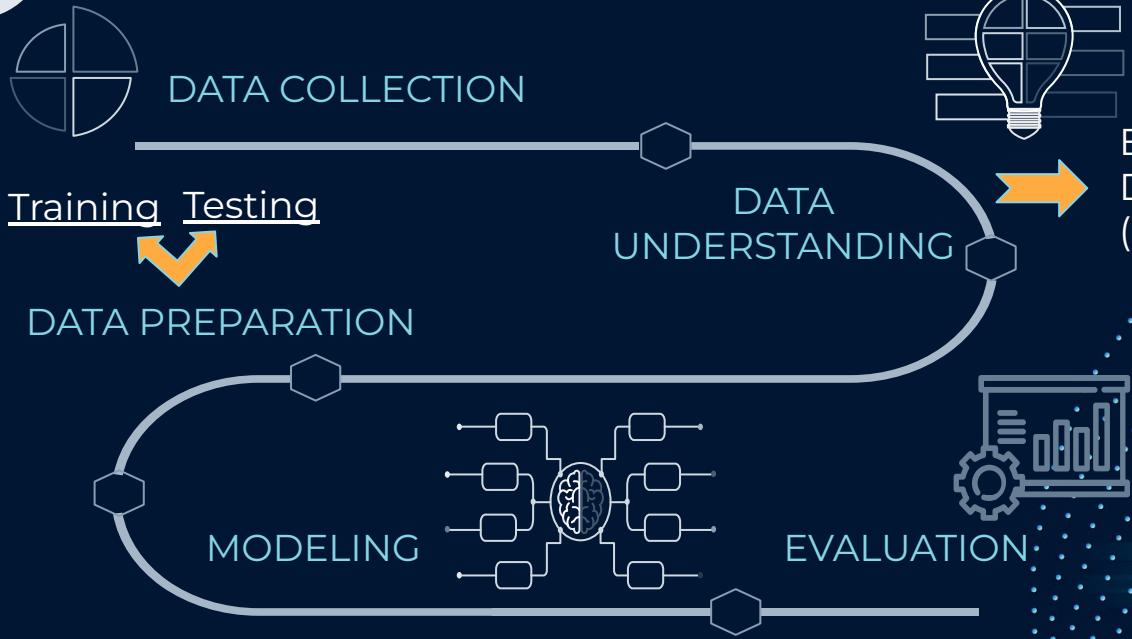
DATASET

OUTPUT VARIABLES

VARIABLES	DESCRIPTIONS
Y_1	No. of repeat paper
Y_2	No. of repeat year
Y_3	No. of distinction
Y_4	Graduation on Time

MATERIALS AND METHODS

04 EXPERIMENTAL PHASE



MATERIALS AND METHODS

05

DATA ANALYSIS

- Calculate statistical summary for each variable.
- Visualize the data into some graphical format (box-plot, bar chart)
- Compute correlation coefficient to find correlation between variables.
- Compare the prediction performance of machine learning algorithms using performance metrics.

Example of result (box plot)

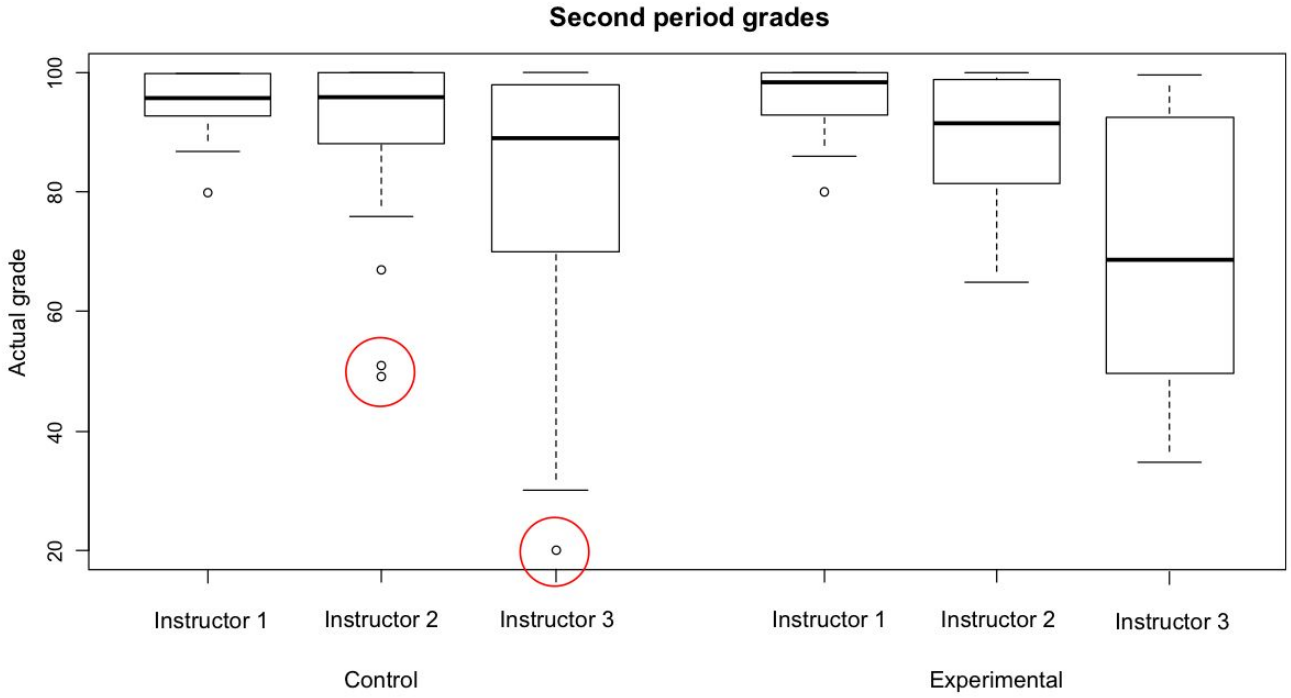
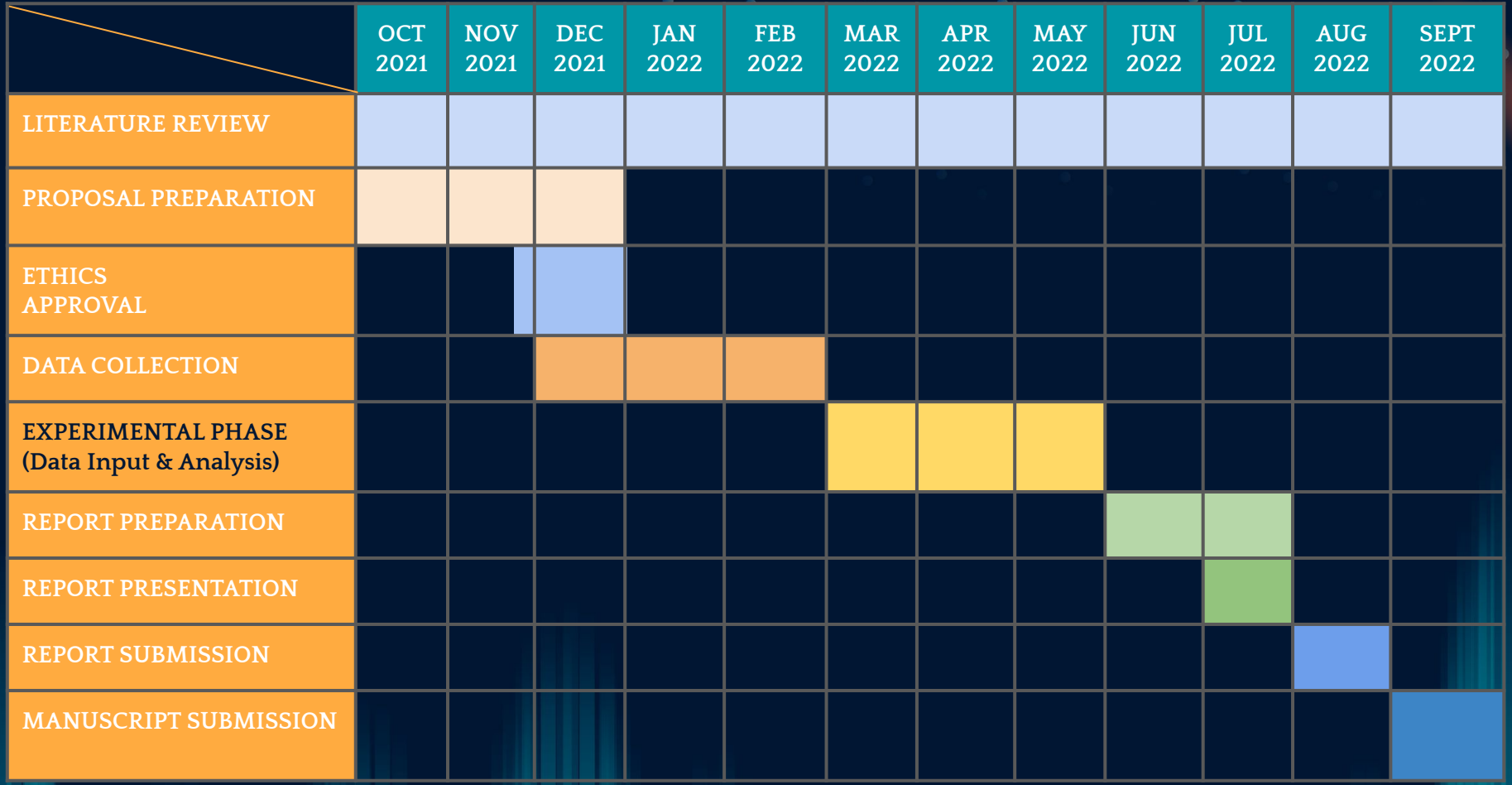


Figure 5. Comparative boxplots. Grades from the second period of the experimental and control groups. The horizontal line inside the boxes represent the median.

EXPECTED RESULT

At the end of this study, we expect to be able to predict the academic performance of KOD IIUM students based on admission result.

RESEARCH TIMELINE



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