การพัฒนาระบบสนับสนุนการตัดสินใจเพื่อทำนายการเข้าศึกษาต่อระดับปริญญาตรีในมหาวิทยาลัยของรัฐ โดยวิธีการเรียนรู้ของเครื่องและกระบวนการวิเคราะห์เชิงลำดับชั้น

THE DEVELOPMENT OF DECISION SUPPORT SYSTEM FOR PREDICTION OF NEW UNDERGRADUATE STUDENTS INTAKE IN GOVERNMENT UNIVERSITIES BY MACHINE LEARNING AND ANALYTIC HIERARCHY PROCESS

เจษฎาพร ปาคำวัง และดวงจันทร์ สีหาราช*

Jetsadaporn Pakamwang and Duangchan Siharad*

บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อพัฒนาระบบสนับสนุนการตัดสินใจและทำนายการเข้าศึกษาต่อในระดับปริญญาตรีในมหาวิทยาลัยของรัฐ ของนักเรียนระดับมัธยมศึกษาตอนปลายโดยวิธีการเรียนรู้ของเครื่องและกระบวนการวิเคราะห์เชิงลำดับชั้น การดำเนินงานวิจัย 3 ขั้นตอน คือ 1) การศึกษาเกณฑ์ในการตัดสินใจเข้าศึกษาต่อในระดับปริญญาตรีจากเอกสารงานวิจัยที่เกี่ยวข้อง และการสัมภาษณ์เชิงลึกกับครูแนะแนวในโรงเรียนระดับมัธยมในพื้นที่จังหวัดเพชรบูรณ์ จำนวน 30 คน โดยคัดเลือกแบบเจาะจงเพื่อสร้างโมเดลการตัดสินใจด้วยกระบวนการวิเคราะห์เชิงลำดับชั้น 2) การพัฒนาระบบ โดยบูรณาการการเรียนรู้ของเครื่องและกระบวนการวิเคราะห์เชิงลำดับชั้น เพื่อเพิ่มประสิทธิภาพในการสร้างทางเลือกในการตัดสินใจและทำนายผลลัพธ์ที่ดีที่สุด และการลดระยะเวลาการฝึกสอน และ 3) การประเมินประสิทธิภาพของระบบ โดยการเปรียบเทียบความถูกต้องในการทำนายผลลัพธ์ของอัลกอริทึมโครงข่ายประสาทเทียมหลายชั้น และอัลกอริทึมต้นไม้การตัดสินใจ ผลการวิจัยพบว่า โครงสร้างการตัดสินใจเอเอชพี ประกอบด้วย 10 เกณฑ์ และ 5 ทางเลือกกลุ่มสาขาวิชา ขั้นตอนวิธีการประมวลผลของระบบประกอบด้วย 10 ขั้นตอน และโมเดลต้นไม้การตัดสินใจที่มีการกำหนดโฟลด์ 5K, 7K, 8K และ 10K มีค่าความแม่นยำในการทำนายสาขาวิชาที่นักเรียนสนใจเรียนสูงที่สุด เท่ากับ 96.7 % อัลกอริทึม

คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏเพชรบูรณ์ อำเภอเมือง จังหวัดเพชรบูรณ์ 67000

Faculty of Science and Technology, Phetchabun Rajabhat University, Muang District, Phetchabun Province 67000

*corresponding author e-mail: kob_siharad@pcru.ac.th

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ต้นไม้การตัดสินใจมีระยะเวลาเฉลี่ยในการประมวลผลเพื่อฝึกโมเดลเร็วกว่าอัลกอริทึมโครงข่ายประสาทเทียมหลายชั้น เท่ากับ 1.33 วินาที

คำสำคัญ: ระบบสนับสนุนการตัดสินใจ การทำนาย การเข้าศึกษาต่อในมหาวิทยาลัย การเรียนรู้ของเครื่อง การวิเคราะห์เชิงลำดับชั้น

Abstract

This research aims 1) to study the students' decision data for studying in the government universities, 2) to develop the decision support system and prediction for studying in the government universities by integrating the machine learning and the Analytic Hierarchy Process (AHP), and 3) to assess the system performance. This research was classified into 3 steps: 1) studying the decision criteria for studying in the government universities from related documents and research and in-depth interview with 30 guidance teachers in high schools in the areas of Phetchabun Province by purposive sampling for creating the AHP decision model, 2) developing the system by integrating the machine learning and the AHP for improving performance in creating decision alternatives and predicting the best results and reducing the training time use, and 3) assessing the system performance by comparing the accuracy of the multi perceptron neural network algorithm and the decision tree algorithm. This research found that the AHP decision structure consists of 10 criteria and 5 alternative subject majors. The algorithm of system processing consists of 10 steps and the decision tree with fold 5K, 7K, 8K and 10K which have highest accuracy in predicting subject major according to students' attentions at 96.7%. The model training by the decision tree is faster than the MLP 1.33 seconds but the model testing by MLP is faster than the decision tree.

Keywords: Decision support system, Prediction, Study in university, Machine Learning, Analytic hierarchy process

Introduction

Recently, most universities in Thailand have problems with a continuous decline in the student number, which affects not only the teaching and learning management but also the management of the university's budget and expenses. In other words, the successful birth control rate of Thai government causes the student

reduction. In the past 10 years, there were approximately 1.1 million new born babies per year, but nowadays it is reduced to 7 hundred thousand a year. During years 2010-2031, the population in all ages and students in the educational system has tended to decline steadily. Overall, although almost students in all levels decreased, the number of educational establishments has not decreased. In spite of a tendency for the smaller institution size, educational establishments have increased (Office of the Education Council, 2017). This situation directly affects universities because nowadays students have many options. For example, the Thai University Central Admission System (TCAS) and special quotas from universities draw students to apply for studies since they have not completed the twelfth grade. The universities use this strategy in order to adapt for survival. On the other hand, some universities do not have prepared plans in this section and lead to no applicants to study. Therefore, they have to deal with the problems that some disciplines do not have enough students to open their courses and may result in the closure of the university.

If a system is available to support decision-making and predict admission to a bachelor's degree in a university, it is advantage for undergraduate students who will be able to use the processed information in planning the selection of faculties/disciplines which are suitable with their preferences, aptitudes, and potentials. In addition to benefit to students, universities can adopt the results from the system in order to plan for curriculum development and prepare resources for promoting study. Therefore, learning materials are sufficient in order to meet the number and need of learners who will continue to study in that academic year. Currently, educational institutions in Thailand still lack a decision supporting system, artificial intelligence for the academic institutional management, and information data for students' further study plan. Consequently, all high school students' future depends on choosing a suitable place to study after graduating from high schools. Regarding data evaluation, Pakamwang et al. (2020) used Artificial Neural Network (ANN) and Decision tree techniques to demonstrate that factors affecting students' decisions to study at Phetchabun Rajabhat University could be university reputation, parental income, numbers of disciplines, university location, parents' occupation, and disciplines' state of the art, respectively. The accuracy of data analysis by using Artificial Neural Network (ANN) and Decision tree techniques was 93.00%

and 88.25%, respectively. In 2020, Kasap et al. (2020) developed knowledge to drive the decision of students' admission to universities or colleges in Kuwait and found that most graduated students from high schools could not choose the right study path due to the increasing number of universities or colleges; as a result, the decision supporting tool should be developed to help new graduates choose the best university or college based on their preferences, suitability, and a variety of criteria suitable to the needs of the students. This tool was developed by Analytic Hierarchy Process (AHP) (Kasap et al., 2020). In this study, we designed to use AHP for generating the decision supporting tool to encourage students to further study in undergraduate level or government universities. In contrast to Kasap (Kasap et al, 2020), AHP in this study integrated with the other prediction technique of machine Learning having instructor with data classification algorithms, such as Artificial Neural Network and Decision tree techniques. To create data set shipped into generating decision process and information prediction, these techniques were combined with only some of the feature selections suitable from all features by using Feature Selection of Greedy (Alexander, 2018). The design of an integrated processing method between AHP, machine Learning and feature Selection provides information that is an informed choice for prioritized decision-making, so the system offers more options than predicting just one discipline. Sael et al. (2019) used AHP technique to analyze students' profiles. For applying many techniques in the decision-making tasks, machine learning, data mining and, multi-criteria analysis techniques have contributed to develop the applications in this field. Kumar et al. (2012) proposed to classify the alternatives that slow down student absenteeism in engineering schools using Fuzzy AHP.

Data science is the discipline that allows the exploration and analysis of data to extract useful and relevant information for decision making and problem solving. In the educational domain, human experiences need to be synthesized to improve the success rate and help the responsibility make the best- informed decision. Analytic Hierarchical Process (AHP) is one of the most widely used multi-criteria analysis techniques in decision making. It allows building models for various problems even in the case of insufficient observation data. This paper aims, benefit from the potentials of AHP technique, to analyze students' profiles. Our objective is to detect and classify

the most important factors that increase Moroccan student dropout and failure. We expect that this study is the first one that explores AHP, studying the Moroccan context and describing student profiles depending on various criteria. It reveals, on the one hand, that Moroccan student failure is strongly related to their family and behavioral characteristics. Indeed, lack of motivation, family instability and lack of responsibility are the top three factors causing failure at the university. On the other hand, student dropout is strongly related to studying context, namely the lack of orientation and repeated failures in modules. These findings will enable the decision makers to develop adequate solutions to overcome these two scourges.

By recommending several appropriate subject options, learners could choose a more suitable field for themselves. In addition, this research has obtained methods for enhancing efficiency in data science to select samples, especially in certain classes in the area of interest or in a top priority weight. The techniques in this study were used to form a prediction model for the field of study that students are interested in further study. As a result, the dataset adapts itself to be more concise and to the point. In order to construct a model, training for teaching is done faster. In agreement with Ahmad (Abdulla et al, 2019), AHP integration and the model for data classification simplify the selection process to select the producers. It can also help reduce the information in files used in order to make predictions and decisions. In this regard, the implementation of this research benefits both students and universities use as a technology tool in planning policy decisions, prepare educational resources, and promote admission to bachelor's degree programs to match learners' preferences and aptitudes through the online service system.

Materials and Methods

This research operation steps were divided into 3 steps as follows:

Step 1: The study of students' decisions to study at the bachelor's degree level by dividing the work process into 2 subsections as follows.

1.1 The study of the criteria for admission to the bachelor's degree

The researchers studied the decision criteria to study for the bachelor's degree from related research papers and profoundly interviewed 30 guidance teachers in high schools in Phetchabun province. The criteria used for the development of the decision supporting tool were divided into 4 groups of information. Total of 42 criteria,

the names of the groups were as follows: 1) general basic information consisting of 6 criteria, 2) aptitude, preference, and personal ability consisting of 4 criteria, 3) opinions to the university consisting of 29 criteria (Tanawan, 2014), and 4) interest in choosing to study at the university consisting of 3 criteria.

1.2 Developing an Admission Decision System for undergraduate Studies with AHP technique

We approved 42 decision criteria mentioned in item 1.1 to build online questionnaires and gathered data from 532 students who applied to study only in Phetchabun Rajabhat University for Academic Year 2020. After we had finished data collection, all information was entered in attribute selecting process with Greedy Stepwise. At the next step, 10 attributes were used to establish criteria in a hierarchical decision-making (AHP) model. The model was fused with 5 disciplines being used to determine the choice in decision-making: 1) science group, 2) education group, 3) agriculture group, 4) law group, and 5) business administration group.

Step 2: Development of a Guidance Prediction System for undergraduate Admission Decision by integrating machine learning on a hierarchical analysis process.

We developed the system using compute integration between AHP hierarchical decision-making processes and machine learning. AHP arranged the rank of the classes suitable for the learners to submit predict answers with supervised learning machines, such as the Multi Layer Perceptron (MLP) algorithm, which is a neural network algorithm with multiple layers. The approach is commonly adapted to estimate the non-linear relationship between input and output by adjusting the weight of the input layer, which is composed of the main steps: feedforward and Backpropagation (Sillapa et al., 2017). Also, Decision tress algorithm, which is similar to tree structure, has “top-down recursive divide-and-conquer” organization. For considering the learning series, they are composed of training data, a set of records of information that each record containing a set of different attributes, and attributes indicating the category of that record data. During tree structure building process, the data were divided into subsets, and machine Learning predicted the results of the study most suitable for the learners. Samples were only used in certain datasets in AHP process-rated classes for more specific training and

modeling purposes. It also helped reduce the time spent on training from data outside the area of interest.

Step 3: Evaluation of the Performance of Guidance Prediction System for undergraduate admission decision by integrating machine learning on a hierarchical analysis process.

The researchers assess the effectiveness and accuracy in predicting the decision to study at the undergraduate level by comparing the capabilities of the data classification algorithm using MLP and decision tree. For student decision-making dataset process, a total of 532 data samples was filtered out from the interesting classes by using AHP, the researchers achieved 320 samples of performance data for test.

Then the researchers divided the training and test datasets and measured the performance of samples in the predictive models by employing the K-fold Cross Validation method, which were divided the data sets into K sets equally. After data segregation, there were all trials for K times, and the efficacy is measured for every trial round (Euawattanamongkol, 2014). Finally, the researchers summarized the accuracy of the two algorithms' answer predictions. By using the Confusion Matrix concept to collect the number of rows classified from real data and prediction groups (Sinsomboontong, 2015), true positive (TP) was the number of students, who chose to study in a field they were interested in or field of study they wanted to actually study. On the other hand, the predictive model for choosing to study, true negative (TN) was the number of students, who preferred to study in a field they like or a field of study they actually wanted to study. However, for the predicted model that they do not choose to study, false positive (FP) was the number of students, who made a decision to study in a field they like or they wished to study. Then the predicted model concluded that they did not choose to study, while and false negative (FN) was the number of students, who selected in order to study in a field they like or a field of study they were interested in studying.

Results

The researchers conducted this research, and the results could be summarized according to the objectives as follows:

1. Results of education, information, decision-making, and admission are to the bachelor's degree of students. The results of the selection of outstanding characteristics

with Greedy Stepwise technique were obtained with 10 attributes, namely 1) gender, 2) parents' career, 3) domicile 4) study plan while they were studying in the high school level (Highschool_curriculum) 5) academic results after they graduated from high school (GPA) 6) subjects that they had enjoyably learned and had the greatest aptitude (Favorite_subject_aptitude) 7) talent or preference to do activities while they were studying at the high school level (talent). 8) interests in areas they like (Department_study) 9) career expected upon completion of higher education (Expected_career), and 10) reasons for choosing to study at Phetchabun Rajabhat University (Reasons_deciding_ study). The 10 attributes including study disciplines were used as alternatives in decision making for total 5 classes which could be used to design decision structure with AHP. The design decision structure consists of 3 main stages as follows: difficulty in making decisions (Problem domain), Decision criteria (Criteria), and Choice of decision layer (Alternative). AHP is one of the methods used in the analysis to decide the most suitable alternative (Saaty, 1980) as shown in Figure 1.

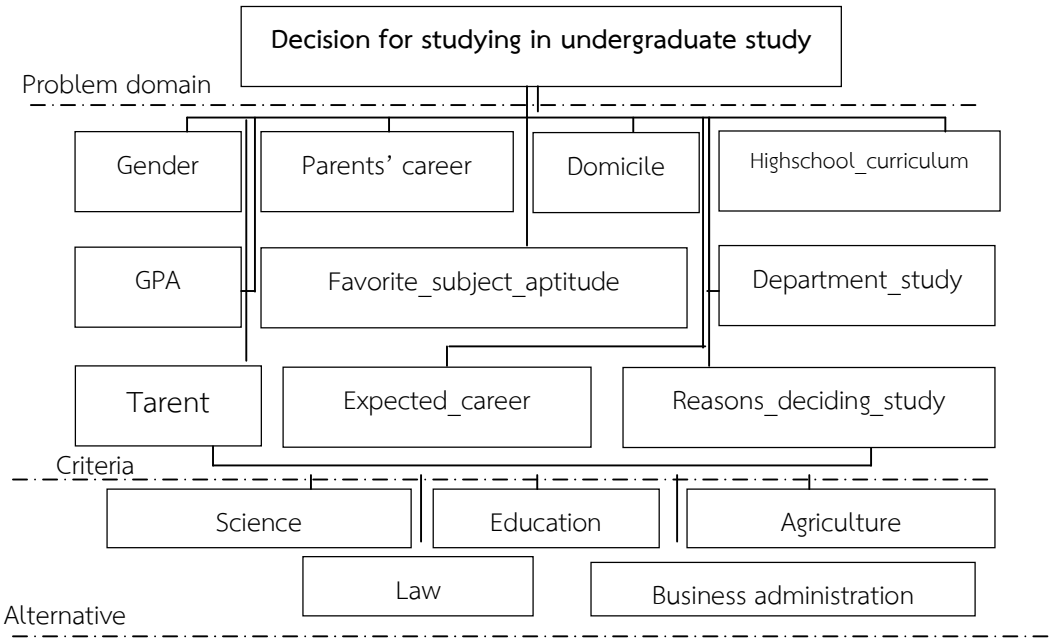

Figure 1 The AHP structure of Decision for studying in undergraduate.

Based on Figure 1, AHP decision making structure in problem domain level was the decision in order to enter an undergraduate degree. Criterion level for making decisions consisted of 10 criteria, which were associated with 10 attributes selected from Greedy stepwise technique. The bottom level was the alternative level. It was composed of fields of study offered at the university where students could choose from 5 disciplines.

2. By integrating machine Learning on an analytic hierarchical process, guidance prediction system of making decision for undergraduate admission was developed.

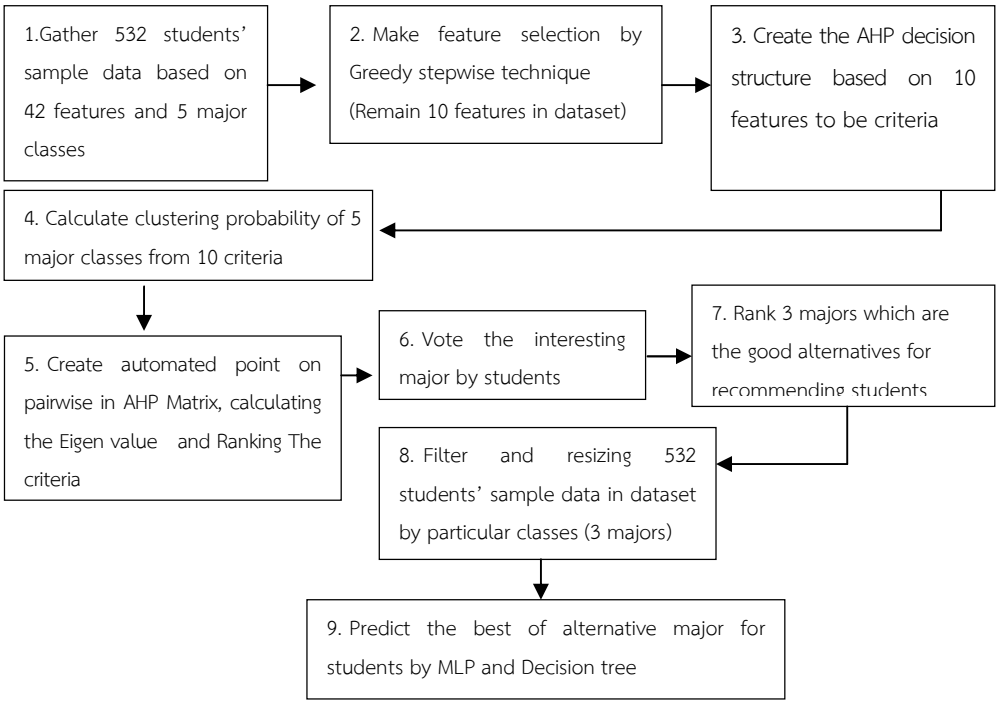

Figure 2 The algorithm of integrating the machine learning on AHP in students' decisions to study in universities

Figure 2 shows machine learning integration algorithms on analytic hierarchical processes in deciding to study for a bachelor's degree. The 9 steps for utilizing the algorithm of integrating the machine learning on AHP were as follows: 1) information was built from decision-making data of 532 students with 42 attributes and 5 major classes; 2) By employing Greedy stepwise procedure, the predominant attributes were

reduced to 10 attributes in dataset; 3) AHP structure was developed as shown in Figure 1; 4) For grouping 5 disciplines, the probability was calculated from 10 criteria; 5) automated point on pairwise in AHP matrix was generated, and then we calculated Eigen value and ranked the criteria; 6) the interesting majors by students were voted; 7) the 3 first good alternatives for recommending students were ranked; 8) by particular classes, dataset was filtered and revised 532 students' information; and 9) by MLP and Decision tree methods, the best Prediction of alternative major for students was established.

In this regard, the method for calculating the probability of 5 disciplines from 10 criteria can be described as in Table 2.

Table 2 The calculation method of probability in clustering 5 major classes from 10 criteria

Gender	Parents' career	GPA	...	...	...	...	...	...	...	Major Class
1	Teacher	2.98	...	...	...	...	...	...	...	Education
2	Nurse	3.10	...	...	...	...	...	...	...	Medical science
2	Farmer	2.80	...	...	...	...	...	...	...	Agriculture
1	Teacher	2.87	...	...	...	...	...	...	...	Education
2	Merchant	2.62	...	...	...	...	...	...	...	Education

Among students, Table 2 shows an example of the calculation of the probability of grouping the interesting study. Based on gender properties, new information was sorted according to the subject, which was Gender (1, 1, 2) Major Class (Education, Education, Education). The highest number in Cluster Education was male (1), the probability of this item was 2 out of 3 or 0.67, while according to both Cluster Medical Science and Cluster Agriculture, the percentage of female students preferring to study was 100%. Then we calculated the average of the probability in order to determine the importance of the gender criteria, which influenced the decision equally to (0.67+1+1)/3 or 0.89. For GPA criteria, the GPA levels were adjusted to low GPA level (2.00-2.49), intermediate GPA level (2.50-2.99), and advanced GPA level (3.00-4.00) in order to make probability determination more convenient.

Based on the technique obtained from Table 2, it could be used to automatically crossover each criterion pair of criteria in the AHP model matrix system as shown in Table 3.

Table 3 The calculation of giving automated pairwise important point on the AHP matrix

Criteria	Gender	Parents' career	GPA
Gender	1	0.89/0.89 = 1	0.89/1 = 0.89
Parents' career	0.89/0.89 = 1	1	0.89/1 = 0.89
GPA	1/0.89 = 1.12	1/0.89 = 1.12	1
Sum	3.12	3.12	2.78

From Table 3, datasets were performed a crossover division of scores across various criteria by considering the criteria in each row and then divided by the score in each column. Finally, the results were reflection value (Mirror) in the criteria divided among themselves.

After mentioned steps above, AHP could be performed calculations according to AHP procedure in order to determine the weight of the importance of all 10 criteria. In order to decide fields of study which were necessary at the bachelor's level, all 10 criteria were important, especially 3 criteria having the 3 top scores as shown in Table 4.

Table 4 The result of calculating important points of all criteria in AHP Process

Criteria	Gender	Parents' career	GPA	Weight	Order
GPA	0.36	0.36	0.36	0.36	1
Gender	0.32	0.32	0.32	0.32	2
Parents' career	0.32	0.32	0.32	0.32	2
Sum	**1**	**1**	**1**	**1**	1

From Table 4, Consistency ratio (C.R.) of AHP model was equal to 0.087, which was an acceptable value. If C.R. value is accepted, it should be < 0.1 (Saaty, 1980). At this step, weight values of decision criteria were as follows: 1) GPA was equal to 0.36; 2) Gender and Parents' career were equal to 0.32.

Weight values of AHP model were shown as in Table 4. In order to process the grading of disciplines suitable for the students, the system in this study was designed to import the student's vote data towards the 5 disciplines offered at the university. By assigning a 1-5 score for students to consider whether their own academic performance, gender, and parent's occupation suitable for various disciplines, the votes were

multiplied by the weight score according to the criteria as shown in Table 4 in order to recommend a suitable field of study for students. For instance, Ms. A is a female, a child with a high academic level, gave herself a grade with a subject in science, which was equal to (4x0.36)+(4x0.32)+(3x0.32)=3.68 scores. For this AHP's calculation processes, we used the weight scores by specialists' assessment to multiply with the students' votes for selecting disciplines. This process method is according to Siriwilailerdanun (2020) used AHP for plaining the bicycle's routes in the Lanna border areas. AHP is used to proceed the specialists' weight score for ranking the bicycle tourism criteria and calculating it with tourists' vote score for offering the popular bicycle's routes. For different disciplines, votes could be calculated in the same way and then ranked the subject areas to guide students' decisions as a top three choice. The developed process at this step would possibly reduce the size of the number of data samples in the dataset used to train the classification algorithms. Only three major classes within the real focus of the student group achieved through the AHP process were submitted in order to retrieve a partial dataset with interest-based classes, without having to use all the information from all classes to teach. This new technique could enable even greater efficiency in creating predictive recommendations for the selection of three subject areas to present to learners. Compared to the new method in this study, the previous approach predicted only one field students could not choose to decide, and the new system would be processed to train the algorithm from some specific snippets, which were only those classes of interest. Therefore, the new system would process faster.

The development of machine learning models in predicting student subject selection with MLP and Decision tree algorithm was designed in order to filter dataset belonging to the class or field of study of interest. The results obtained from the AHP process summarize the modeling method as follows.

1. MLP conducted an experiment with K-Fold Cross Validation method by adjusting the value from 2K upto 10K and modifying some parameters, such as the class receives the input of 10 nodes, Layer data out of 5 nodes, Neuron layer hidden number (10 + 5)/2=7, Node learning rate value 0.3, and Number of learning cycles 500.

2. Decision tree was employed with K-Fold Cross Validation technique by revising the value from 2K upto 10K and varying some parameters, such as confident Factor value 0.25, Minimum object 5, and Folds values from 2K upto 10K.

3. By integrating machine learning on a hierarchical analysis process, Table 5 shows the results of the evaluation of the effectiveness of the guidance prediction system on the decision to study at the bachelor's degree level.

Table 5 The result of prediction performance assessment by MLP and Decision tree

K-Fold	True Positive (%)		False Positive (%)		Accuracy (%)		Incorrectly (%)		Training time usage (second)		Testing time usage (second)	
	MLP	Decision tree	MLP	Decision tree	MLP	Decision tree	MLP	Decision tree	MLP	Decision tree	MLP	Decision tree
2K	0.907	0.937	0.023	0.026	90.7 %	93.7 %	9.3 %	6.3 %	16.69	1.45	0.34	1.21
3K	0.930	0.960	0.017	0.012	93.0 %	96.0 %	7.0 %	4.0 %	16.61	1.65	0.50	1.34
4K	0.925	0.958	0.019	0.016	92.5 %	95.8 %	7.5 %	4.2 %	16.70	1.50	1.07	1.93
5K	0.937	**0.967**	0.015	**0.009**	93.7 %	**96.7%**	6.3 %	**3.3%**	16.19	1.24	1.25	**1.98**
6K	0.923	0.965	0.019	0.010	92.3 %	96.5 %	7.7 %	3.5 %	16.91	1.33	1.45	1.99
7K	0.949	0.967	0.013	0.009	94.9 %	**96.7 %**	5.1 %	3.3%	16.44	1.17	1:58	1.68
8K	0.939	0.967	0.015	0.009	93.9 %	**96.7 %**	6.1 %	3.3 %	16.27	1.43	2.16	1.82
9K	0.946	0.963	0.013	0.012	94.6 %	96.3 %	5.4 %	3.7%	16.90	1.23	2.39	1.90
10K	0.951	0.967	0.012	0.009	**95.1 %**	**96.7 %**	4.9 %	3.3%	**16.73**	**1.00**	2.51	1.72
Averag	**0.934**	**0.934**	**0.934**	**0.934**	**93.41%**	**93.41%**	**6.59%**	**6.59%**	16.60	1.33	1.31	1.73

From Table 5, Decision tree model with defining Folds 5K, 7K, 8K and 10K, the highest accuracy in predicting the interesting subject area of the students was 96.7%, and Decision tree model was more accurate than the MLP model with 10K Folds designation. Compared to Decision tree model, the highest accuracy in predicting the interesting subject area of the students was 96.7% for MLP model. The Decision tree had 1.33 seconds averaging time to train the model faster than the MLP; however, MLP has a mean time of execution to test the model is 1.31 seconds faster than the Decision tree.

Discussion

According to the results in this study, Decision tree algorithm provided the highest performance of prediction or data classification. Decision tree characteristic was extract knowledge or search the main features of studied dataset to build a relationship function or model for kind, type, and group identification from various properties of existing data. Classification is supervised learning or a target-aware classification by specifying or defining the type of information to be classified in advance.

The function or model construction for the classification requires mathematical, statistical or artificial intelligence tools in order to analyze data (Rokach & Maimon, 2015).

Multi Layer Perceptron (MLP) algorithm are efficiently used for complex tasks with a training process having an instructor (Supervise) and using the procedure to send the value back (Backpropagation). For practicing the process of sending back values, the process consists of 2 subsets, which are Forward Pass and Backward Pass. For Forward Pass process, the information passes through the neural network at the input layer and is passed from one layer to the other until it reaches the exit layer. In contrast to Forward Pass process, weight values in Backward Pass process are adjusted according to Error-Correction rule. In other words, the difference between Actual Response and Target Response is an Error signal, which is sent back into the neural network in the opposite direction of the connection, and the connection weight value is adjusted until the actual response approaches the target response (Witten et al., 2017).

Based on theory mentioned above, integration with Analytic Hierarchy Process: (AHP) is an effective method and widely used in research today, while Algorithms supports information classification and provides results in selecting data. For instance, wine is selected based on different attributes (Thakkar et al., 2016). Also, AHP algorithms combined with Machine learning algorithms improve the ability of tools in order to make decisions and predict outcomes. Machine learning can be used to learn to adjust weight from probable relationships and dependencies within the input and without the need to establish a specific connection between input nodes (Kamps & Zargani, 2018). The integration of the two technologies enables us to present decisions and make predictions more in line with user data characteristics. This study demonstrates a new concept of filtering samples for use in scaled down prediction models and more consistent with the problem.

Without having to use all the information from all classes to be used to train the model, this new method ships a class in the field of study in the real interest of the student group, which is obtained from the AHP process to retrieve a partial dataset of the class according to interest. Therefore, it is suitable for where the dataset contains too many or various multiple subjects. The results show that Decision tree algorithm, set at Folds 5K, 7K, 8K, and 10K, is able to predict the most accurate interesting subject areas.

By using the techniques demonstrated in this study to reduce some variable, variable manipulation may be required for certain classes to predict the interest of learners. Particularly, some faculties or disciplines have experienced a decrease in students. Also, faculty members are not enough for the number of students. Machine learning, such as MLP algorithms, can be used to determine the best alternatives to AHP models (Harianja & Lumbantoruan, 2018). It also helps expand the predictive results of the answers in the field of study. So, students can have 3 or more disciplines to study, instead of one choice. This gives students the option to decide whether to study in other areas of interest.

Conclusions

In this study, the new method was established to prioritize and suggest options in the interesting subject area for high school students. In addition to prediction of interesting disciplines, it can reduce the number of data samples used to train the classification algorithms and is possible to identify the classes truly interest the student group from the AHP process, which brings it into training with machine learning. Decision tree algorithm, set at Folds5K, 7K, 8K and 10K, demonstrate that the highest accuracy prediction of interesting subject areas of students was 96.7%. The decision tree algorithm having a mean processing time to train the model faster than a Multi Layer Perceptron (MLP) algorithm was 1.33 seconds; however, MLP having a mean time of execution to test models seconds faster than the Decision tree model was 1.31 seconds.

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