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Prediction Of College Student Achievement Based On Educational Background Using Decision Tree Methods

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Abstract

College student as a product can be used as a reference to show the success of education. This research will build a system prediction of college student achievement based on educational background using decision tree method.The research will be conducted on students of Informatics Engineering Department, Faculty of Engineering, University of Nusantara PGRI Kediri. The objective of this system is to help the new admissions process in the selection of students is based on the predicted results of student achievement and help the department to classify new students based on educational background. The method used to predict student achievement is the algorithm C4.5 decision tree method using several criteria based on the educational background of students before, they are the uan mathematical value, the uan Indonesian value, the uan English value, the majors in the school, and the average report cards in the school of origin. This system will be made based on the web to be more effective, fast and easy to use. This system will produce predictions of student achievement information on Informatics Engineering.

Keywords*: decison tree, c.45 algoritm method, web*

1. Introduction

Higher education as one of the business institution engaged in education services can not be separated from the globalization. Trend change education and free movement of science and technology is one important aspect of globalization will touch the field of education [1].

The college is academic education provider for students [2]. College student as a product can be used as a reference to show the success of education. Student achievement can be seen based on the grade point average (GPA) of student.

The success of student achievement is influenced by several factors, among these factors is the educational background that is owned by a student before, that school achievement of origin, national test scores, accreditation of schools and school departments of origin. The causes of the failure of student achievement is the incompatibility of previous educational background with a department base of the college.

University Nusantara PGRI Kediri is a private university in Kediri has five faculties, including the Faculty of Engineering, which has five departments that is; Information Engineering, Mechanical Engineering, Electrical Engineering, Industrial Engineering and Information Systems. Based on the amount of existing departments at the University of Nusantara PGRI Kediri then needed a system that could help predict student achievement when entered on one of the departments.

The decision tree is a classification and prediction method that is powerful and famous. Decision tree method change the fact that a very large into a decision tree that represents the rule. Rules can be easily understood by the natural language [3].

The research will be conducted on Informatics Engineering Program to help predict the achievement of students who will go into the study program. Prediction method is the method of decision tree. Expected results of this system can help the process of selection of new admissions in Informatics Engineering Program so that the future can improve student achievement of learning outcomes and student achievement can avoid failures caused by the incompatibility of educational backgrounds.

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Based on the description above is the background of the problems in this study will be made of a system that can predict student achievement based on his educational background using a decision tree.

The problems can be formulated in this research are how to create a system that can predict student achievements based on educational background and how to apply the method of C4.5 decision tree algorithm to predict student achievement and accurately.

The purpose of this research is to improve student achievement of learning outcomes in Information Engineering Program Faculty of Engineering, University of Nusantara PGRI Kediri.

Benefits and contributions of this research are helping new admissions committee in the selection of new students based on the results predicted student achievement, assist the department to classify new students based on the results predicted student achievement, helping students to determining the direction of the predicted outcome achievement by the educational background.

2. Research Method

The method for the development of systems that will be created using the concept of the waterfall method. The following is a stage of the research methods to be performed.

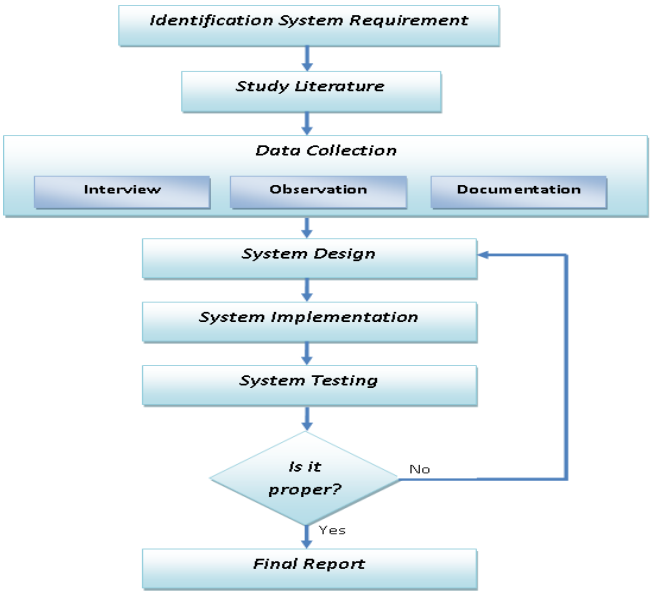

Figure 1. Stages Methods

Figure 1 the stages of research methods broadly described as follows:

a. Identification System Requirements: At this stage, the analysis of the needs of both software and hardware systems.
b. Study Literature: At this stage, the process of extracting information and study materials relating to research to be done, the materials studied are sourced from the relevant journals and books related to the research.
c. Data Collection: In this phase also carried out the data collection process by conducting interviews, observation and documentation of the data - the student data is needed. This stage will produce a document user requirements or data relating to the wishes of the user in the manufacturing system. This document will be the reference in the design stage of the system.
d. System Design: System design requirements will translate requirements into a software design before coding is made. In this process created the software architecture design, data structures, interface representations, and procedural algorithms.

e. Implementation: At this stage of the design process of translation into the language that can be recognized by the computer. In this process do the programming (coding) in accordance with the system. The programming language used in this system is PHP, the database used to store data is MySQL.
f. System Testing: In this stage testing of the program that was created by conducting tests on all functions and modules in the system.
g. Final Report: At this stage, the results of the report creation system manufacture.

3. Results and Analysis

Consists of three processes, they are process of the calculation method of decision tree algorithm, system design process and implementation process.

3.1. Decision Tree Algoritm

Process in the decision tree are changing the shape of the data (table) into tree, changing the model tree into a rule, simplify rule (pruning) [4]. Several algorithms can be used in the formation of decision tree among others ID3, CART and C4.5. C4.5 algorithm is the development of algorithms ID3 [5]. In general, the C4.5 algorithm to build a decision tree is as follows select an attribute as root, create a branch for each value, for the case in branch, and repeat the process for each branch until all cases the branches have the same class [6].

Table 1. Training Data

NAME	UAN VALUE	MAJORS	REPORT AVERAGE	ACHIEVEMENT
Adi Nurcahyo	Lulus	IPA	Lulus	Ya
Agus Putro Wicaksono	Lulus	IPS	Tidak Lulus	Tidak
Andi Purnomo	Lulus	Teknik Kejuruan	Lulus	Ya
Arrizal Bayu Pratama	Tidak Lulus	IPS	Lulus	Tidak
Awik Tamaroh	Lulus	Teknik Kejuruan	Lulus	Ya
Bagas Yulio Hermawan	Tidak Lulus	Bahasa	Lulus	Tidak
Bagus Prayitno	Lulus	IPS	Tidak Lulus	Tidak
Davit Dwi Hartono	Lulus	IPA	Lulus	Ya
Dimas Setiawan Dwi	Tidak Lulus	IPS	Lulus	Tidak
Fiki Hermawan	Lulus	IPS	Tidak Lulus	Tidak
Gati Ratna Sari	Lulus	IPA	Lulus	Ya
Hendra Susetya Prambudi	Lulus	Teknik Kejuruan	Lulus	Ya
Hendri Nur Setya Prambudi	Lulus	Teknik Kejuruan	Lulus	Ya
Irsadul Abidin	Tidak Lulus	IPA	Lulus	Ya
Moch. Helmi Nur Yahya	Lulus	IPA	Lulus	Ya
Moh.Danang Saputra	Lulus	IPA	Lulus	Ya
Moh.Rofiqu Diqyah	Tidak Lulus	Teknik Kejuruan	Lulus	Ya
Mohamad Andi Santoso	Tidak Lulus	IPS	Lulus	Tidak
Mohammad Nur Yahya	Lulus	IPA	Tidak Lulus	Tidak
Mohammad Shofiyul Manan	Lulus	IPA	Lulus	Ya
Mokhammad Baidowi Alwi	Tidak Lulus	Teknik Kejuruan	Lulus	Ya
Muhammad Irfan Zidny	Lulus	IPA	Lulus	Ya
Nurul Qomariyah	Lulus	Bahasa	Lulus	Ya
Oki Saifudin	Tidak Lulus	IPS	Lulus	Tidak
Oky Willyand S	Lulus	Teknik Kejuruan	Lulus	Ya
Reja Ajuanda	Tidak Lulus	Teknik Kejuruan	Lulus	Ya
Riyan Wulan Tari	Lulus	IPA	Tidak Lulus	Tidak
Ruly Kartika Sari	Lulus	IPS	Lulus	Ya
Wahyu Aditya Nugroho	Lulus	Bahasa	Tidak Lulus	Tidak
Wahyu Setyawan	Tidak Lulus	IPS	Lulus	Tidak
Wahyudi Febrianto	Lulus	IPS	Lulus	Ya
Yudha Wardana	Tidak Lulus	IPA	Lulus	Ya
Yuli Ica Kurniawati	Lulus	Teknik Kejuruan	Tidak Lulus	Tidak
Yuli Subarkah Wahyu B	Lulus	Bahasa	Lulus	Ya
Yunan Azzumardi Irawan	Lulus	Teknik Kejuruan	Lulus	Ya

Entropy theory was adopted to choose the solution appropriate attributes to the algorithm C4.5, stating the average amount of information required to classify the samples [7].

In this system predictive of student achievement based on his educational background will be performed using decision tree method. Data are presented in tabular form with the

attributes and records. Attributes declared a parameter that is created as criteria in tree establishment. In this system to determine student achievement of the required criteria is the value of the national final examination (uan), department in the school, and value average school report. One attribute is an attribute that express the data solution per-item data called by the target attribute.

Attributes have values that are called by the instance. In this system attribute has the value uan instance pass (value> 55) and did not pass (score ≤ 55). Attributes majors have IPA instance, IPS, language and vocational techniques. Attributes average value of report have graduated instance (value> 55) and did not pass (score ≤ 55).

The process in the first decision tree is changing the shape of the data (table) to be a model tree. Table 1 the following is a table training data taken from the student data generation Informatics Engineering Study Program, 2014.

Step in transforming the data into a tree that first is to determine the selected node. To determine the selected node is used entropy of each criterion with the data sample / training specified in Table 1. Selected Node is the criterion by entropy is the smallest. Here is the process in selecting the initial node.

The first process is to calculate the number of achievements by each - each criterion that uan value criteria, majors' criteria, and average value of report criteria that will be shown in Table 2, Table 3 and Table 4.

Table 2. Achievement Base On UAN Value Criteria

UAN VALUE	ACHIEVEMENT	VALUE
Lulus	Ya	17
Lulus	Tidak	7
Tidak Lulus	Ya	5
Tidak Lulus	Tidak	6

Table 3. Achievement Base On Majors Criteria

MAJORS	ACHIEVEMENT	VALUE
IPA	Ya	9
IPA	Tidak	2
IPS	Ya	2
IPS	Tidak	8
Bahasa	Ya	2
Bahasa	Tidak	2
Teknik Kejuruan	Ya	9
Teknik Kejuruan	Tidak	1

Table 4. Achievement Base On Report Average Criteria

REPORT AVERAGE	ACHIEVEMENT	VALUE
Lulus	Ya	23
Lulus	Tidak	6
Tidak Lulus	Ya	0
Tidak Lulus	Tidak	6

Based on Table 2 number of achievement based on value criteria uan, Table 3 number of achievements by the majors and Table 4 numbers of achievements based on average report, than calculated entropy value of each criterion.

q1 to value criteria uan = pass is:
q1 = (log2 17/24 -17/24 *) + (* log2 7/24 -7/24)
q1 = 0.87
q2 to value criteria uan = not pass are:
q2 = (* log2 5/11 -5/11) + (* log2 6/11 -6/11)
q2 = 0.99
Entropy uan value is:
E = (24/35 * q1) + (11/35 * q2)
E = (24/35 * 0.87) + (11/35 * 0.99) = 0.91

Next calculate the entropy value for the criterion majors, q1 for majors criteria = IPA are:

q1 = (* log2 9/11 -9/11) + (-2 / 11 * log2 2/11)
q1 = 0.68
q2 = IPS subject to criteria are:
q2 = (-2 / 10 * log2 2/10) + (8/10 -8/10 * log2)
q2 = 0.72
q3 criteria are subject = Language:
q3 = (* log 2 2/4 -2/4) + (-2/4 * log2 2/4)
q3 = 1
q4 for majors = Vocational Technical criteria are:
q4 = (* log2 9/10 -9/10) + (* log2 1/10 -1/10)
q4 = 0.47
Entropy majors criteria are:
E = (11/35 * q1) + (10/35 * q2) + (4/35 * Q3) + (10/35 * q4)
E = (11/35 * 0.68) + (10/35 * 0.72) + (4/35 * 1) + (10/35 * 0:47) = 0.91

Next calculate the entropy value for the criterion on average report, q1 to the criteria of the average report = pass is:

q1 = (log2 23/29 -23/29 *) + (* log2 6/29 -6/29)
q1 = 0.74
q2 = criteria = average reports do not pass are:
q2 = 0 + (-6/6 * log2 6/6)
q2 = 0
Entropy criterion average report is:
E = (29/35 * q1) + (6/35 * q2)
E = (29/35 * 0.74) + 0 = 0.61

Table 5. Training Data For Report Average Criteria “Lulus”

NAME	UAN VALUE	MAJORS	ACHIEVEMENT
Adi Nurcahyo	Lulus	IPA	Ya
Andi Purnomo	Lulus	Teknik Kejuruan	Ya
Awik Tamaroh	Lulus	Teknik Kejuruan	Ya
Bagas Yulio Hermawan	Tidak Lulus	Bahasa	Tidak
Davit Dwi Hartono	Lulus	IPA	Ya
Dimas Setiawan Dwi Atmaja	Tidak Lulus	IPS	Tidak
Gati Ratna Sari	Lulus	IPA	Ya
Hendra Susetya Prambudi	Lulus	Teknik Kejuruan	Ya
Hendri Nur Setya Prambudi	Lulus	Teknik Kejuruan	Ya
Irsadul Abidin	Tidak Lulus	IPA	Ya
Moch. Helmi Nur Yahya	Lulus	IPA	Ya
Moh.Danang Saputra	Lulus	IPA	Ya
Moh.Rofiqu Diqyah	Tidak Lulus	Teknik Kejuruan	Ya
Mohamad Andi Santoso	Tidak Lulus	IPS	Tidak
Mohammad Shofiyul Manan	Lulus	IPA	Ya
Mokhammad Baidowi Alwi	Tidak Lulus	Teknik Kejuruan	Ya
Muhammad Irfan Zidny	Lulus	IPA	Ya
Nurul Qomariyah	Lulus	Bahasa	Ya
Oki Saifudin	Tidak Lulus	IPS	Tidak
Oky Willyand S	Lulus	Teknik Kejuruan	Ya
Reja Ajuanda	Tidak Lulus	Teknik Kejuruan	Ya
Ruly Kartika Sari	Lulus	IPS	Ya
Wahyu Setyawan	Tidak Lulus	IPS	Tidak
Wahyudi Febrianto	Lulus	IPS	Ya
Yudha Wardana	Tidak Lulus	IPA	Ya
Yuli Subarkah Wahyu B	Lulus	Bahasa	Ya
Yunan Azzumardi Irawan	Lulus	Teknik Kejuruan	Ya

Table 5 is training data table for the average criteria report = pass. Based on data in Table 5 will be used to calculate the amount of achievement based on criteria uan value for the average graduate will report are shown in Table 6 and the number of majors criteria for the average report cards that will pass shown in Table 7.

Based on the results of the three criteria entropy calculation showed that the average entropy criteria report so that the selected attributes of the average report as a starting node. Figure 2 the following is a picture compilation initial tree.

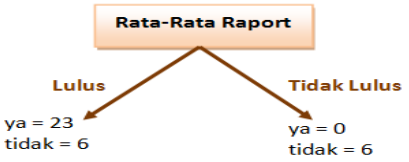

Figure 2. Tree Building At The Firs Node

Having obtained the initial node in Figure 2, the next leaf node can be selected on the achievements that have values yes and no. On average node criteria report over the leaf node has passed the achievement scores while yes and no leaf node does not pass only have value achievement not, so the only criterion on average report = pass that would have a leaf node. To sort the leaf nodes is done one by one.

Table 6. Achievement Based On UAN Value For Report Average "Lulus"

UAN VALUE	ACHIEVEMENT	VALUE
Lulus	Ya	17
Lulus	Tidak	0
Tidak Lulus	Ya	5
Tidak Lulus	Tidak	5

Table 7. Achievement Based On Majors For Report Average "Lulus"

MAJORS	ACHIEVEMENT	VALUE
IPA	Ya	9
IPA	Tidak	0
IPS	Ya	2
IPS	Tidak	4
Bahasa	Ya	2
Bahasa	Tidak	1
Teknik Kejuruan	Ya	9
Teknik Kejuruan	Tidak	0

According to the Table 6 number of achievements based on criteria uan value to the average report to pass and Table 7 number of achievements by the Department for the average report to pass on selanjutkan calculated entropy value of each criterion.

q1 to value criteria uan = pass is:
q1 = (log2 17/17 -17/17 *) + (* log2 0/17 -0/17)
q1 = 0
q2 to value criteria uan = not pass are:
q2 = (* log2 5/10 -5/10) + (* log2 5/10 -5/10)
q2 = 0.99
Entropy uan value is:
E = (17/27 * q1) + (10/27 * q2)
E = 0 + (10/27 * 0.99) = 0,367

Calculate the entropy value for the criterion majors, q1 for majors criteria = IPA are:
q1 = (* log 2 9/9 -9/9) + (-0/9 * log2 0/9)
q1 = 0
q2 = IPS subject to criteria are:
q2 = (* log 2 2/6 -2/6) + (-4/6 * log2 4/6)
q2 = 0.92
q3 criteria are subject = Language:
q3 = (* log 2 2/3 -2/3) + (-1/3 * log2 1/3)

q3 = 0.92
q4 for majors = Vocational Technical criteria are:
q4 = (* log 2 9/9 -9/9) + (-0/9 * log2 0/9)
q4 = 0
Entropy majors criteria are:
E = (9/27 * q1) + (6/27 * q2) + (3/27 * Q3) + (9/27 * q4)
E = (9/27 * 0) + (6/27 * 0.92) + (3/27 * 0.92) + (9/27 * 0) = 0.307

Based on the calculation above, the entropy obtained results that entropy criteria subject to an average report to pass smaller than entropy criteria uan value to the average report cards pass that was selected as the second node majors attributes and attribute values as attribute uan third. Figure 3 is a picture compilation tree on the second node.

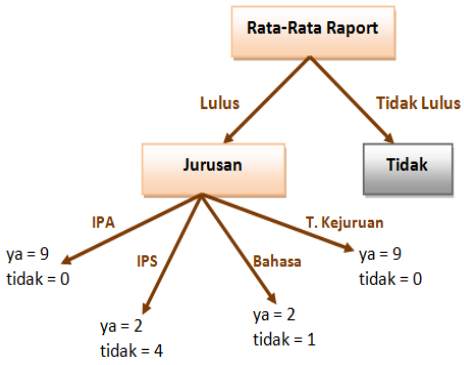

Figure 3. Tree Building At The Second Node

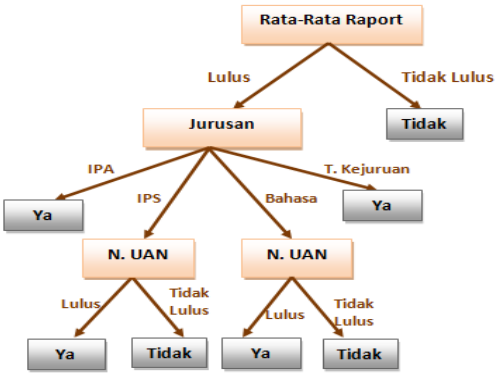

Figure 4. Tree Building Result

After the second node in Figure 3, the next leaf node can be selected on the achievements that have values yes and no. On the subject criteria above leaf node node IPS and language achievement have value yes and no leaf node while the IPA and Vocational Technical achievement ya just have value, so that the only criteria for IPS and majors majors = = The language will have a leaf node. Table 8 the following is a data table training for majors criteria = Language or IPS to the average report cards = pass.

Table 8. Training Data For Majors "Bahasa" Or "IPS" In Average Report "Lulus"

NAME	MAJORS	UAN VALUE	ACHIEVEMENT
Bagas Yulio Hermawan	Bahasa	Tidak Lulus	Tidak
Dimas Setiawan Dwi Atmaja	IPS	Tidak Lulus	Tidak
Mohamad Andi Santoso	IPS	Tidak Lulus	Tidak
Nurul Qomariyah	Bahasa	Lulus	Ya
Oki Saifudin	IPS	Tidak Lulus	Tidak
Ruly Kartika Sari	IPS	Lulus	Ya
Wahyu Setyawan	IPS	Tidak Lulus	Tidak
Wahyudi Febrianto	IPS	Lulus	Ya
Yuli Subarkah Wahyu B	Bahasa	Lulus	Ya

Table 9. Achievement Based On UAN Value For Report Average "Lulus" And Majors "IPA" Or "IPS"

JURUSAN	NILAI UAN	PRESTASI	JUMLAH
IPS	Lulus	Ya	2
IPS	Lulus	Tidak	0
IPS	Tidak Lulus	Ya	0
IPS	Tidak Lulus	Tidak	4
Bahasa	Lulus	Ya	2
Bahasa	Lulus	Tidak	0
Bahasa	Tidak Lulus	Ya	0
Bahasa	Tidak Lulus	Tidak	1

Based on training data Studies program criteria or IPS to the average report pass in Table 8 will be used to calculate the amount of achievement based on criteria uan value to the average report cards graduation and majoring in science or social studies that will be shown in Table 9.

Based on the data amount uan achievement based on criteria for the average report pass and majors IPA or ips in the Table 8 can be generated modeling tree. Figure 4 is a picture preparation on a third node tree or the result of preparation tree.

After a model tree as shown in Figure 4, the next step in the process of decision tree is reshaped into a rule tree. Here is a rule obtained by modeling the tree above.

Rule 1 → IF Rata2 Raport = Disqualified THEN Achievement = No
Rule 2 → IF Rata2 Raport = Passed AND THEN Achievement Programs = IPA = Yes
Rule 3 → IF Rata2 Raport = Passed AND THEN Programs = Vocational Technical Achievement = Yes
Rule 4 → IF Rata2 Raport = Passed AND Subject = IPS AND THEN Value UAN = Passed Achievement = Yes
Rule 5 → IF Rata2 Raport = Passed AND Subject = IPS AND Value UAN = Disqualified THEN Achievement = No
Rule 6 → IF Rata2 Raport = Passed AND Subject = English AND THEN Value UAN = Passed Achievement = Yes
Rule 7 → IF Rata2 Raport = Passed AND Subject = English AND Value uan = Disqualified THEN Achievement = No

3.2. System Design

Data flow diagram of student achievement prediction system using decision tree method described in more detail in Figure 5.

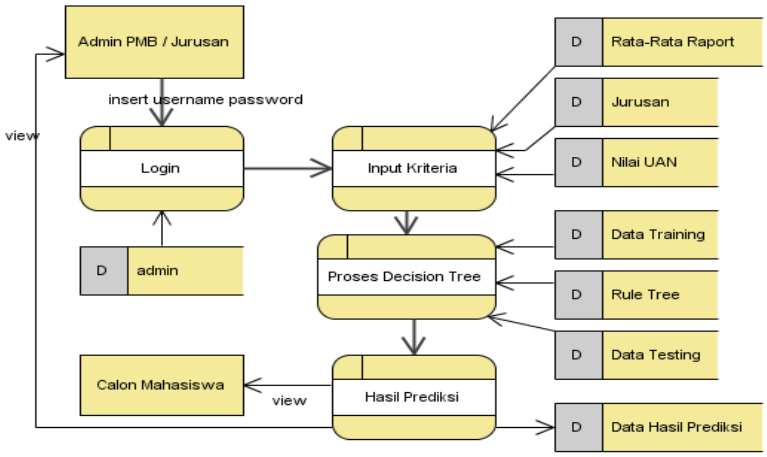

Figure 5. Data Flow Diagram

Figure 5 is a data flow diagram (DFD) prediction system of student achievement based on the educational background of decison tree method. In the data flow diagram, there are four main processes for the admin user login process, the input criteria, the decision tree and the predicted results. There are eight of them datastore datastore admin, on average report, majors, uan value, training data, rule tree, testing of data and data predicted results.

Entity relationship diagram database design shown in Figure 6. Figure 6 is an entity relationship diagram (ERD) system predictive of student achievement using methods decison tree. In the ERD are eight entities, those entities admin, rata rata raport, jurusant, nilai_uan, data_training, rule_tree, data_testing and data_hasil.

3.3. Implementation

Student achievement program making predictions based on the educational background using decision tree method. The system created with a web based system using

the programming language html, php and java script, while for the storage of data using mysql database. Based on the student testing data that there is further to do the predictions of student achievement using decision tree method. Figure 7 shows the prediction of student achievement.

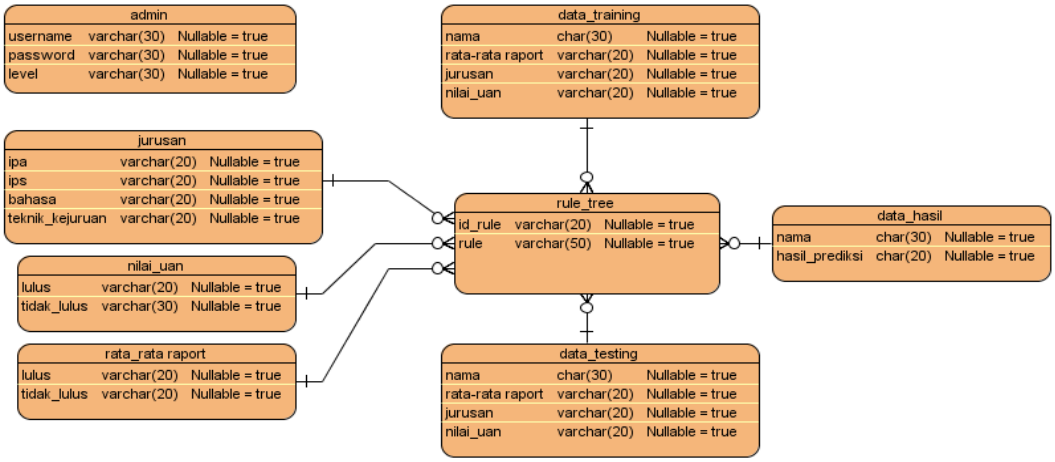

Figure 6. Entity Relatinship Diagram

Figure 7. Prediction Proses Pages

NPM	Nama	Rata Rata Raport	Kriteria Raport	Jurusan	Nilai UAN	Kriteria UAN	Prediksi Prestasi
14.1.03.02.0099	Zifilia Umaroh	78	Lulus	IPS	60	Lulus	Berprestasi
14.1.03.02.0100	Bagas Prambudi	70	Lulus	Bahasa	54	Tidak Lulus	Tidak Berprestasi
14.1.03.02.0103	Jesica Idris	65	Lulus	Teknik Kejuruan	60	Lulus	Berprestasi
14.1.03.02.0032	Agus Nur Wahyudi	75	Lulus	Teknik Kejuruan	63	Lulus	Berprestasi
14.1.03.02.0098	Najwa Erlinda	85	Lulus	IPA	70	Lulus	Berprestasi
14.1.03.02.0098	Najwa Erlinda	85	Lulus	IPA	70	Lulus	Berprestasi
14.1.03.02.0235	Ahmad Hadi W.	80	Lulus	IPA	78	Lulus	Berprestasi
14.1.03.02.0150	Ahmad Syaikhoni	74	Lulus	IPS	72	Lulus	Berprestasi
14.1.03.02.0273	Anggi Wahyu Tri P.	68	Lulus	Bahasa	65	Lulus	Berprestasi
14.1.03.02.0164	Iman Puspita Rahayu	68	Lulus	IPS	53	Tidak Lulus	Tidak Berprestasi
14.1.03.02.0108	Bagus Nurul Huda	80	Lulus	Teknik Kejuruan	75	Lulus	Berprestasi
14.1.03.02.0164	Iman Puspita Rahayu	68	Lulus	IPS	53	Tidak Lulus	Tidak Berprestasi

Figure 8. Prediction Result Pages

Figure 7 is a page prediction process of student achievement, on the page called back testing students' data to be predicted based on the student identification number (NPM). Once the button is pressed it will show a view of data NPM, name, average report value, majors and uan value of students based on NPM is called. Furthermore, to make the process of achievement can be pressed button prediction prediction process provided it will display the results predicted.

The prediction results of student achievement based on the educational background using decision tree method is shown in the Figure 8.

Based on the picture 8 on the results page displayed data is predictive of student achievement student identification number (NPM), the name of the student, the average report value, report value criteria, majoring in the school, uan value, uan value criteria and the predicted results of student achievement. On the criterion value of report cards can be grouped into a category value of report cards to pass for report value> 55 and the value of report do not pass the value of report value ≤ 55. On the majors of criteria there are four categories: IPA majors, ips, language and vocational techniques. On the uan value criteria are grouped into categories uan pass value for uan value> 55 and the uan value is not passed to uan value ≤ 55.

From the picture 8 can be seen predictive results of student achievement using decision tree method, the prediction results are grouped into two categories including achieving and not achieving

4. Conclusion

The conclusion of student achievement system predictions based on the educational background desicion tree method is:

1) The system of student achievement predictions made using the method desicion tree with criteria based on the educational background of students which is an average value of report cards, grades and majors UAN School of origin.
2) Parameter calculation decision tree method uses a reference training data of students in the previous generation.
3) The results of student achievement prediction on this system can be used by the committee for admission and the course of study to determine the classification of new students.

References

[1] Indrajit RE, Djokopranoto R. Manajemen Perguruan Tinggi Modern. Yogyakarta: Andi. 2006.
[2] Indonesian Government Regulation Number 66 on 2010 about the Amendment of Government Regulation Number 17 on 2010 about the Management and Operation of Education.
[3] Kusrini, Luthfi ET. Algoritma Data Mining. Yogyakarta: Andi Offset. 2009.
[4] Basuki A, Syarif I. Modul Ajar Decision Tree. Surabaya: PENS-ITS. 2014.
[5] Larose, Daniel T. Discovering Knowledge in Data: An Intoduction to Data Mining. Inc: John Wiley and Sons. 2005.
[6] Hartama D. *Model Aturan Keterhubungan Data Mahasiswa dengan Algoritma Decision Tree. S*eminar Nasional Teknologi Informasi dan Komunikasi (SNASTIKOM). 2012: 47-53.
[7] Hastuti K*. Analisis Komparasi Algoritma Klasifikasi Data Mining untuk Prediksi Mahasiswa Non Aktif*. Seminar Nasional teknologi Informasi dan Komunikasi Terapan (Semantik). 2012: 241-249.