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Decision Support System for Internet Package Using Naïve Bayes Algorithm

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Abstract**—** *Today's home internet has become a necessity for the wider community. Currently, there are many Internet Service Providers in Indonesia and home internet products for sale consist of various internet packages with different services and features. In facing market competition to be able to compete with other ISP competitors, a company must determine the marketing strategy for the internet packages it sells. Based on these problems, a solution can be given, namely building a computerized system to be able to assist the sales team in obtaining a decision to market the best internet package. The system built is a decision support system to provide recommendations for decision makers. One method to support decision making from various criteria and alternatives is the Naïve Bayes Method. The Naïve Bayes method can provide a prediction of the outcome of a decision based on calculations involving several available criteria and alternatives. These results can help the sales team in their efforts to increase sales.*

Keywords**—** *Home Internet, Decision Support System, Naïve Bayes*.

I. INTRODUCTION

Technology developments have resulted in increasing tight competition for market share among telecommunications service providers today. Companies that want to be successful in competition in the millennium era must have good strategy and management [1]. The use of home internet is now increasingly widespread, and home internet is widely used by all groups. Many home internet providers have similar products so the competition is getting more competitive. Internet packages currently being sold can include several types of internet packages with different services and functions. So that in facing market competition to increase sales, home internet provider companies must determine a good sales strategy.

Based on the problems above, a solution can be given, namely building a computerized system to be able to assist decision makers in getting a decision to choose the best internet package. The system built is a decision support system to produce a decision result for decision makers. One method for solving decision selection from various criteria and alternatives is the Naive Bayes method. The Naive Bayes method can provide a prediction of the outcome of a decision from the results of calculations involving several available criteria and alternatives. Therefore, It is hoped that the decision support system using the Naive Bayes method for selecting Internet packages can help decision makers who can help sales to market Internet packages according to segmentation and customer needs.

II. LITERATURE REVIEW

A. Definition of Decision Support System

Decision Support System/ is a computer-based system that can support semi-structured decision making, by utilizing data and then processing it into information in the form of suggestions that can assist in making final decisions [4]. SPK consists of four stages of the process [6], namely:

1) *Intelligence*, is a process that identifies problems that require a decision to later be processed into relevant information to make a final decision.
2) *Design*, create, develop and perform analysis for each alternative that will be used according to the problem to be analyzed.
3) *Choice*, choose the best alternative that has been evaluated and obtained based on the highest value of each alternative tested.
4) *Implementation*, implementation of the options that have been selected, if the implementation fails it will return to the modeling process.

B. Naïve Bayes Algorithm

The Naive Bayes algorithm is a classification method using probability and statistical methods proposed by British scientist Thomas Bayes. The Naive Bayes algorithm predicts future opportunities based on previous experience, so it is known as Bayes' Theorem. The main feature of this Naïve Bayes Classifier is the very strong (naïve) assumption of the independence of each condition/event [6]

There are several steps taken in probability calculations using the Naïve Bayes algorithm [7] as follows:

1. Determination of sample data to be used for calculations.
2. Determination of data classification (dimensional)
3. Determine the probability variable to be searched for from the test data.

$$X = (X1, X2, X3..X_N)$$

*X*is the probability variable sought
X1, X2, X3..Xn is the details of the criteria of the probability variable sought.Determine and calculate the probability of the criteria class.

$$P(C_I) = C_I / \text{TOTAL (C)}.$$

- *P(Ci)*is the probability of each criterion class
- $C_I$is the value of each criterion class
- *Total (C)*is the total value of all criteria class

4. Calculating the probability of class variables against the same class criteria. P(X|Ci) = X|Ci / Total (X|Ci).

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- *P(X|Ci)*is the probability of the class variable against the class criteria the same one
- *X|Ci*is the value of the class variable against the same class criteria
- *Total (X|Ci)*is the total value of the class variable against the class criteria the same one

5. Calculating each criterion class probability with the probability of the same criterion class. P(Xi|Ci) = P(X|Ci) * P(Ci).
6. Compare the calculation of the probability value of each class criteria and class variables and take the highest probability value for the criteria you are looking for. Max P(X|Ci) * P(Ci).

III. Research Methodology

1.1. Method of collecting data

According to Wiratna Sujarweni, the data collection method is a method that researchers use to reveal or collect data from respondents or informants according to the data selected for research. There are several research data collection techniques that are commonly used such as tests, interviews, observations, questionnaires or questionnaires, surveys, and document analysis. However, researchers used data collection techniques as follows:

1. Observations

Observation is a formal observation and recording of symptoms that appear on the research object. Observations are considered important by researchers, so researchers can test the quality of the truth of a problem being tested.

2. Interviews

Interview is one of the methods used to retrieve results orally. This is done in order to obtain detailed information according to the object being studied.

3. Documentation

Documents are information about past situations. Documents can also be in the form of writing, drawings or monumental works. If accompanied by related documents, the analysis and interview findings will be more reliable. Documentation is a method of collecting data as a support for the problem being studied.

1.2. Research Stages

The following is a further explanation of the research flowchart shown in the image above:

1) Method data collection

In the early stages, researchers conducted literature studies and interviews to obtain the data needed during the research process.

2) Processing data

It is a process where the data obtained from the first stage will be used in calculations using the naïve bayes algorithm, starting by comparing each criterion and then producing an average value for each criterion then comparisons are also made to the sub criteria and producing the same results then from the results of the comparison criteria and sub-criteria, then a ranking process is carried out based on the conditions of the residents. The final result is an alternative ranking of beneficiary candidates which can be used to support the final decision.

3) Implementation

Is the stage where the system is designed starting with describing it in the Unified Modeling Language form which consists of use case diagrams to describe business processes, activity diagrams describe the activities of business processes for each user, class diagrams describe the class design and its relationships and sequence diagrams describe the processes that occur between objects to one business process. This stage also describes a model that forms the basis for the process of designing a Decision Support System and describes how the database structure is used which consists of database names, tables, fields and descriptions of each attribute.

4) Conclusions and recommendations

It is the conclusion of the research results and provides advice to someone who reads with the aim of being able to develop research for the better.

IV. Results and Discussion

Information to find the probability P(Xi|Ci) of each criterion Packages are as follows:

- 2P Internet +Phone Package Probability
  $= P(X1|C1) * P(X2|C1) * P(X3|C1) * P(X4|C1) * P(C1)$
  = 0.00523 * 0.72351* 1.00000 * 0.51257 * 0.33574
  = 0.00427
- Package Probability 2P Internet + TV
  $= P(X1|C2) * P(X2|C2) * P(X3|C2) * P(X4|C2) * P(C2)$
  = 0.86942 * 0.36175 * 1.0000 * 0.51219* 0.26264
  = 0.00137
- Probability of the 3P Internet + Phone + TV Package
  $= P(X1|C3) * P(X2|C3) * P(X3|C3) * P(X4|C3) * P(C3)$
  = 0.33149 * 0.02841 * 0.0000 * 0.15549 * 0.06010
  = 0.00000
- Internet Gamer Probability 2020
  $= P(X1|C4) * P(X2|C4) * P(X3|C4) * P(X4|C4) * P(C4)$
  = 0.62649 * 0.28882 * 0.0000 * 0.54995 * 0.08737
  = 0.00000
- New USEETV Internet Entry Package Probability
  $= P(X1|C5) * P(X2|C5) * P(X3|C5) * P(X4|C5) * P(C5)$
  = 0.03975 * 0.74215 * 0.0000 * 0.39475 * 0.09216
  =0.00000
- Internet StaySafe SBR Package Probability
  $= P(X1|C6) * P(X2|C6) * P(X3|C6) * P(X4|C6) * P(C6)$
  = 0.50835 * 0.56018 * 0.0000 * 0.44012 * 0.16199
  = 0.00000

Probability of the largest package (criteria class) for the segment (criteria variable): Data: Lengkong, Speed: 10 Mbps, Service Status: 2 Services, Customer Category: Boarding Houses is the "2P Internet + Phone" Package with a probability value = 0.00427 or 99.68% of the training data population. So that sales provide the right package recommendations, namely the 2P Internet + Phone package for the Datel Lengkong segment,

On measurementNaïve Bayes performance is measured using a confusion matrix (accuracy). Confusion matrix is a

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method used to perform accuracy calculations on data mining concepts.

TABLE 1. Confusion Matrix Table

CONFUSION TABLES	CLASS PREDICTION						
	2P Internet + Phone	4					
	2P Internet + TV		2				
	3P Internet + Phone + TV						
	Gamers 2020						
	New USEETV Entry				2	2	
	SBR StaySafe						

ACCURACY	80%

Out of a total of 10 trials tested on naive Bayes, there were 2 data that did not match the New USEE TV Entry package class but the predicted result was the Gamer 2020 package. So out of a total of 10 trials, the accuracy rate was 80%.

V. CONCLUSIONS

A. *Conclusion*

Based on the results of research and analysis that has been done, it can be concluded as follows:

1. The Naïve Bayes method can provide answers to the needs of Internet package sales that are right and in accordance with customer segmentation.
2. Application of the Naïve Bayes method for a decision support system selling Internet packages makes it easy for sales to make proper and appropriate sales.

B. *Suggestions*

In order to use the classification in the Internet package sales decision support system is becoming more perfect, so in the next research it is recommended to add attributes or criteria to produce patterns or recommendations for new, more diverse information. As well as being able to add complete information about Internet packages.

REFERENCES

[1.] Rara Astili Siregar, SE, M.Sc. "The Influence of Service Quality on ASTRA Credit Companies' Consumer Satisfaction". Corporate Business Journal 3rd Edition, December 2017

[2.] Diana S.Si.M.Kom, "Decision Support System Methods & Applications". Deepublish, 2018.

[3.] D. Nofriansyah and Sarjon deficit, "Multi-Ctiretia Decision Making (MCDM) on Decision Support Systems", Pert Edition. Yogyakarta: Deepublish, 2017.

[4.] Saleh, A. (2015). "Implementation of the Naive Bayes Classification Method in Predicting the Amount of Household Electricity Use". Citec Journal, 2(3), 207-2017

[5.] Utomo Pujianto, "Application of the naïve Bayes classifier algorithm for the classification of thesis titles and final assignments based on Expertise Field Groups', State University of Malang, 2017

[6.] Astrid Novita Putri. "Application of Naive Bayesian for Activity Ranking at the Faculty of ICT, University of Semarang". SIMETRIS Journal. Vol 8 No 2 November 2017, ISSN: 2252-4983.

[7.] Suhari Primary. "Data Warehouse Uses the Naïve Bayes Algorithm to Support Marketing Division Analysis in Multifinance Companies" Cendikia Journal Vol. XVII, April 2019

[8.] Haris Pramudia, Adi Nugroho. "Laptop Damage Information System Using the Naïve Bayes Method". Journal of Electrical Technology, Mercu Buana University ISSN: 2086-9479, Vol. 8 No. Sept. 3, 2017.

[9.] Bayu Setyaji, "Decision Support System for Determining the Eligibility of Candidates for Employment Using the Naive Bayes Method (Case Study of CV. Linggar Aksi)" Dian Nuswantoro University Semarang, 2018

[10.] Chairul Fadlan, Selfia Ningsih, Agus Perdana Windarto "Application of the Naïve Bayes Method in the Eligibility Classification of Rastra Rice Recipient Families" JUTIM, Vol 3 No 1, June 2018

[11.] Dwiasnati, S., & Devianto, Y. (2018). Naïve Bayes Optimization Based On Particle Swarm Optimization to Predict the Decision of Insurance Customer Candidate. Int. J. Comput. Tech, 5(5), 8-14.

[12.] I. Ranggadara, G. Wang, and ER Kaburuan, "Applying Customer Loyalty Classification with RFM and Naïve Bayes for Better Decision Making," Proc. - 2019 Int. Monday. appl. Technol. inf. commun. ind. 4.0 Retrosp. Prospects. Challenges, iSemantic 2019, no. september, pp. 564–568, 2019, doi: 10.1109/ISEMANTIC.2019.8884262.

[13.] Muhammad Husni Rifqo, "Implementation of Deep Naïve Bayes Algorithm

[14.] Determination of Credit Granting" Journal of Pseudocode, Volume IV Number 2, September 2017

[15.] Ervin Adhi Cahyanugraha, Rizal Isnanto, Ike Pertiwi. "Online Warehouse System at PT. PLN (Persero) Central Java and DI Yogyakarta Regional Distribution. Journal of Technology and Computer Systems (JTsiskom), Vol.3, No.1, January 2015 (e-ISSN: 2338-0403) Page 154-160

[16.] Indrajani, S. Database Systems All in One Theory, Practice, and Case Study. Elex Media Komputindo. 2018

[17.] RA Saputra. "Application of the Naïve Bayes Algorithm for Determining Prospective Scholarship Recipients at Pasim Plus Sukabumi Vocational School" SWABUMI VOL IV No.2, September 2016

[18.] Taghsya Izmi Andini. "Predicting the Potential of Marketing New Products with the Naïve Bayes Classifier and Linear Regression Methods", Jendral Achmad Yani University, 2018