Application of the C.45 Algorithm in Measuring the **Satisfaction Level of Hotel Visitors**

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Abstract. Hotel visitor satisfaction is one of the most important things in assessing the level of service by the hotel to its visitors. The purpose of this study was to determine the satisfaction of hotel visitors based on service criteria (very good, good, good enough, not good), facilities (good, pretty good, not good), quality (high, medium), and classification (first class, business, economy) hotel rooms by applying the C.45 Algorithm method. to visitors who expressed satisfaction or dissatisfaction. In The Crew Hotel, the criteria have not been measured with certainty, so the management is still manually determining visitor satisfaction so it is less effective. Thus, the author tries to measure the four criteria by applying the processing of the questionnaire dataset given to visitors, when staying, either in writing or asking visitors. using the C4.5 algorithm in measuring the level of satisfaction of visitors to The Crew so that a decision tree is formed. to advance the development of The Crew Hotel and improve service at the hotel. After the calculation is done manually, then the proof is done using an application designed by the author according to the existing rules

Keywords— Application, Data Mining, C.45 Algorithm, Hotel, Visitor Satisfaction

1. Introduction

A hotel is a building or company that provides services in the form of rooms, or a place to rest as well as recreation for visitors who come from within the city or outside the city. Every hotel will try to provide the best facilities and services. tricks for every hotel business to strengthen competition in every business. If at any time there are visitors who feel dissatisfied with the services of a hotel, it will cause disappointment and feel less suited to the hotel. One of them, the hotel which is currently under development is The Crew Hotel.

In terms of services and facilities, The Crew still has shortcomings because there are still complaints to the receptionist from visitors about hotel facilities and the quality of service. After all, if visitors are not satisfied with the service they receive, then the visitor will leave the hotel provider and become a visitor at another hotel. which in the end will greatly reduce the reputation of the hotel concerned. Therefore, measuring the level of satisfaction of hotel visitors requires a system that can measure the level of satisfaction of hotel visitors systematically and updated and one of them is using data mining.



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Data mining is a process of finding meaningful relationships, patterns, and trends by examining large sets of data stored in storage using pattern recognition techniques such as statistical and mathematical techniques (Santoso, n.d.). One of the algorithms in data mining is the C4.5 algorithm.

According to (Sukma Putri Utari, 2015) the C4.5 algorithm is an algorithm used to form a decision tree. While the decision tree can be interpreted as a way to predict or group very strongly.

2. Research Method

2.1. Data Needs analysis

According to Desyanti (2018), the C4.5 algorithm is one of the algorithms used to classify or group datasets. The basis of the C4.5 algorithm is the formation of a decision tree (Decision Tree). The branches of the decision tree are a classification question while the leaves are the classes or groups. Because the purpose of the C4.5 algorithm is to classify, the result of dataset processing is in the form of grouping data into certain classes.

The stages of design and development include the following:

1. Identification

The identification stage is used to determine the boundaries of the problem, those involved, and the goals to be achieved.

- a. Limitations of the problem in this study are: Discussed the level of visitor satisfaction with The Crew Hotel's services by applying the C45 method. The system is designed in the form of a web by utilizing the PHP and MySQL programming languages in database management.
- b. As an indicator of assessment to measure customer satisfaction are facilities, service, quality, and classification at The Crew Hotel

2. The criteria

The criteria used in this study are as follows:

Table 1. Criteria							
No. Atribut		Variable	Amount	Amount	Amount Not		
INU	Autout	v allable	Case	Satisfied	satisfied		
		Sangat Baik	69	24	45		
1	Delevenen	Baik	81	43	38		
1	Pelayanan	Cukup Baik	35	0	35		
		Tidak Baik	15	0	15		
		Bagus	70	35	35		
2	Fasilitas	Lumayan	95	32	63		
		Tidak Bagus	35	0	35		
2	Kualitaa	Tinggi	138	67	71		
3	Kuantas	Sedang	62	0	62		
		First Class	56	27	29		
4	Klasifikasi	Bisnis	95	40	55		
		Ekonomi	49	0	49		

2.2. C45 Algorithm

Based on questionnaire data from The Crew Hotel as shown in the following table :

Table 2. Questionnaire results							
Pelayanan	Fasilitas	Kualitas	Klasifikasi				
Sangat Baik = 69	Bagus=70	Tinggi=138	First Class=56				
Baik = 81	Lumayan =95	Sedang = 62	Bisnis=95				





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Cukup Baik=35	Tidak Bagus=35	Ekonomi=49
Tidak Baik =15		

1. Process node 1 as root (root)

The root node is obtained by first calculating the Entropy or initializing it as E (all data) to the class composition. With the following formula:

Entropy (S) =
$$\sum_{i=1}^{n} - pi * \log_2 pi$$

Where :

- S : Case Collection
- A : Features
- n : Number of Partitions S
- pi : Proportion of Si to S

$$= -\left(\left(\frac{67}{200}x\,\log_2\left(\frac{67}{200}\right)\right) + \left(\frac{133}{200}\,x\,\log_2\left(\frac{133}{200}\right)\right)\right)$$

= -((0,335 x (-1,57777)) + (0,665 x (-0,58857)))
= -((-0,52855) + (-0,3914)) = -(-0,91995)=(0,91995)

2. Calculate the entropy and Gain value

A Delevenen

Furthermore, it is the same as calculating the previous entropy, except that it is divided according to the criteria so that it is obtained as follows:

$$E \left[Pelayanan - Sangat Baik\right] = -\left(\left(\frac{24}{69}x \log_2\left(\frac{24}{69}\right)\right) + \left(\frac{45}{69}x \log_2\left(\frac{45}{69}\right)\right)\right)$$

$$= -\left((0,34783 x (-1,52356)\right) + (0,65217 x (-0,61667))\right)$$

$$= -\left((-0,52993) + (-0,40218)\right)$$

$$= -\left(-0,93211\right) = 0,93211$$

$$E\left[Pelayanan - Baik\right] = -\left(\left(\frac{43}{81}x \log_2\left(\frac{43}{81}\right)\right) + \left(\frac{38}{81}x \log_2\left(\frac{38}{81}\right)\right)\right)$$

$$= -\left((0,53086 x (-0,91358)) + (0,46913 x (-1,09192))\right)$$

$$= -\left((-0,48499) + (-0,51226)\right)$$

$$= -\left(-0,99725\right)$$

$$E \left[Pelayanan - Cukup Baik\right] = -\left(\left(\frac{0}{35}x \log_2\left(\frac{0}{35}\right)\right) + \left(\frac{35}{35}x \log_2\left(\frac{35}{35}\right)\right)\right)$$

$$= -\left((0 x (0)) + (1 x (0))\right)$$

$$= -\left((0) + (0)\right)$$

$$= -\left((0 x (0)) + (1 x (0))\right)$$

$$= -\left((0) + (0)\right)$$

$$= -\left((0)$$



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Calculate the gain with the following formula:

Gain (S, A) = Entropy(S) -
$$\sum_{i=1}^{n} \frac{|Si|}{|S|} * Entropy(Si)$$

Where :

S : Case Collection

A : Features

- n : Number of Partitions S
- Si : Number of Cases on the ith certainty

S: Number of Cases in S

$$G [Total, Pelayanan] = 0,91995 - \left((us \ 0,93211) + \left(\frac{81}{200} x \ 0,99725\right) + \left(\frac{35}{200} x \ 0\right) + \left(\frac{15}{200} x \ 0\right) \right)$$

= 0,91995 - $\left((0,345 x \ 0,93211) + (0,405 x \ 0,99725) + (0,175 x \ 0) + (0,075 x \ 0) \right)$
= 0,91995 - $\left((0,32158) + (0,40389) + 0 + 0 \right)$
= 0,91995 - $\left((0,72546) = 0,19449 \right)$

B .Fasilitas

$$E [Fasilitas - Bagus] = -\left(\left(\frac{35}{70}x \log_2\left(\frac{35}{70}\right)\right) + \left(\frac{35}{70}x \log_2\left(\frac{35}{70}\right)\right)\right)$$

$$= -\left((0.5 x (-1)) + (0.5 x (-1))\right)$$

$$= -\left((-0.5) + (-0.5)\right)$$

$$= -(-1) = 1$$

$$E \left[Fasilitas - Lumayan Bagus\right] = -\left(\left(\frac{32}{95}x \log_2\left(\frac{32}{95}\right)\right) + \left(\frac{63}{95}x \log_2\left(\frac{63}{95}\right)\right)\right)$$

= -((0,33684 x (-1,56985)) + (0,66316 x (-0,59257)))
= -((-0,52879) + (-0,39297))
= -(-0,92176)
= 0,92176
$$E \left[Fasilitas - Tidak Bagus\right] = -\left(\left(\frac{0}{35}x \log_2\left(\frac{0}{35}\right)\right) + \left(\frac{35}{35}x \log_2\left(\frac{35}{35}\right)\right)\right)$$

= -((0 x (0)) + (1 x (0)))
= -((0) + (0))
= -(0)
= 0
$$G \left[Total, Fasilitas\right] = 0,91995 - \left(\left(\frac{70}{200}x \ 0,93211\right) + \left(\frac{95}{200}x \ 0,99725\right) + \left(\frac{35}{200}x \ 0\right)$$

= 0,91995 - ((0,35) x 0,93211) + (0,475 x 0,99725) + (0,175 x 0))
= 0,91995 - (0,78784) = 0,13212

C .Kualitas $E [Kualitas - Tinggi] = -\left(\left(\frac{67}{138}x \log_2\left(\frac{67}{138}\right)\right) + \left(\frac{71}{138}x \log_2\left(\frac{71}{138}\right)\right)\right)$ = -((0,48551 x (-1,04243)) + (0,51449 x (-0,95878)))= -((-0,50611) + (-0,49238))= -(-0,99939)= 0,99939



 $E\left[Kualitas - Sedang\right] = -\left(\left(\frac{0}{62}x \log_2\left(\frac{0}{62}\right)\right) + \left(\frac{62}{62}x \log_2\left(\frac{62}{62}\right)\right)\right)$ = -((0x(0)) + (1x(0)))= -((0) + (0))= -(0)= 0 $G [Total, Fasilitas] = 0.91995 - \left(\left(\frac{138}{200} x \ 0.99939 \right) + \left(\frac{62}{200} x \ 0 \right) \right)$ $= 0.91995 - ((0.69 \times 0.93211) + (0.31 \times 0))$ = 0,91995 - ((0,68958) + 0)= 0,91995 - (0,68958)= 0,23037D. Klasifikasi $E\left[Klasifikasi - First Class\right] = -\left(\left(\frac{27}{56}x \log_2\left(\frac{27}{56}\right)\right) + \left(\frac{29}{56}x \log_2\left(\frac{29}{56}\right)\right)\right)$ = -((0,48214 x (-1,05215)) + (0,57895 x (-0,78849)))= -((-0,50744) + (-0,49164))= -(-0,99908)= 0,99908 $E\left[Klasifikasi - Bisnis\right] = -\left(\left(\frac{40}{95}x \log_2\left(\frac{40}{95}\right)\right) + \left(\frac{55}{95}x \log_2\left(\frac{55}{95}\right)\right)\right)$ = -((0,42105 x (-1,24792)) + (0,57895 x (-0,78849)))= -((-0,52544) + (-0,45649))= -(-0,98194)= 0,98194 $E\left[Klasifikasi - Ekonomi\right] = -\left(\left(\frac{0}{49}x \log_2\left(\frac{0}{49}\right)\right) + \left(\frac{49}{49}x \log_2\left(\frac{49}{49}\right)\right)\right)$ = -((0 x (0)) + (1 x (0)))= -((0) + (0))= -(0) = (0) $G [Total, Klasifikasi] = 0,91995 - \left(\left(\frac{56}{200} x \ 0,99908 \right) + \left(\frac{95}{200} x \ 0,98194 \right) + \left(\frac{49}{200} x \ 0 \right) \right)$ $= 0.91995 - ((0.280 \times 0.93211) + (0.475 \times 0.99725) + (0.245 \times 0))$ = 0,91995 - ((0,27974) + (0,46642) + 0)= 0,91995 - (0,74616)= 0,17379

3. Result and Discussion

The decision process is carried out through the user interface of the system. The system start page can be seen in the explanation below:



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THE CREW HOTEL 🗮 Konsultasi 🕒 Login	
THE Crew HOTEL	
Login	
thecrew	
• Masuk	

Figure 1. Login

On this login page, the user must enter the specified username and password and enter the system

	🖬 Atribut	🛗 Nilai Atribut	★ Dataset	a Tree	🎝 Akurasi	🗮 Perhitungan	🗮 Laporan	Arrow Password	C• Logout	
PENE	ERAPA	N ALGO KEPU	RITM/ IASAN	A C.4 PEN	5 DAL IGUNJ	AM ME	NGUK OTEL	UR TIN	GKAT	
The Crew	Hotel									
PELAYA	NAN Y	ANG TER	RBAIK							
The Crew Hotel Medan sebagian tempat duduk Anda & Crew Airlines me	merupakan Ne pesawat serta rasa nyaman ur	w Konsep Modern i kursi tradisional sert ituk bersantai dan be	dan Minimalis, I :a setiap kamar eristirahat dengi	hal ini lebih dengan kor an pelayana	n berasa sewak nsep yang berb n kekeluargaar	itu masuk lobby ho eda beda dengan o noleh staf dan kary	otel seolah-oleh linding kamar d awan Hotel.	dalam pesawat ihiasi dengan bin	sebab sofa yang tersedia gkai Batik, akan membuat	
Hotel berlokasi yang st melakukan departure jik	rategis dan har a pernerbangar	iya memerlukan 15 i yang anda ikuti jika	menit dari Ban terlalu larut.	idara Kualar	namu Internati	onal Airport. Anda	dapat merasak	an kemudahan ji	ka menginap disini dalam	
Terdapat restoran yang akses jaringan WiFi di se Cabin Spa melepaskan p	menyajikan me luruh area, Shu enak serta anda	nu lezat ala The Cre ttle Bus menuju Kual i juga dapat menikma	w Hotel , di The lanamu Internat ati aromatherap	e Cockpit Ca tional Airpor shy yang kha	ife & Resto khi rt,room service is disini	isus untuk Anda.De 24 Jam, kamar hot	mi mendukung el yang nyaman	mobilitas Anda s , dan sini anda d	elama menginap, tersedia apat merelaksasikan diri di	
THE CREW HOTEL : 2021	Penginapan De	ngan Fasilitas terbai	k					Ros	malina Purba (170121071)	

Figure 2. Main Form

On the main page, the user selects the master and selects the desired form according to what will be done then the user clicks the desired menu to enter the next form

Atribut					
Pencarian	CRefresh +Tambah				
Kode	Nama Atribut	Aksi			
A01	Pelayanan	0			
A02	Fasilitas	6			
A03	Kuəlitas	6			
A04	Klasifikasi	0 Î			
A05	Hasil	6			





In the attribute form display, it functions to fill in the attribute name in the provided column.

Datas	et							
Pencarian	Pencarlan							
Nomer	Pelayanan	Fasilitas	Kualitas	Klasifikasi	Hasil	Aksi		
1	Sangat Baik	Bagus	Sedang	Bisnis	Tidak Puas	6		
2	Sangat Balk	Begus	Sedang	Bisnis	Tidak Puas	6		
3	Balk	Lumayan Bagus	Sedang	First Class	Tidak Puas	C C		
4	Baik	Lumayan Bagus	Sedang	Bisnis	Tidak Puas	C a		
5	Sangat Baik	Bagus	Sedang	Disnis	Tidak Puas	6		
6	Balk	Lumayan Bagus	Sedang	Disnis	Tidak Puas	C C		
7	Cukup Balk	Tidak Bagus	Sedang	Ekonomi	Tidak Puas	6		
8	Baik	Lumayan Bagus	Sedang	Ekonomi	Tidak Puas	6		
9	Sangat Baik	Tidak Bagus	Tinggi	Ekonomi	Tidak Puas	6		
10	Sangat Baik	Tidak Bagus	Tinggi	Ekonomi	Tidak Puas	6		
11	Sangat Balk	Tidak Bagus	Sedang	Ekonomi	Tidak Puas	C C		
12	Sangat Baik	Tidak Bagus	Tinggi	Ekonomi	Tidak Puas	6		
13	Sangat Balk	Bagus	Sedang	Ekonomi	Tidak Puas	6		
14	Balk	Lumayan Bagus	Sedang	Bisnis	Tidak Puas	67 💼		
15	Balk	Lumayan Bagus	Sedang	Bisnis	Tidak Puas	C B		
16	Sangat Baik	Bagus	Tinggi	First Class	Puas	6		
17	Baik	Lumayan Bagus	Sedana	First Class	Tidak Puas			

Figure 4. Dataset Form

The dataset form is used to store all the data used in the application, and next is the calculation form

Tre Tre f f Ratting 1: Sening 100 Title Poin f Ratting 1: Sening 100 Title Poin f Ratting 1: Sening 100 Title Point f f Ratting 1: Sening 100 Title Point f f Ratting 1: Sening 100 Title Point f f Ratting 1: Sening 100 Title Point f Ratting 1: Sening 1: Seni	C45 Tree
True Text Destitues 15 design FRE 1014 Print P destitues 15 design FRE 1014 Print P destitues 15 destitues 16 P destitues 15 destitues 16 P destitues 15 destitues 16 P destitues 15 destitues 16 P destitues 15 destitues 10 destitues	Perhitungan
Part P	Tree
TO Contribute To Track Barrier Total Disc.	For Examples State Press Fore Examples Press Fore Press

Figure 5. Tree Form

C45 Tree			
Perhitungan			
Perhitungan Cabang Root			
Pelayanana			
Sangat Baik(57/200): 0.856			
Baik(76/200): 0.811			
Cukup Baik(39/200): 0			
Tidak Baik(28/200): 0			
GAIN: 0.117			
SPLIT INFOI 1.904			
GAIN KATIO: 0.061			
Fastilitasi			
Lumburg Radus (65/388): 0.639			
Tidak Bagur (35/300): 0			
GAIN: 0.055			
SPLIT INFO: 1.48			
GAIN RATIO: 0.046			
Kuelites			
Sedang(114/200): 0			
Tinggi(86/200): 0.975			
GAIN: 0.25			
SPLIT INFO: 0.986			
GAIN RATIO: 0.253			
Klasifikasi:			
Bisnis(98/200): 0.849			
First Class(50/200): 0.634			
Ekonomi(52/200): 0			
GAIN: 0.004			
SPEIT 1800: 1.51			
Atribut terbaik: Kualitas (0.253)			
Hasil Cabang Kualitas(Sedang):Tida	Puas		
Perhitungan Cabang Kualitas(Tinggi)			
Pelayanani			
Sangat Baik(25/86): 0.943			
Cukup Baik(22/86): 0			
Tidak Baik(12/86): 0			
Baik(27/86): 0.877			
GAIN: 0.426			

Figure 6. Calculation Form

On the process page Displays the calculation data page based on the dataset that has been created, the final result will determine whether the customer is satisfied or dissatisfied with the services provided by the management of The Crew Hotel.



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Perhitungan							
Pengatura	n Training						
	Prosentase Testir	ig 60					
	Masukkan prosentase testing dari 30 sampe 100						
	Data Testing Acak						~
		al Hitung					
		and the second					
Perhitung	jan						
Tree							
Nomor	Pelayanan	Fasilitas	Kualitas	Klasifikasi	Hasil	Prediksi	Benar?
132	Tidak Baik	Bagus	Sedang	First Class	Tidak Puas	Tidak Puas	1
60	Sangat Baik	Bagus	Tinggi	Bisnis	Puas	Puas	1
143	Sangat Baik	Tidak Bagus	Sedang	First Class	Tidak Puas	Tidak Pues	1
21	Baik	Lumayan Bagus	Sedang	Bisnis	Tidak Puas	Tidak Puas	4
198	Balk	Lumayan Bagus	Sedang	Bisnis	Tidak Puas	Tidak Puas	1
119	Baik	Lumayan Bagus	Sedang	First Class	Tidak Puas	Tidak Pues	1
5	Baik	Lumayan Bagus	Sedang	Bisnis	Tidak Puas	Tidak Puas	1
		-					

Figure 7. Accurate Form

On the dataset accuracy form page, check the accuracy of the data set that has been inputted. Perhitungan

Data yang diketahui					
Pelayanan	Sangat Baik	*			
Fasilitas	Lumayan Bagus	~			
Kualitas	Tinggi	~			
Klasifikasi	Ekonomi	~			
	al Hitung				
Perhitungan					
Tree					
Hasil					
Jika Peleyaran = Sangat Buik dan Fasilizas = Lumayan Bagus dan Kualizas = Tinggi dan Klasifikzi = Ekonomi maka Hastil = "Itdak Paas HTUMGULANIC					

Figure 8. Global Result Form

On the dataset accuracy form page, check the accuracy of the data set that has been inputted.

Laporan						
Disfrect 🖨 Cask						
No	Tanggal	Jam	Hasil			
1	2021-11-17	17:02:00	Tidak Puas			

Figure 9. Report Form

4. Conclusion

By the explanation described, to measure the level of visitor satisfaction at The New Hotel using the C.45 method, therefore it can be produced, namely:

1. Applying the C4.5 algorithm in measuring the level of satisfaction of hotel visitors is applied through an assessment with the criteria (service, facilities, quality, classification). With these criteria, a decision tree is obtained for the final result in determining hotel visitor satisfaction.



2. In building data mining applications using the C4.5 algorithm, sublime text applications are used to make programming with HTML, PHP, CSS programming and use the Mysql database as data storage media.

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