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Detecting Indonesian ambiguous sentences using Boyer-Moore algorithm

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ABSTRACT

Ambiguous sentences are divided into 3 types namely phonetic, lexical, and grammatical. This study focuses on grammatical ambiguous sentences, grammatical ambiguous sentences are ambiguities that occur due to incorrect grammar, but this ambiguity will disappear once it is used within a sentence. Ambiguous sentences become a big problem when they are processed by a computer. In order for the computer to interpret ambiguous words correctly, this study seeks to develop detection of Indonesian ambiguous sentences using Boyer Moore algorithm. This algorithm matches ambiguous sentences that are inserted as input with the data set. Then the sentence is being detected whether it contains ambiguous sentences, by calculating the percentage of similarity using cosine similarity method. Cosine similarity system is able to find out the meaning of the sentence. In the data set, the number of ambiguous sentences that can be collected is 50 words. The 50 words consist of ambiguous words data, ambiguous sentences, and ambiguous sentence meanings. This system trial was carried out for 200 times and the accuracy level was 0.935, precision was 0.9320, and Recall was 0.8. While the F-Measure was 0.8061. While the speed for word search 0.003275 seconds

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1. INTRODUCTION

Ambiguous sentences are sentences that have more than one meaning. Ambiguous sentences are divided into 3 types, namely phonetic, lexical, and grammatical. This research will focus on grammatical ambiguity. Grammatical ambiguity occurs due to incorrect grammar usage. However, this ambiguity would disappear once it is used within a sentence [1-4]. In Indonesian, the inability to understand ambiguous sentences often occurs due to different levels of language use, different levels of education, and culture [5]. Ambiguous word is a word that has a vague (unclear) nature, in Indonesian, there are a number of grammatical ambiguous words such as "*bulan* (moon/ month)". "*Bulan*" has two meanings, the first meaning is "an astronomical object orbiting the earth", and the second meaning means "a period of time" [6, 7]. Grammatical ambiguous sentences would not pose a big problem when used in direct conversation, direct dialogue between humans, and sentences read by humans [8]. Because humans have intelligence that can process, and absorb ambiguous words in accordance with the topic of conversation, and words related to the ambiguous sentence. This is very different from computers, computers do not have the intelligence to detect ambiguous sentences. By using the grammatical ambiguous sentence detection system, the system is able to find out the meaning of

an ambiguous sentence, and translate it according to the meaning [9]. This system is aimed to enable computer to understand ambiguous sentences in Indonesian properly.

Research on grammatical ambiguous sentences has not been widely developed, especially regarding the detection of Indonesian grammatical ambiguous sentences. Currently, researches related to ambiguous sentences were only able to find ambiguous sentences but were not able to understand the meaning of ambiguous sentences [10]. So far, the data sets covering Indonesian ambiguous grammatical sentences are still not available yet. While the availability of grammatical ambiguous sentences detector is highly needed. For instance, in order to improve the accuracy of a translator system, and to make it easier for computers to understand a text. So, in this research, the expected novelty that will be achieved is to create a grammatical ambiguous sentence detection system in Indonesian, using the Boyer-Moore algorithm

2. RESEARCH METHOD

Figure 1 explains the processes involved in the ambiguous sentence detection system using Boyer-Moore algorithm. This flowchart explains the sentence being entered, then the sentence is checked using Boyer-Moore algorithm, so that it can be selected whether the sentence contains any ambiguous words. If the sentence is stated to contain ambiguous words, then the meaning of the sentence would be searched using Cosine Similarity method. Several steps are needed to build this research; the following is the research method used.

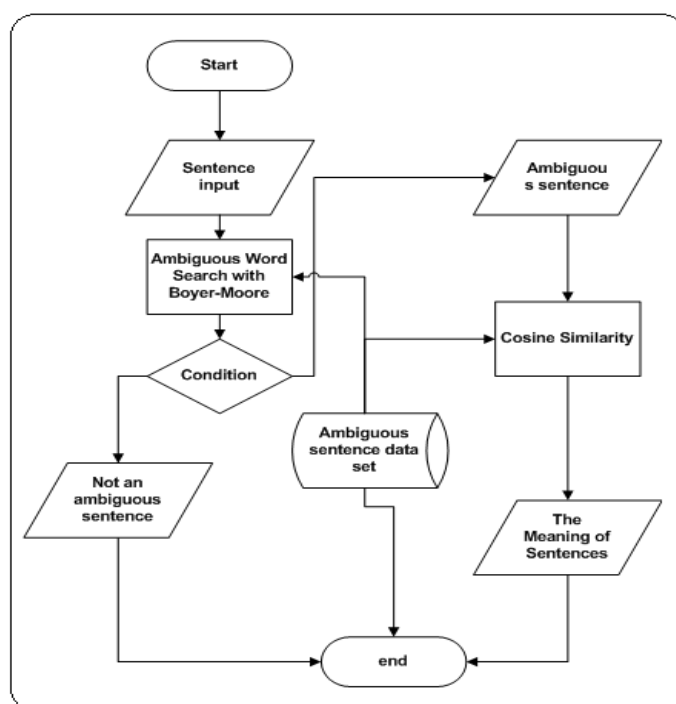


Figure 1. Flowchart detection of ambiguous Indonesian sentences with Boyer-Moore algorithm

2.1. Sentence input

Sentence input consists of sentences which are still unknown whether it contains ambiguity. The sentences are conversational sentences in Indonesian. In Indonesian, there are several types of ambiguous sentences, namely grammatical, lexical, and phonetic [11]. This research will focus on grammatical ambiguity. Grammatical ambiguous sentences are ambiguous sentences that occur due to incorrect grammar use, but this ambiguity will disappear once it is used in a sentence. The following are examples of ambiguous sentences

“Setiap awal bulan kami gajian (We are paid at the beginning of each month)”

The sentence above contains an ambiguous word that is "*bulan* (month)", the word "*bulan*" has two meanings, which are;

- *Bulan* (month) = a period of time
- *Bulan* (moon) = sky object

In Figure 2, it is explained that the word “*bulan*” has two meanings, in which one refers to a particular unit of time (month), and the “*bulan*” which shows the earth's satellites (moon--an object in the sky). At this stage the meaning of the word is unknown. The following is a simple description of an ambiguous word.

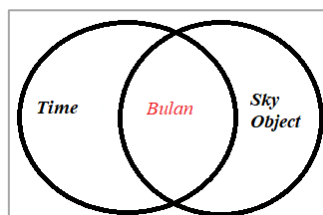


Figure 2. Grammatical ambiguous word description

2.2. Ambiguous word search using Boyer-Moore

Boyer-Moore algorithm is an algorithm used for string searching [12-20]. In conducting string searching, the Boyer-Moore algorithm is highly accurate. Following are the steps conducted by Boyer-Moore algorithm to find ambiguous sentences.

2.2.1. 1st step

Figure 3 explains the process of searching for the ambiguous word “*bulan*” in the sentence “*setiap awal bulan kami gajian* (at the beginning of each month we are paid).” This search is carried out from the first string, the search is carried out from the left side to the right side. If the word has not been found, the search would be repeated again, starting with the second string.

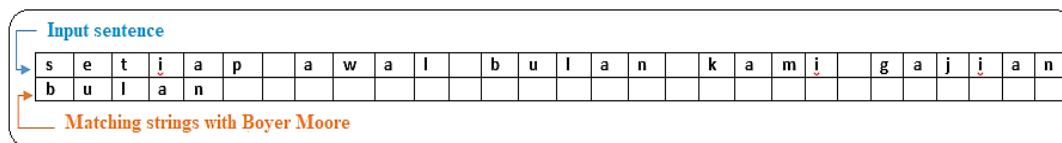


Figure 3. Ambiguous word search step 1

2.2.2. 2nd step

Figure 4 explains the process of searching for the ambiguous word “*bulan*” in the sentence “*setiap awal bulan kami gajian* (at the beginning of each month we are paid)”. This process is a continuation of the first process, the search string starts from the second string.

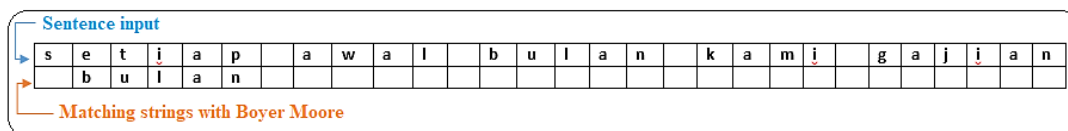


Figure 4. Ambiguous word search step 2

2.2.3. 13th step

Figure 5 shows that the process of searching for the ambiguous word “*bulan*” in the sentence “*setiap awal bulan kami gajian* (at the beginning of each month we are paid)” has been successful. The word “moon” is found on the 13th process, the word “*bulan*” was found in the 13th string. On the 13th step, a grammatical ambiguous word was found; the word is the word “*bulan*”. In this study, the Boyer-Moore algorithm is used to check strings. Inputs (sentences that are not yet known to be grammatically ambiguous) are being matched with data sets of words that have been identified as grammatically ambiguous. At present, the number of data sets that can be stored is only 50; this happens because there are no researchers who have developed applications related to grammatical ambiguous sentences in Indonesian.

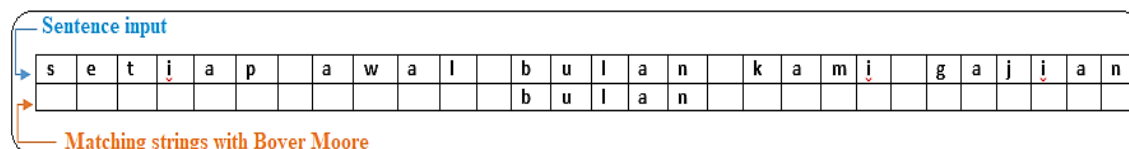


Figure 5. Ambiguous word search step 13

Figure 6 explains the Flowchart where the ambiguous word in a sentence is searched, on the Flowchart it is shown that if the ambiguous word has not been found, then a search is carried out on the next string, until the word is found or declared to be missing. If the word is found from the beginning, the system will immediately be terminated and it can be decided that the ambiguous word exists. The following is a flowchart describing the Boyer-Moore string searching process.

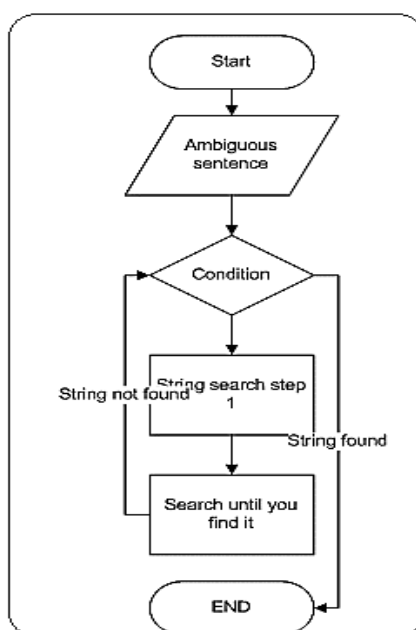


Figure 6. String searching flowchart using boyer-moore algorithm

2.3. Ambiguous sentences data SET

Grammatical ambiguous sentence dataset is a collection of ambiguous words and sentences used as a benchmark [21-23]. Since up to this stage, there was no ambiguous sentences found, this research has collected data on ambiguous words and sentences from Indonesian linguists. In this research, the resource person is an Indonesian language lecturer, Encil Puspitoningrum, M. Pd. The following is a table of ambiguous words and sentences obtained from her. Table 1 consists of 3 rows, line 1 is "Ambiguous Words" which contains the list of ambiguous words. Line 2 "Sentences" contains sentences that usually use ambiguous words. Line 3 is the "Meaning" can which contains the meaning of the ambiguous sentences.

Table 1. Ambiguous words and sentences

Ambiguous words	Sentence	Meaning
Budi (Mind)	Aku mengenang budi baikmu (I remember your kindness)	Kebaikan (Kindness)
Salam (Regards)	Gus kamu kemarin mendapatkan salam dari anggi (Gus, Anggi sent you regards yesterday)	Sapaan (Greetings)
Tahu (Tofu)	Agus kesini tadi memberi tahu (Agus came here to give us tofu)	Makanan (Food)
Bunga (Interest)	Bunga deposito di bank jatim lumayan tinggi (The deposit interest rate in Bank Jatim is quite high)	Keuntungan (Profit)
Bangku (Bench)	Dia tidak pernah makan bangku sekolah (He never went to school)	Pendidikan (Education)
Kemas (Organized)	Acara ini dikemas dengan sangat baik (This event is very well organized)	Melakukan pekerjaan (Doing work)
Bulan (Month)	Awal Bulan Kamu gaji (You are paid at the beinning of the month)	Waktu (Time)

2.4. Cosine similarity

The sentences inputted are calculated in terms of their resemblance to the sentences in the data set. In order to calculate similarities between sentences, cosine similarity is used [24-28]. In this research, the sentence to be used as input is "*setiap awal bulan kami gajian*". The sentence has been identified to contain a grammatical ambiguous word, "*bulan* (month)". Sentences related to "*bulan* (month)" are:

- *Awal bulan kami gajian* (We are paid at the beginning of the month).
- *Bumi dan bulan merupakan benda langit* (The Earth and The Moon are sky objects).

By using cosine similarity, we can find the similarity of a string. After the string similarity is known, the system is able to show the meaning of the sentence. The following is the cosine similarity algorithm processing. In a more detailed explanation, the example used is the closeness between "*awal bulan kami gajian*" (We are paid at the beginning of each month) and "*awal bulan kamu gajian*" (You are paid at the beginning of each month) ".

- S1 = *awal bulan kami gajian* (We are apid at the beginning of the month).
- S2 = *awal bulan kamu gajian* (You are paid at the beginning of the month).

Table 2 explains the existence of each word in a sentence. If the word is contained in the sentence, code 1 will be given in line A. Conversely, code 0 will be given when the word is not found in the sentence.

Table 2. Ambiguous words and sentences

Word	Count				
	A	B	A. B	A ²	B ²
<i>Awal</i> (beginning)	1	1	1	1	1
<i>Bulan</i> (month)	1	1	1	1	1
<i>Kami</i> (we)	1	0	0	1	0
<i>Kamu</i> (you)	0	1	0	0	1
<i>Gajian</i> (paid)	1	0	0	1	0
			2	4	3

Cosine Similarity is a method used to calculate the degree of similarity between two objects. For the purpose of data clustering, a good function is the Cosine Similarity function. For the set notation the formula as shown in (1):

$$\begin{aligned}
 \text{Similarity} = \cos(\theta) &= \frac{A.B}{||A|| ||B||} \\
 &= \frac{2}{(4 \times 3)} \\
 &= 0.166
 \end{aligned} \tag{1}$$

After being calculated using the Cosine Similarity method, the highest closeness is 0.166. More detailed explanation is shown in Table 3. In Table 3 two values appear, which are 0.16 and 0.05. Given the high similarity value of the sentences "*setiap awal bulan kami gajian*" and "*setiap awal bulan kamu gajian*". It can be concluded that the word "*bulan*" in the sentence means "a period of time".

Table 3. The results of analyzing the meaning of sentences using confusion matrix method

Id	Input Sentences	Data Set	Value of Similarity
1	<i>Setiap awal bulan kami gajian</i> (We are paid at the beginning of each month)	<i>Setiap awal bulan kamu gajian</i> (You are paid at the beginning of each month)	0.16
2	<i>Setiap awal bulan kami gajian</i> (We are paid at the beginning of each month)	<i>Bumi dan bulan merupakan benda langit</i> (Earth and moon are sky objects)	0.05

2.5. Determining the meaning of sentences when being processed in the program

From the Boyer-Moore Algorithm and Cosine Similarity processes some results are obtained [29, 30]. These results stated that "*bulan*" in the input sentence means a period of time (month). Following are the results obtained, the results are also implemented on the web. Figure 7 discusses the results of calculations performed by using Cosine Similarity method. At this stage the sentence "*Setiap awal bulan kami gajian* (we are paid at the beginning of each week) " had been tested for the similarity with the sentence "*Setiap awal bulan kamu gajian* (you are paid at the beginning of each month) and "*Bumi dan Bulan merupakan benda langit* (The Earth and The Moon are sky objects)". After being calculated using Cosine Similarity method, the sentence has been

proven to have closeness in meaning with the sentence "*Setiap awal bulan kami gajian* (We are paid at the beginning of each month)" this sentence contains word "*bulan*" which means a period of time (month) with the value of similarity +of 0.16.

Ambiguous sentence detection results			
ambiguous words	Cut string	significance	cosine similarity value
Bulan	Awal bulan kamu	waktu	0,16
Bulan	Bumi bulan merupakan	benda	0,05

Figure 7. The results of detecting grammatical ambiguous sentences using cosine similarity

3. RESULTS AND ANALYSIS

3.1. Accuracy, precision, recall and F-measure test

At this stage, the system is tested using a confusion matrix, which is often used to find out precision, accuracy, and recall [31-33]. With the confusion matrix, it can be seen how well the system is able to understand grammatically ambiguous sentences. This system experiment has been carried out 200 times. While there are 50 words in the database which are ambiguous words, this word is called True Positive (TP). When separating ambiguous words there is also an error, which is an unambiguous word but an ambiguous word is captured, this word is called false positive (FP). In some cases, there are ambiguous words but cannot be recognized by the system, this word is called false negative (FN). Whereas words that are not ambiguous are called true negatives (TN). The calculations can be seen in Table 4.

Table 4. Confusion matrix value	
TP=40	FP=3
FN=10	TN=147

$$Accuracy = \frac{40+147}{40+147+3+10} = 0.935 \quad (2)$$

$$Precision = \frac{40}{40+3} = 0.9302 \quad (3)$$

$$Recall = \frac{40}{40+10} = 0.8 \quad (4)$$

The value scale of matrix confusion ranges from 0-1. From the above calculation it is obtained the value of accuracy which is 0.935, Precision is 0.9320, and Recall is 0.8. Judging from the recall value, the system is able to recognize ambiguous words as much as 80%. Meanwhile, the lack of data sets has made the system unable to recognize ambiguous words. F-Measure is one of the evaluation calculations method in retrieving information that combines recall and precision. The values of recall and precision in a situation might bear different weights. The measurement that displays the reciprocity between recall and precision is the F-Measure, which is the weight of the harmonic mean of the Recall and Precision. The f-measure range is between 0-1. From the above calculation, the F-measure value is 0.86.

$$F1 = 2 * \frac{0.9302 * 0.8}{0.9302 + 0.8} = 2 * \frac{0.744}{1.73} = 0.8601 \quad (5)$$

3.2. The speed in detecting ambiguous words

In understanding grammatical ambiguous sentences, the system requires different time to process each sentence; the processing of this sentence depends on the number of characters understood [34]. The average sentence search value is 0.003275. There is a need for speed calculations to analyze system performance. Ambiguous sentence detection speed is presented in Table 5. The highest speed in this speed detector is 0.0024 to detect the sentence "*Dia bagai kuda hitam* (He is like a dark horse)". While the lowest speed is 0.0042 in the sentence "*Acara ini dikemas dengan sangat baik* (This event is very well organized)". The following table shows the rate of speed in detecting ambiguous words:

Table 5. Speed in detecting ambiguous words

Ambiguous words	Sentences	Speed
Kemas (organized)	<i>Acara ini dikemas dengan sangat baik</i> (This event is very well organized)	0.0042
Budi (Mind)	<i>Aku mengenang budi baikmu</i> <i>Aku mengenang budi baikmu</i> (I remember your kindness)	0.0036
Salam (Regards)	<i>Gus kamu kemarin mendapatkan salam dari anggi</i> (Gus, Anggi sent you regards yesterday)	0.0039
Tahu (Tofu)	<i>Agus kesini tadi memberi tahu</i> (Agus came here to give us tofu)	0.0039
Bunga (Interest)	<i>Bunga deposito di bank jatim lumayan tinggi</i> (The deposit interest rate in Bank Jatim is quite high)	0.0037
Bangku (Bench)	<i>Dia tidak pernah makan bangku sekolah</i> (he never went to school)	0.0043
Kuda (Horse)	<i>Dia bagai kuda hitam</i> (He is like a dark horse)	0.0024

4. CONCLUSION

Grammatical ambiguous sentences in Indonesian are sentences that have two meanings. To recognize ambiguous sentences, we need a Boyer-Moore algorithm and cosine similarity algorithm. Boyer-Moore algorithm is used to find strings (ambiguous sentences). While the cosine similarity algorithm is used to calculate the degree of similarity between two objects. Cosine similarity can be used to find out the meaning of a sentence, by calculating the similarity of the test data to the data set. The Boyer-Moore algorithm and the Cosine similarity algorithm are very effective for detecting ambiguous words. This can be proven by the success rate of the system in retrieving information (recall) of 80%. While the average speed of the Boyer-Moore algorithm when detecting ambiguous sentences takes 0.003275 seconds.

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[TELKOMNIKA, Vol.x, No.x, Januari 2020, pp.101~10x ISSN: 1693-6930, accredited First Grade by Kemenristekdikti, Decree No: 21/E/KPT/2018 DOI: 10.12928/TELKOMNIKA.vxix.xxxx • 101](#) Detecting Indonesian Ambiguous Sentences using Boyer-Moore Algorithm Risky Aswi Ramadhani¹, I Ketut Gede Darma Putra^{2*}, Made Sudarma³, I.A.D. Giriantari^{3 1,4} Doctoral program in engineering, Udayana University, Denpasar, Bali 1,4Jalan [P.B. Sudirman, Denpasar, Bali, Indonesia](#) *Corresponding author, e-mail: riskyaswiramadhani@gmail.com¹, ikgdarmaputra@unud.ac.id², imasudarma@gmail.com³, dayu.giriantari@unud.ac.id⁴ Abstract Ambiguous sentences are sentences that have more than one meaning. Ambiguous sentences are divided into 3 types namely phonetic, lexical, and grammatical. This study focuses on grammatical ambiguous sentences, grammatical ambiguous sentences are ambiguities that occur due to incorrect grammar, but this ambiguity will disappear once it is used within a sentence. Ambiguous sentences will not pose a big problem if it is used in a communication between people to people because humans have the intelligence to understand the meaning of the word. Ambiguous sentences become a big problem when they are processed by a computer. In order for the computer to interpret ambiguous words correctly, this study seeks to develop detection of Indonesian ammbiguous sentences using Boyer Moore Algorithm. This algorithm matches ambiguous sentences that are inserted as input with the data set. Then the sentence is being detected whether it contains ambiguous sentences, by calculating the percentage of similarity using Cosine Similarity method. Cosine Similarity system is able to find out the meaning of the sentence. In the data set, the number of ambiguous sentences that can be collected is 50 words. The 50 words consist of ambiguous words data, ambiguous sentences, and ambiguous sentence meanings. This system trial was carried out for 200 times and the accuracy level was 0.935, Precision was 0.9320, and Recall was 0.8. While the F-Measure was 0.8061. While the speed for word search 0.003275 seconds. Keywords: Ambiguous, Boyer-Moore, Grammatical, Indonesian sentences, Text, String. Copyright © 2020 [Universitas Ahmad Dahlan. All rights reserved.](#) **1. Introduction** Ambiguous sentences [are](#) sentences that [have](#) more than one meaning. Ambiguous sentences are divided into 3 types, namely phonetic, lexical, and grammatical. This research will focus on grammatical ambiguity. Grammatical ambiguity occurs due to incorrect grammar usage. However, this ambiguity would disappear once it is used within a sentence [1-4]. In Indonesian, the inability to understand ambiguous sentences often occurs due to different levels of language use, different levels of education, and culture [5]. Ambiguous word is a word hat has a vague (unclear) nature, in Indonesian, there are a number of grammatical ambiguous words such as "bulan (moon/ month)". "Bulan" has two meanings, the first meaning is "an astronomical object orbitting the earth", and the second meaning means "a period of time" [6,7]. Grammatical ambiguous sentences would not pose a big problem when used in direct conversation, direct dialogue between humans, and sentences read by humans [8]. Because humans have intelligence that can process, and absorb ambiguous words in accordance with the topic of conversation, and words related to the ambiguous sentence. This is very different from computers, computers do not have the intelligence to detect ambiguous sentences. By using the grammatical ambiguous sentence detection system, the system is able to find out the meaning of an ambiguous sentence, and translate it according to the meaning [9]. This system is aimed to enable computer to understand ambiguous sentences in Indonesian properly. Research on grammatical ambiguous sentences has not been widely developed, especially regarding the detection of Indonesian grammatical

ambiguous sentences. Currently, researches related to ambiguous sentences were only able to find ambiguous sentences but were not able to understand the meaning of ambiguous sentences [10]. [Received September 5, 2019; Revised November 28, 2019; Accepted December 12, 2019](#) 102 • ISSN: 1693-6930 So far the data sets covering Indonesian ambiguous grammatical sentences are still not available yet. While the availability of grammatical ambiguous sentences detector is highly needed. For instance, in order to improve the accuracy of a translator system, and to make it easier for computers to understand a text. So in this research, the expected novelty that will be achieved is to create a grammatical ambiguous sentence detection system in Indonesian, using the Boyer-Moore algorithm.

2. Research Method Several steps are needed to build this research; the following is the research method used. Figure 1. Flowchart Detection Of Ambiguous Indonesian Sentences With Boyer-Moore Algorithm Figure 1 explains the processes involved in the ambiguous sentence detection system using Boyer-Moore algorithm. This flowchart explains the sentence being entered, then the sentence is checked using Boyer-Moore algorithm, so that it can be selected whether the sentence contains any ambiguous words. If the sentence is stated to contain ambiguous words, then the meaning of the sentence would be searched using Cosine Similarity method.

2.1. Sentence Input Sentence input consists of sentences which are still unknown whether it contains ambiguity. The sentences are conversational sentences in Indonesian. In Indonesian, there are several types of ambiguous sentences, namely grammatical, lexical, and phonetic [11]. This research will focus on grammatical ambiguity. Grammatical ambiguous sentences are ambiguous sentences that occur due to incorrect grammar use, but this ambiguity will disappear once it is used in a sentence. The following are examples of ambiguous sentences. TELKOMNIKA Vol. x, No. x, Januari 2020: 791-79x TELKOMNIKA ISSN: 1693-6930 • 103 "Setiap awal bulan kami gajian (We are paid at the beginning of each month)" The sentence above contains an ambiguous word that is "bulan (month)", the word "bulan" has two meanings, which are a. Bulan (month) = A period of time b. Bulan (moon) = sky object The following is a simple description of an ambiguous word Figure 2. Grammatical ambiguous word description In Figure 2, it is explained that the word "bulan" has two meanings, in which one refers to a particular unit of time (month), and the "bulan" which shows the earth's satellites (moon--an object in the sky). At this stage the meaning of the word is unknown.

2.2. Ambiguous Word Search using Boyer-Moore. Boyer-Moore algorithm is an algorithm used for string searching [12-20]. In conducting string searching, the Boyer-Moore algorithm is highly accurate. Following are the steps conducted by Boyer-Moore algorithm to find ambiguous sentences.

a. 1st step Figure 3. Ambiguous Word Search step 1 Figure 3 explains the process of searching for the ambiguous word "bulan" in the sentence "setiap awal bulan kami gajian (at the beginning of each month we are paid)." This search is carried out from the first string, the search is carried out from the left side to the right side. If the word has not been found, the search would be repeated again, starting with the second string.

b. 2nd step Figure 4. Ambiguous Word Search step 2 Figure 4 explains the process of searching for the ambiguous word "bulan" in the sentence "setiap awal bulan kami gajian (at the beginning of each month we are paid)". This process is a continuation of the first process, the search string starts from the second string.

c. 13th step Figure 5. Ambiguous Word Search step 13 Title of paper.. (First Author) 104 • ISSN: 1693-6930 Figure 5 shows that the process of searching for the ambiguous word "bulan" in the sentence "setiap awal bulan kami gajian (at the beginning of each month we are paid)" has been successful. The word "moon" is found on the 13th process, the word "bulan" was found in the 13th string. On the 13th step, a grammatical ambiguous word was found; the word

is the word "bulan". In this study, the Boyer-Moore algorithm is used to check strings. Inputs (sentences that are not yet known to be grammatically ambiguous) are being matched with data sets of words that have been identified as grammatical ambiguous. At present, the number of data sets that can be stored is only 50; this happens because there are no researchers who have developed applications related to grammatical ambiguous sentences in Indonesian. The following is a flowchart describing the Boyer-Moore string searching process. Figure 6. String Searching Flowchart using Boyer-Moore Algorithm Figure 6 explains the Flowchart where the ambiguous word in a sentence is searched, On the Flowchart it is shown that if the ambiguous word has not been found, then a search is carried out on the next string, until the word is found or declared to be missing. If the word is found from the beginning, the system will immediately terminated and it can be decided that the ambiguous word exists.

2.3. Ambiguous Sentences Data SET

Grammatical ambiguous sentence dataset is a collection of ambiguous words and sentences used as a benchmark [21-23]. Since up to this stage, there was no ambiguous sentences found, this research has collected data on ambiguous words and sentences from Indonesian linguists. In this research, the resource person is an Indonesian language lecturer, Encil Puspitoningrum, M. Pd. The following is a table of ambiguous words and sentences obtained from her.

Ambiguous words	Sentence	Meaning
Budi (Mind)	Salam (Regards)	Tahu (Tofu)
Aku mengenang budi baikmu (I remember your kindness)	Gus kamu kemarin mendapatkan salam dari anggi (Gus, Anggi sent you regards yesterday)	Kebaikan (Kindness)
Sapaan (Greetings)	Makanan (Food)	TELKOMNIKA Vol. x, No. x, Januari 2020: 791-79x
TELKOMNIKA ISSN: 1693-6930 • 105	Agus kesini tadi memberi tahu (Agus came here to give us tofu)	Bunga deposito di bank jatim
Bunga (Interest)	lumayan tinggi (The deposit interest rate in Bank Jatim is quite high)	Dia tidak pernah makan bangku
Bangku (Bench)	sekolah (He never went to school)	Acara ini dikemas dengan sangat
Kemas (Organized)	baik (This event is very well organized)	Awal Bulan
Kamu	gajian (You Bulan (Month) are paid at the beinning of the month)	Keuntungan (Profit)
Pendidikan (Education)	Melakukan pekerjaan (Doing work)	Waktu (Time)

Table 1 consists of 3 rows, line 1 is "Ambiguous Words" which contains the list of ambiguous words. Line 2 "Sentences" contains sentences that usually use ambiguous words. Line 3 is the "Meaning" ean which contains the meaning of the ambiguous sentences.

2.5. Cosine Similarity

The sentences inputted are calculated in terms of their resemblance to the sentences in the data set. In order to calculate similarities between sentences, Cosine Similarity is used [24- 28]. In this research, the sentence to be used as input is "setiap awal bulan kami gajian". The sentence has been identified to contain a grammatical ambiguous word, "bulan (month)". Sentences related to "bulan (month)" are: a. Awal bulan kami gajian (We are paid at the beginning of the month). b. Bumi dan bulan merupakan benda langit (The Earth and The Moon are sky objects). By using Cosine Similarity, we can find the similarity of a string. After the string similarity is known, the system is able to show the meaning of the sentence. The following is the Cosine Similarity algorithm processing. In a more detailed explanation, the example used is the closeness between "awal bulan kami gajian" (We are paid at the beginning of each month) and "awal bulan kamu gajian" (you are paid at the beginning of each month) ". S1= awal bulan kami gajian (We are apid at the beginning of the month). S2= awal bulan kamu gajian (You are paid at the beginning of the month). Table 2. Ambiguous Words and Sentences

Word Count	A	B	A.B	A2	B2
Awal (beginning)	1	1	1	1	1
Bulan (month)	1	1	1	1	1
Kami (we)	1	0	0	1	0
Kamu (you)	0	1	0	0	1
Gajian (paid)	1	1	1	1	1
	1	0	0	1	0
	1	1	1	1	0
	0	0	0	1	1
	1	0	1	2	4
	1	1	0	1	0
	3	3	0	3	3

Table 2 explains the existence of each word in a sentence. If the word is contained in the sentence , code 1 will be given in line A. Conversely, code 0 will be given when the word is not

found in the sentence. Cosine Similarity is a method used to calculate the degree of similarity between two objects. For the purpose of data clustering, a good function is the Cosine Similarity function. For the set notation the formula below is used: Title of paper.. (First Author) 106 • ISSN: 1693-6930

$$Rililarity = \cos(\theta) = \frac{|AA| \cdot |BB|}{|AA| \cdot |BB|} (1) = \frac{2}{4+3} = 0,166$$

After being calculated using the Cosine Similarity method, the highest closeness is 0.166. More detailed explanation is shown in table 3 Table 3. The Results of Anayzing the Meaning of Sentences using Confusion Matrix method

Id Input Sentences Data Set Value of Similarity

1 Setiap awal bulan kami gajian (We are paid at the beginning of each month)

2 Setiap awal bulan kami gajian (We are paid at the beginning of each month)

Setiap awal bulan kamu gajian (You are paid at the beginning of each month)

Bumi dan bulan merupakan benda langit (Earth and moon are sky objects)

0,16 0,05

In table 3 two values appear, which are 0.16 and 0.05. Given the high similarity value of the sentences "setiap awal bulan kami gajian" and "setiap awal bulan kamu gajian", It can be concluded that the word "bulan" in the sentence means "a period of time".

2.6. Determining the Meaning of Sentences when Being Processed in the Program From the Boyer-Moore Algorithm and Cosine Similarity processes

some results are obtained [29,30]. These results stated that "bulan" in the input sentence means a period of time (month). Following are the results obtained, the results are also implemented on the web. Figure 7. The Results of Detecting Grammatical Ambiguous Sentences using Cosine Similarity

Figure 7 discusses the results of calculations performed by using Cosine Similarity method. At this stage the sentence "Setiap awal bulan kami gajian (we are paid at the beginning of each week) " had been tested for the smiliarity with the sentence "Setiap awal bulan kamu gajian (you are paid at the beginning of each month) and "Bumi dan Bulan merupakan benda langit (The Earth and The Moon are sky objects)". After being calculated using Cosine Similarity method, the sentence has been proven to have closeness in meaning with the sentence "Setiap awal bulan kami gajian (We are paid at the beginning of each month) " this sentence contains word "bulan" which means a period of time (month) with the value of similarity +of 0.16.

3. Results and Analysis

3.1. Accuracy, Precision, Recall and F-Measure Test

At this stage, the system is tested using a confusion matrix, which is often used to find out precision, accuracy, and recall [31-33]. With the confusion matrix, it can be seen how well the system is able to understand grammatically ambiguous sentences. This system experiment has been carried out 200 times. While there are 50 words in the database. The calculations can be seen below: Table 4. Confusion Matrix Value

TP=40 FP=3 TELKOMNIKA Vol. x, No. x, Januari 2020: 791-79x TELKOMNIKA ISSN: 1693-6930 • 107 FN=10

TN=147

$$Accrracy = \frac{40+4104+71+837+10}{40+4104+71+837+10} = 0,935$$

$$Precirill = \frac{40}{40+3} = 0,9302$$

$$Recall = \frac{40}{40+3} = 0,8$$

(1) (2) (3) The value scale of matrix confusion ranges from 0-1. From the above calculation it is obtained the value of accuracy which is 0.935, Precision is 0.9320, and Recall is 0.8. Judging from the Recall value, the system is able to recognize ambiguous words as much as 80%. Meanwhile, the lack of data sets has made the system unable to recognize ambiguous words. F-Measure is one of the evaluation calculations method in retrieving information that combines recall and precision. The values of Recall and Precision in a situation might bear different weights. The measurement that displays the reciprocity between Recall and Precision is the F-Measure, which is the weight of the harmonic mean of the Recall and Precision.

$$F1 = \frac{2 * 00,99330022 * 00,88}{00,99330022 + 00,88} = \frac{2 * 01,77434}{00,99330022 + 00,88} = 0,8601$$

(4) The f-measure range is between 0-1. From the above calculation, the F-measure value is 0.86.

2.4. The Speed in Detecting Ambiguous Words

In understanding grammatical ambiguous sentences, the system requires different time to process each sentence; the processing of this sentence depends on the number of characters understood [34]. The average sentence

search value is 0.003275. The following table shows the rate of speed in detecting ambiguous words: Table 5. Speed in Detecting Ambiguous Words

Ambiguous words	Sentences	Speed
Acara ini dikemas dengan sangat Kemas (organized) baik (This event is very well organized)	Aku mengenang budi baikmu Budi (Mind) Aku mengenang budi baikmu(I remember your kindness)	Gus kamu kemarin mendapatkan Salam (Regards) salam dari anggi (Gus, Anggi sent you regards yesterday)
Tahu (Tofu) Agus kesini tadi memberi tahu (Agus came here to give us tofu)	Bunga deposito di bank jatim Bunga (Interest) lumayan tinggi (The deposit interest rate in Bank Jatim is quite high)	Bangku (Bench) Dia tidak pernah makan bangku sekolah (he never went to school)
Kuda (Horse) Dia bagai kuda hitam (He is like a dark horse)	0.0042	0.0036
0.0039	0.0039	0.0037
0.0043	0.0024	

There is a need for speed calculations to analyze system performance. Ambiguous sentence detection speed is presented in table 5. The highest speed in this speed detector is 0.0024 to detect the sentence "Dia bagai kuda hitam (He is like a dark horse)". While the lowest speed is 0.0042 in the sentence "Acara ini dikemas dengan sangat baik (This event is very well organized)". Title of paper.. (First Author) 108 • ISSN: 1693-6930

4. Conclusion

Grammatical ambiguous sentences in Indonesian are sentences that have two meanings. To recognize ambiguous sentences, we need a Boyer-Moore algorithm and Cosine Similarity algorithm. Boyer-Moore algorithm is used to find strings (ambiguous sentences). While the Cosine Similarity algorithm is used to calculate the degree of similarity between two objects. Cosine Similarity can be used to find out the meaning of a sentence, by calculating the similarity of the test data to the data set. The Boyer-Moore algorithm and the Cosine Similarity Algorithm are very effective for detecting ambiguous words. This can be proven by the success rate of the system in retrieving information (recall) of 80%. While the average speed of the boyer-Moore algorithm when detecting ambiguous sentences takes 0.003275 seconds.

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Device(SSD) Istambul. 2019. Pp. 357- 360 [102 • ISSN: 1693-6930](#) So far the data sets covering Indonesian ambiguous grammatical sentences are still not available yet. While the availability of grammatical ambiguous sentences detector is highly needed. For instance, in order to improve the accuracy of a translator system, and to make it easier for computers to understand a text. So in this research, the expected novelty that will be achieved is to create a grammatical ambiguous sentence detection system in Indonesian, using the Boyer-Moore algorithm.

2. Research Method Several steps are needed to build this research; the following is the research method used. Figure 1. Flowchart Detection Of Ambiguous Indonesian Sentences With Boyer-Moore Algorithm

Figure 1 explains the processes involved in the ambiguous sentence detection system using Boyer-Moore algorithm. This flowchart explains the sentence being entered, then the sentence is checked using Boyer-Moore algorithm, so that it can be selected whether the sentence contains any ambiguous words. If the sentence is stated to contain ambiguous words, then the meaning of the sentence would be searched using Cosine Similarity method.

2.1. Sentence Input Sentence input consists of sentences which are still unknown whether it contains ambiguity. The sentences are conversational sentences in Indonesian. In Indonesian, there are several types of ambiguous sentences, namely grammatical, lexical, and phonetic [11]. This research will focus on grammatical ambiguity. Grammatical ambiguous sentences are ambiguous sentences that occur due to incorrect grammar use, but this ambiguity will disappear once it is used in a sentence. The following are examples of ambiguous sentences. [TELKOMNIKA Vol. x, No. x, Januari 2020: 791-79x](#)
[TELKOMNIKA ISSN: 1693-6930 • 103](#) "Setiap awal bulan kami gajian (We are paid at the beginning of each month)" The sentence above contains an ambiguous word that is "bulan (month)", the word "bulan" has two meanings, which are a. Bulan (month) = A period of time b. Bulan (moon)= sky object The following is a simple description of an ambiguous word

Figure 2. Grammatical ambiguous word description In Figure 2, it is explained that the word "bulan" has two meanings, in which one refers to a particular unit of time (month), and the "bulan" which shows the earth's satellites (moon--an object in the sky). At this stage the meaning of the word is unknown.

2.2. Ambiguous Word Search using Boyer-Moore. Boyer-Moore algorithm is an algorithm used for string searching [12-20]. In conducting string searching, the Boyer-Moore algorithm is highly accurate. Following are the steps conducted by Boyer-Moore algorithm to find ambiguous sentences.

a. 1st step Figure 3. Ambiguous Word Search step 1 Figure 3 explains the process of searching for the ambiguous word "bulan" in the sentence "setiap awal bulan kami gajian (at the beginning of each month we are paid)." This search is carried out from the first string, the search is carried out from the left side to the right side. If the word has not been found, the search would be repeated again, starting with the second string.

b. 2nd step Figure 4. Ambiguous Word Search step 2 Figure 4 explains the process of searching for the ambiguous word "bulan" in the sentence "setiap awal bulan kami gajian (at the beginning of each month we are paid)". This process is a continuation of the first process, the search string starts from the second string.

c. 13th step Figure 5. Ambiguous Word Search step 13 [Title of paper.. \(First Author\). 104 • ISSN: 1693-6930](#) Figure 5 shows that the process of searching for the ambiguous word "bulan" in the sentence "setiap awal bulan kami gajian (at the beginning of each month we are paid)" has been successful. The word "moon" is found on the 13th process, the word "bulan" was found in the 13th string. On the 13th step, a grammatical ambiguous word was found; the word is the word "bulan". In this study, the Boyer-Moore algorithm is used to check strings. Inputs (sentences that are not yet known to be grammatically ambiguous) are being matched with data sets of words that have been identified as grammatical ambiguous. At present, the number of data sets

that can be stored is only 50; this happens because there are no researchers who have developed applications related to grammatical ambiguous sentences in Indonesian. The following is a flowchart describing the Boyer-Moore string searching process. Figure 6. String Searching Flowchart using Boyer-Moore Algorithm Figure 6 explains the Flowchart where the ambiguous word in a sentence is searched, On the Flowchart it is shown that if the ambiguous word has not been found, then a search is carried out on the next string, until the word is found or declared to be missing. If the word is found from the beginning, the system will immediately terminated and it can be decided that the ambiguous word exists.

2.3. Ambiguous Sentences Data SET

Grammatical ambiguous sentence dataset is a collection of ambiguous words and sentences used as a benchmark [21-23]. Since up to this stage, there was no ambiguous sentences found, this research has collected data on ambiguous words and sentences from Indonesian linguists. In this research, the resource person is an Indonesian language lecturer, Encil Puspitoningrum, M. Pd. The following is a table of ambiguous words and sentences obtained from her.

Ambiguous words	Sentence	Meaning
Budi (Mind)	Salam (Regards)	Tahu (Tofu)
Aku mengenang budi baikmu (I remember your kindness)	Gus kamu kemarin mendapatkan salam dari anggi (Gus, Anggi sent you regards yesterday)	Kebaikan (Kindness)
Sapaan (Greetings)	Makanan (Food)	

[TELKOMNIKA Vol. x, No. x, Januari 2020: 791-79x TELKOMNIKA ISSN: 1693-6930 • 105](#) Agus kesini tadi memberi tahu (Agus came here to give us tofu) Bunga deposito di bank jatim Bunga (Interest) lumayan tinggi (The deposit interest rate in Bank Jatim is quite high) Dia tidak pernah makan bangku Bangku (Bench) sekolah (He never went to school) Acara ini dikemas dengan sangat Kemas (Organized) baik (This event is very well organized) Awal Bulan Kamu gajian (You Bulan (Month) are paid at the beinning of the month) Keuntungan (Profit) Pendidikan (Education) Melakukan pekerjaan (Doing work) Waktu (Time)

Table 1 consists of 3 rows, line 1 is "Ambiguous Words" which contains the list of ambiguous words. Line 2 "Sentences" contains sentences that usually use ambiguous words. Line 3 is the "Meaning" ean which contains the meaning of the ambiguous sentences.

2.5. Cosine Similarity

The sentences inputted are calculated in terms of their resemblance to the sentences in the data set. In order to calculate similarities between sentences, Cosine Similarity is used [24- 28]. In this research, the sentence to be used as input is "setiap awal bulan kami gajian". The sentence has been identified to contain a grammatical ambiguous word, "bulan (month)". Sentences related to "bulan (month)" are: a. Awal bulan kami gajian (We are paid at the beginning of the month). b. Bumi dan bulan merupakan benda langit (The Earth and The Moon are sky objects). By using Cosine Similarity, we can find the similarity of a string. After the string similarity is known, the system is able to show the meaning of the sentence. The following is the Cosine Similarity algorithm processing. In a more detailed explanation, the example used is the closeness between "awal bulan kami gajian" (We are paid at the beginning of each month) and "awal bulan kamu gajian" (you are paid at the beginning of each month) ". S1= awal bulan kami gajian (We are apid at the beginning of the month). S2= awal bulan kamu gajian (You are paid at the beginning of the month). Table 2. Ambiguous Words and Sentences Word Count

	A	B	A	B	A2	B2
Awal (beginning)	1	1	1	1	1	1
Bulan (month)	1	0	0	1	1	0
Kami (we)	1	1	0	0	0	1
Kamu (you)	1	0	1	2	4	1
Gajian (paid)	1	0	1	0	3	0

Table 2 explains the existence of each word in a sentence. If the word is contained in the sentence , code 1 will be given in line A. Conversely, code 0 will be given when the word is not found in the sentence. Cosine Similarity is a method used to calculate the degree of similarity between two objects. For the purpose of data clustering, a good function is the Cosine Similarity function. For the set notation the formula below is used: [Title of paper.. \(First Author\) 106 • ISSN: 1693-6930](#)

$Rililariry = \cos(\theta) = \frac{||AA|| \cdot ||BB||}{||AA|| \cdot ||BB||} (1) = \frac{2}{4+3} = 0,166$ After being calculated using the Cosine Similarity method, the highest closeness is 0.166. More detailed explanation is shown in table 3 Table 3. The Results of Anayzing the Meaning of Sentences using Confusion Matrix method Id Input Sentences Data Set Value of Similarity 1 Setiap awal bulan kami gajian (We are paid at the beginning of each month) 2 Setiap awal bulan kami gajian (We are paid at the beginning of each month) Setiap awal bulan kamu gajian (You are paid at the beginning of each month) Bumi dan bulan merupakan benda langit (Earth and moon are sky objects) 0,16 0,05 In table 3 two values appear, which are 0.16 and 0.05. Given the high similarity value of the sentences "setiap awal bulan kami gajian" and "setiap awal bulan kamu gajian", It can be concluded that the word "bulan" in the sentence means "a period of time".

2.6. Determining the Meaning of Sentences when Being Processed in the Program From the Boyer-Moore Algorithm and Cosine Similarity processes some results are obtained [29,30]. These results stated that "bulan" in the input sentence means a period of time (month). Following are the results obtained, the results are also implemented on the web. Figure 7. The Results of Detecting Grammatical Ambiguous Sentences using Cosine Similarity Figure 7 discusses the results of calculations performed by using Cosine Similiarity method. At this stage the sentence "Setiap awal bulan kami gajian (we are paid at the beginning of each week) " had been tested for the smiliarity with the sentence "Setiap awal bulan kamu gajian (you are paid at the beginning of each month) and "Bumi dan Bulan merupakan benda langit (The Earth and The Moon are sky objects)". After being calculated using Cosine Similarity method, the sentence has been proven to have closeness in meaning with the sentence "Setiap awal bulan kami gajian (We are paid at the beginning of each month) " this sentence contains word "bulan" which means a period of time (month) with the value of similarity +of 0.16. 3.

Results and Analysis 3.1. Accuracy, Precision, Recall and F-Measure Test At this stage, the system is tested using a confusion matrix, which is often used to find out precision, accuracy, and recall [31-33]. With the confusion matrix, it can be seen how well the system is able to understand grammatically ambiguous sentences. This system experiment has been carried out 200 times. While there are 50 words in the database. The calculations can be seen below: Table 4. Confusion Matrix Value TP=40 FP=3 [TELKOMNIKA Vol. x, No. x, Januari 2020: 791-79x TELKOMNIKA ISSN: 1693-6930 • 107](#) FN=10

TN=147 $Accrracy = \frac{40+4104+71+837+10}{40+4104+71+837+10} = 0,935$ $Precirill = \frac{40}{40+3} = 0,9302$ $Recall = \frac{40}{40+3} = 0,8$ (1) (2) (3) The value scale of matrix confusion ranges from 0-1. From the above calculation it is obtained the value of accuracy which is 0.935, Precision is 0.9320, and Recall is 0.8. Judging from the Recall value, the system is able to recognize ambiguous words as much as 80%. Meanwhile, the lack of data sets has made the system unable to recognize ambiguous words. F-Measure is one of the evaluation calculations method in retrieving information that combines recall and precision. The values of Recall and Precision in a situation might bear different weights. The measurement that displays the reciprocity between Recall and Precision is the F-Measure, which is the weight of the harmonic mean of the Recall and Precision. $F1 = \frac{2 * 00,99330022 * 00,88}{00,99330022 + 00,88} = \frac{2 * 01,7,7434}{00,99330022 + 00,88} = 0,8601$ (4) The f-measure range is between 0-1. From the above calculation, the F-measure value is 0.86. 2.4. The Speed in Detecting Ambiguous Words In understanding grammatical ambiguous sentences, the system requires different time to process each sentence; the processing of this sentence depends on the number of characters understood [34]. The average sentence search value is 0.003275. The following table shows the rate of speed in detecting ambiguous words: Table 5. Speed in Detecting Ambiguous Words Ambiguous words Sentences Speed Acara ini dikemas dengan sangat Kemas (organized) baik (This event is very well organized) Aku mengenang budi

baikmu Budi (Mind) Aku mengenang budi baikmu(I remember your kindness) Gus kamu kemarin mendapatkan Salam (Regards) salam dari anggi (Gus, Anggi sent you regards yesterday) Tahu (Tofu) Agus kesini tadi memberi tahu (Agus came here to give us tofu) Bunga deposito di bank jatim Bunga (Interest) lumayan tinggi (The deposit interest rate in Bank Jatim is quite high) Bangku (Bench) Dia tidak pernah makan bangku sekolah (he never went to school) Kuda (Horse) Dia bagai kuda hitam (He is like a dark horse) 0.0042 0.0036 0.0039 0.0039 0.0037 0.0043 0.0024 There is a need for speed calculations to analyze system performance. Ambiguous sentence detection speed is presented in table 5. The highest speed in this speed detector is 0.0024 to detect the sentence "Dia bagai kuda hitam (He is like a dark horse)". While the lowest speed is 0.0042 in the sentence "Acara ini dikemas dengan sangat baik (This event is very well organized)". [Title of paper.. \(First Author\) 108 • ISSN: 1693-6930](#)

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Tahu (Tofu) Agus kesini tadi memberi tahu	(Agus came here to give us tofu)	0.0039
Bunga deposito di bank jatim	Bunga (Interest) lumayan tinggi	0.0037
Bangku (Bench) Dia tidak pernah makan bangku sekolah	(he never went to school)	0.0043
Kuda (Horse) Dia bagai kuda hitam	(He is like a dark horse)	0.0024

There is a need for speed calculations to analyze system performance. Ambiguous sentence detection speed is presented in table 5. The highest speed in this speed detector is 0.0024 to detect the sentence "Dia bagai kuda hitam (He is like a dark horse)". While the lowest speed is 0.0042 in the sentence "Acara ini dikemas dengan sangat baik (This event is very well organized)". Title of paper.. (First Author) 108 • ISSN: 1693-6930

4. Conclusion Grammatical ambiguous sentences in Indonesian are sentences that have two meanings. To recognize ambiguous sentences, we need a Boyer-Moore algorithm and Cosine Similarity algorithm. Boyer-Moore algorithm is used to find strings (ambiguous sentences). While the Cosine Similarity algorithm is used to calculate the degree of similarity between two objects. Cosine Similarity can be used to find out the meaning of a sentence, by calculating the similarity of

the test data to the data set. The Boyer-Moore algorithm and the Cosine Similarity Algorithm are very effective for detecting ambiguous words. This can be proven by the success rate of the system in retrieving information (recall) of 80%. While the average speed of the boyer-Moore algorithm when detecting ambiguous sentences takes 0.003275 seconds. References [1] Charina I N. Lexical And Syntactic Ambiguity In Humor. *International Journal of Humanity Studies*. 2017; Vol.1, Issues 1, and page 120–131 [2] Soyusiawaty D, Ariwibowo E. Designing And Implementing Parsing For Ambiguous Sentences In Indonesian Language. *Journal of Theoretical and Applied Information Technology*. 2016; Vol.84, Issues 3, and page 339-347 [3] Andarini SRP, Anugerahwati M G. Structural Ambiguity In The Jakarta Post Newspaper's Headline News. *English Language Education Universitas Negeri Malang*. 2013; Vol.4, Issues 2, and page 1-15 [4] Moukrim C, Traghaa A, Benlahmera HEH, Almalkib T. An innovative approach to autocorrecting grammatical errors in Arabic texts . *Journal of King Saud University - Computer and Information Sciences*. 2019 [5] Dennis D, Dewi I I, . Students' Understanding Of Ambiguous Sentences In Websites. *HUMANIORA* Vol.2 No.1 April 2011: 381-394. [6] Uliniansyah MT, Ishizaki S, Uchiyama K. Solving Ambiguities in Indonesian Words by Morphological Analysis Using Minimum Connectivity Cost. *Journal of natural language Processing*. 2004; 11(1): 1-20. [7] Clare QC. Language Ambiguity: A Curse and a Blessing. *Literary Translation*. 2003; Vol.7, Issues 1, and page 1-4 [8] Ritan YCG. Ambiguity and Tree Structure Of Setences in Home Movie. Thesis. Yogyakarta& Universitas Sanata Dharma Yogyakarta. 2018. [9] Gatt A, Kramher E. Survey of the State of the Art in Natural Language Generation: Core tasks, applications and evaluation. *Journal of Artificial Intelligence Research*. 2018; Vol.61, Issues 1, and page 65-70. [10] Rizki T D, Yusliani N. Rancang Bangun Sistem Pengecekan Ambiguities Kalimat Berbahasa Indonesia Mengunakan Harmony Search Algorithm. *Annual Research Seminar*. 2016.Vol 2. No 1. [11] Anwari Y, Kartika D, Saibi E A. Analisis Kalimat Ambigu Dalam Novel Suatu Tinjauan Semantik. *Bung Hatta*. 2013. Vol 2. No 3. [12] Lin Y, Wang X, Ng WWY. Sphere Classification for Ambiguous Data. *International Confrence on Machine Learning and Cybernetics, Dalian, China*.2016. Pages 2571-2574 [13] Xiong Y. A Composite Boyer-Moore Algorithm for the String Matching Problem. *International Confrence on Pararallel and Distributed Computing, Application and Technologies*. Wuhan, China.2010. P [14] Wang Y. A New Method to Obtain the Shift-table in Boyer-Moore's. *International Confrence on Pattern Recognition , Tampa*. 2008. Pages 1-4. [15] Goldschlag DM. Mechanically Verifying Concurrret Programs With The Boyer-Moore Prover. *IEEE Transaction on Software Engineering*. 1990. Vol.16, Issues 9. Pages 1005-1023 [16] Domingues A, Carballo PP, Nunez A. Prommable Soc Platform for Deep Packet Inspection Using Enhanced Boyer- Moore Algorithm. *Internasional Symposium on Reconfigurable Commication-Centric System-on- Chip*. Madrid. 2018. Pages 1-8 [17] Danvy O, Rohde HK. On Obtaining the Boyer-Moore String-Matching Algorithm by Partial Evaluation. 2006, Volume 99, Issue 4 [18] Saleh AZM, Rozali NA, Buja AG, Jalil KA, Ali FHM, Rahman TFA. A Method for Web Application Vulnerabilities by Using Boyer-Moore String Matching Algorithm. *Procedia Computer Science*, 2015. Volume 72. Pages 112-121 [19] Watson WB. A New Regular Gramar Pattern Matching Algorithm. *Theoretical Computer Science*. 2003. Volume 299, Issues 1-3 Pages 509-521 [20] Sabriye A O J, Zainon W M N W. An Approch For Detection Syntax and Syntatic Ambiguity in Software Requitment Specification. *Journal of Theretical and Applied Infoemation Tecnology*. 2018. Vol 96. No 8 TELKOMNIKA Vol. x, No. x, Januari 2020: 791-79x TELKOMNIKA ISSN: 1693-6930 • 109 [21] Ramadhani R A, Putra I K G D, Sudarma M, Giriantari I A D. Database of Indonesian Sign Systems. *ICSGTEIS*.2018. pp. 225-228 [22] Jiang H. Study on Information Retrieval Model Based on Rough Set Theory. *Internasional*

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