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THE DEVELOPMENT OF BAHASA INDONESIA CORPORA FOR MACHINE LEARNING MODEL IN COMBATING CYBER BULLYING: A CASE STUDY OF THE INDONESIAN 2017 CAPITAL CITY GOVERNOR ELECTION

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ABSTRACT

The cyber bullying is considered as a serious problem and it is proven that the impact obtained from cyber bullying is larger than the suppression of physical in traditional bullying. One way to reduce the cyber bullying is doing an earlier detection on it. Therefore, each of uploaded bullying content could be removed by an application of concerned. However, it is not an easy task to do this detection because of several reasons. First of all, the language form of the cyber bullying constructed is usually not in accordance with the formal language structure. As the result, the assessment of content cannot be processed per word individually, but in the contrary, it should include the whole sentence, including the punctuation marks, emoticons, and tagging. In other words, ones cannot rely on the rough/dirty word filtering in combating the cyber bullying, but rather have a tool that understands the bullying context within a sentence. Secondly, every language is different in how it is used in expressing its user mood. Thus, although there are reports on how machine learning successfully used in certain levels in combating cyber bullying in English, it does not mean that it can be used in other languages. In fact, the machine learning algorithm should work on the top of large and structured sets of texts of a certain language that can be stored and processed electronically called corpora. The ultimate goal is to propose a machine learning algorithm for combating cyber bullying in Bahasa Indonesia. Bahasa Indonesia corpora have been developed and will be tested using the existing machine learning algorithms that work in Indonesia, English, and Hindi. The data had been scraped and derived from social media during the 2017 Indonesian capital city governor election.

Keywords: *Machine Learning, Cyber Bullying, Social Media, Corpora, Feature Space Design, Classification*

1. INTRODUCTION

Cyber bullying is a subject of the research conducted by ministry of communication and information along with United Nations International Children's Emergency Fund (UNICEF) in 2011 until 2012 involving representative samples of 400 children and teenagers from urban and rural areas in 11 provinces of Indonesia [1]. The research results that 13% of them are cyber bullying experienced, 8.2% of them have been sent a bullying message through social media, and other 4.4% have been sent a bullying message through text message. In addition, IPSOS, a Global Market and Opinion Research Specialists in collaboration with Reuters, Business Financial News, US International Breaking News, found that 74% of Indonesian respondents pointed out that social media such as Facebook are where cyber bullying happens [2].

Several researchers have been doing researches in detection of cyber bullying. [3]Farisia has done detection of cyber bullying using text mining by

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crawling twitter with HyperPipes, Tree J.48, and Support Vector Machine (SVM) method. It was reported that among these methods, J.48 reached accuracy of 86.24%, which was the best among other methods used in this research. For the purpose of the research, Farisia used Margono corpora namely the collection of written and spoken texts. Furthermore, [6]Farisia reported that SVM method did not work well in the research, and suggested that it has to be used by oversampling, oversizing, and using punctuation mark as well as the emoticons on the corpora. [4]Dinakar has done detection of cyber bullying by crawling youTube comments using Naive Bayes, HyperPipes, Tree-J.48, SVM methods as well as the feature space design. [5]Nahar has done detection of cyber bullying by crawling social media using SVM with linear kernel and 10-fold cross validation, as well as feature selection. [6]Desai has done detection of cyber bullying using SVM with Radial Basis Function (RBF) kernel to classify sentences or phrase which contains bullying: #kataksh has accuracy of 78.84%, markers (the positive and negative word, #tag kataksh, and emoticon which includes bullying context) has accuracy of 83.74% and without marker (cue word, odd combination of words, pair of words, and its antonym which includes bullying context) has accuracy of 66%. Kataksh is a Hindi word which means something like insinuation or sarcasm in English word.

In Indonesia, the pre-election days often filled with bullying especially cyber bullying at social media. The following sentence is bullying sentence example in social media, "*Kesalahan terbesar Prabowo adalalah memberi tunggangan kepada pecatan menteri yang cuma bermodalkan kata-kata manis dan indah*." This sentence is a bullying sentence, because this sentence says that there is a politic actor which hired a fired officer of state to be the capital city governor. Furthermore, the fired officer of state did not has skill, instead he has promises, 'sweet' and 'beautiful' words only. These words convey the meaning of bullying context, since there are negative words such as fired minister (*pecatan menteri*) and has sweet and beautiful words only(*bermodalkan kata-kata manis dan indah saja*). If we see this sentence, the sentence can be an information or bullying sentence. If the sentence was not occur in the capital city governor election event period, the sentence will be an information sentence. But if it occurs in capital city governor election event period, the sentence will be a bullying sentence. Social media is used as a campaign media to support their side. The bullying is presented in text, picture, and video. Especially for text, the senders write their bullying sentence in their social media status or comment on other status, like the previous sentence example. This sentence is not easy to be assessed. Assessment should be seen from the context of sentence, instead of per word. But if we see this sentence, there are some key words which are possibly elements of bullying sentence, such as: "*pecatan menteri*" (the fired minister) and "*bermodalkan kata-kata manis dan indah*" (he has many 'sweet' and 'beautiful' words, sweet and beautiful words are good appointment which are not easy to implement his condition). Those key words have negative meaning. When a sentence includes the key words, the sentence probably is used to bully. Therefore, we will use key word lists to produce feature space design that can help to detect cyber bullying.

In the machine learning, there are challenges in the field of text classification. In the implementation, there are many ways to fight this challenge. One of them is we can use feature space design as a solution for this challenge [7]. [6][4][3]The researchers also have the feature space design to detect the cyber bullying. Feature space design can facilitate and improve accuracy of cyber bullying detection. Hence, this research carried out the learning about pattern of Indonesia bullying phrase/sentence that focused on the people reaction or respond to capital city governor election in social media. Seen from the corpora, it is already positively containing bullying which has feature space design containing: word, phrase, cue word, punctuation mark, #tag, and emoticon. Researchers hope the feature space design can help to detect the cyber bullying in social media.

The section II of this paper discusses the similar works, fundamental theory of machine learning. The section III discusses the data collection, while section IV discusses the feature space that will be used. Then, section V discusses the proposed algorithm that will be used. And the last, section VI discusses the result of this paper which produces the conclusion in section VII.

2. LITERATURE REVIEW

Machine learning is one of the branches of discipline artificial intelligence which discuss a development of system based on data. Many things have been learned, but there are basically 4 basics learned in machine learning; supervised learning,

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unsupervised learning, semi-supervised learning, and reinforcement learning. One technique of machine learning implementation is supervised learning. In this research, we used supervised learning or SVM. As discussed earlier, machine learning without data will not be able to work. Hence, the first thing that should be prepared is the data. The data usually is divided into 3 groups, those are training data, validation data, and testing data. Training data was used to train algorithm for looking for the suitable model, validation data was used to validate the model before testing, while data testing was used to test. It also knows both performance model and stage testing. We can do two kinds of prediction depends on its output type. If it is a discrete prediction then it is called as the classification. Meanwhile, if it is a consistent prediction, then it is called as regression process. In this research, we use prediction to classify sentences whether it is bullying or not-bullying.

In this research, we used text mining approach to analyze every sentence derived from social media. Text mining is a technique that can be used to do classification, in which text mining is a variety of data mining trying to discover patterns withdrawn from a bunch of textual data [13]. Text mining usually involves processes of text arrangement input (usually parsing, along with the addition of some derivative linguistic features and the omission of some of them, as well as the insertion of sub-sequent into a database), determining patterns in structured data, and finally evaluate and interpret the output.

In the process, machine learning has many process, those are:

1. Problem Definition, at this stage we discuss what we want to be resolved.
2. Analyzing the Data, at this stage, firstly, we figure out everything we will use as the measurement. In this research, the measurement is used to detect the cyber bullying.
3. Preparing the Data
   a) Pre-processing
      After learning the data we will use, we must change the data representation that we can compute as learning for computers. To process the classifications, the data used was data in the form of vector.
   b) Labeling Data
      Now that we have data representation, then we do manual labelling. Manual labelling mean assigning labels/tag at each data. In this research, we have two labels which are bullying and not bullying.
   c) Data Division
      After we had numbers of data, we have to divide the data into 3 groups those are training, validation, and testing data.
4. Evaluating the Algorithms, at this stage we chose the suitable algorithms classifications to be applied to the dataset we have. There are many algorithm classifications as SVM, Naive Bayes, and etc. In this research, we used SVM, HyperPipes, and Tree J.48 as the algorithm. We evaluated the result using data testing. We counted the accuracy percentage of the models in the test to classify the data. We took cross validation in evaluation stage. Cross validation is dividing the data into n parts, then evaluate it as much as n times. In every evaluation, one part was used as data testing, while the rest is used for training file. It means that the classification does not suitable for a particular party.
5. Improving the Results. The next stage is the stage where we had improved the model we had made. It is done by conducting training model at regular intervals when there is new data which is not classified correctly.
6. Presenting the Results. The final stage is how to make this model classifications and how it can be used by others.

There are many machine learning tools, such as RapidMiner, R Library, and the Waikato Environment for Knowledge Analysis (WEKA).

2.1 SVM

SVM is a technique to do a prediction, either in the classification or regression [8]. SVM was developed by Boser, Guon, and Vapnik (1992) and first presented in 1992 in annual workshop on computational learning theory. The basic concept of SVM is actually a harmonious combination of computed theory which exist decades earlier, as the hyper lane margin (Duda Hart [1973], Cover [1965], Vapnik [1964], etc), the kernel introduced by Aronszajn in 1950, and likewise the concept is supported by the others. The fundamental concept of SVM can be explained in an effort of best hyper plane that serves 2 in out classes [14]. Simply, SVM is able to solve classifications problems in 2 classes. It makes the model based on the data military training input of each class done by SVM.

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The SVM is known as the most reliable machine learning technique after the previous machine learning known as neural network (NN). Both SVM and NN have been used in pattern recognition learning conducted using pairs of data input and data output desired. Such learning called supervised learning which obtain function depends on input and output. Next, the expected functions are obtained to have good generalization ability in the sense that these functions can be used for data input outside the data learning. Before SVM technique is used, the NN engineering (especially based on back propagation neural network) has succeeded in using recognition pattern issue. But, this technique has some weaknesses, one of them is that it does not always reach the minimum value of the curve function. In addition, phenomena over learning sometimes occurs which often can incapacitate its generalizations. Various efforts have been done to supervise this weakness, one of them is by using constructive approach of radial basis function networks by Moody et al (1989) and projection generalizing neutral networks [9].

Effort tin finding the hyperplane location is the core of the learning process in SVM. Figure 1 illustrates the deviation field of values that produce the largest margin. Margin is the distance between the barriers with an element of the second class outermost.

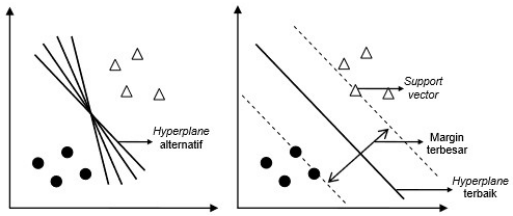

Figure 1: SVM is Trying to Get the Best Hyper Line [15]

The barrier function needed was linear functions as follows [15]:

$$f\vec{x} = sign\ (\vec{w}^{\tau}\vec{x} + b) \qquad (1)$$

With $\vec{w}$ is weight to represent the position of hyperplane in the normal plane, $\vec{x}$ is input data vector, and b is bias to represent the position of the field of relative to central coordinates. This technique tries to find the best hyperplane among the functions which do not limit the numbers to separate 2 kinds of objects. It looks for the best equivalent hyperplane in order to maximize the margin between 2 classes that can be obtained from formula of $2/|\vec{w}|$. It is equal to minimize the function of $\frac{1}{2}\vec{w}^{\tau}\vec{w}$ with the notice barrier of $y_i(\vec{w}^{\tau}\vec{x}_i + b) \geq 1$, with $\vec{x}_i$ is vector data, y_i is class label, and $\vec{w}$, b is the parameters to find the value. Next is the classification problems formulated in quadratic programming (QP). The problem can be solved by using the lag range multiplier, therefore the classification function will be as the following formula 2.

$$f(\overrightarrow{x}) = sign\ (\sum_i a_i\, y_i \overrightarrow{x_i^t}\vec{x} + b) \qquad (2)$$

With a_i is a lag range multiplier that correspondents to $\overrightarrow{x_i}$ [15].

Using the kernel function, data will transform into infinite-dimensional higher vector spaces. The next step is looking for the field of separation between the two classes in new vector spaces new. The following figure 2 illustrated the vector to infinite-dimensional higher vector space.

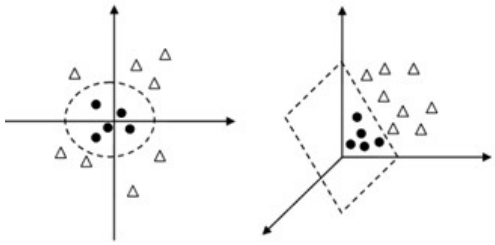

Figure 2: The Application of Kernels on SVM in Transformation into Dimension Higher [16]

There are several forms of function kernels, the most commonly used are linear, a polynomial, radial the base function (RBF), and sigmoid. The recommended kernel function for first testing is kernels RBF function because its performance is equal to SVM linear on a certain parameter, it also has similar behavior like kernels sigmoid function on parameter and small range value [0,1][17]. The RBF kernel function is shown on formula 3.

$$K\left(\overrightarrow{x_i}, \overrightarrow{x_j}\right) = \exp(-\gamma\, |\overrightarrow{x_i} - \overrightarrow{x_j}|)^2 \qquad (3)$$

With $\vec{x}_i$ is data training vector and $\vec{x}_j$ is data testing vector. Then, decided surface function is described as the following formula 4.

$$f(\vec{x}) = sign\ (\sum_i a_i\, y_i K\left(\overrightarrow{x_i}, \overrightarrow{x_j}\right) + b) \qquad (4)$$

Today, libsvm is one of SVM software's which is the most commonly used as well as promotes the classification support factor [18]. The use of libsvm covers the data practice and testing of the experimental SVM model.

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2.2 HyperPipes

HyperPipes is an algorithm that only exists in WEKA applications. This algorithm is one of the groups of supervised learning algorithms. HyperPipes is a very simple algorithm classification. This algorithm has 2 advantages which are having a very fast and can handle data which has many attributes. The HyperPipes algorithm cannot handle numerical data [20]. This becomes a problem in a discrete process. This is the basic idea for creating a pipe for each dataset class. During the training, the pipe for each class keeps track of the attribute values encountered in the training dataset but it does not count the numbers. Then, when it is tested, this pipe can be used to classify the value of the dataset test. The uniqueness of HyperPipes is its simplicity. The algorithm operates as follows:

1. Training
   Pipe is built for each class in the training and each pipe is marked with the class owned. Then, for each pipe built, the datasets are trained one by one. For each value in the corpus, if its value is known and not existed before in the dataset, then the attribute value is added to the pipe. The numeric classes are handled by maintaining various values for the attributes. If the value is outside the pipe range then the pipe range is updated so that this value is inside the range (as new minimum or maximum). As long as its value is discrete, the algorithm is not used.

2. Testing
   Each corpus on the dataset is compared to the previous pipe for each class. To determine which pipe is the most appropriate, there is a counter that increases every match between the corpus and the pipe. Corpus is grouped into the most suitable classes. When there are many pipes, the corpus is grouped into classes of the last pipes that have many conformities. For example, if there are pipe 1, pipe 2, pipe 3, and pipe 4 and the number of suitability of each pipe; 7, 0, 7 and 4, then the corpus will be grouped in pipe 3.

2.3 Tree J-48

Decision of tree J.48 is an implementation of the C4.5 algorithm that produces the decision tree. This is the standard algorithm used in machine learning. Decision tree is one of the classification algorithms in data mining. The classification algorithm is an inductive algorithm in learning to construct a model of a pre-classified dataset. Each data item is based on the value of each attribute. Classification can be seen as a mapping of a set of attributes of a particular class. The decision tree classifies the data given using the value of the attribute [21].

J.48 is an implementation of C4.5 in WEKA. C4.5 is a development of ID3. Some differences include:

1. Able to handle discrete or continuous types attributes.
2. Able to handle the empty attribute (missing value)
3. Can prune the branch

ID3 is an algorithm used to build a decision tree. This algorithm was discovered by J. Ross Quinlan, utilizing Shanon's Information Theory. ID3 itself is an abbreviation of Iterative Dichotomiser 3. The idea, is to make the tree with the most significant attribute initial branching, see Figure 3. Significant means the most practicable between yes and no.

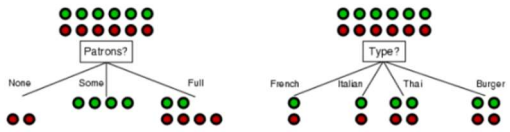

Figure 3: IDE Illustration [21]

It can be seen that the attribute “patron” divides into three where the division is quite ideal. The ideal meaning is every branch consists of only green or red. Indeed, for the “full” branch, it is not one color only (green or red only). But, the selection of the patron attributes is definitely better than the type attribute. To determine which attribute is used first to create tree branches, the information theory was used.

Decision Tree J.48 is an implementation of C4.5 algorithm (Java based) on Weka [20]. The C4.5 algorithm is used for object separators [22]. Tree or decision tree is widely known as part of the Graph, which is included in the slices of the field of automata science and language theory as well as discrete mathematics. The tree itself is a connected unconnected graph, and contains no circuit [23]. In general, the C4.5 algorithm for building decision trees is as follows [24]:

1. Select the attribute as the root
2. Create a branch for each value
3. Divide the case in the branch
4. Repeat the process for each branch until all the case on the branch has the same class.

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To select an attribute as a root, it should be based on the highest gained value of the attributes. To calculate the gain, it uses the following equation:

$$Gain(S, A) = Entropy(S) - \sum^{n} = Entropy\ (Si) \quad ..(5)$$

Description:
S = set of cases
A = attribute
n = number of attribute partition
A | Si | = number of cases on the i-th partition
| S | = number of cases in S

$$Entropy(s) = \sum_{i=1}^{n} = pi \times \log 2\ pi \ ..\ (6)$$

The description of base formula of the entropy is as follows
S = set of cases
A = feature
n = number of partitions
S pi = proportion of Si to S

2.4 RapidMiner

RapidMiner is one of the software's for processing data mining [10]. RapidMiner is an environment for machine learning, mining data, mining and text predictive analytics. The text mining is done by RapidMiner is range from the analysis text, extract patterns from the data set large and combine it with the methods of statistic, artificial intelligence, and a database. The aim of the text analysis is to get the highest quality information of text processed.

2.5 WEKA

The WEKA is an open source software which allows the researchers to easily access the state-of-the art techniques in machine learning [11]. This includes algorithms for regression, classification, and clustering. The workbench also has several graphical user interfaces that enable easy access to the underlying functionality, like as loading data from various sources (files like as CSV and LibSVMs format), URLs and databases). Besides, the workbench also has learning algorithm, classification (supervised and unsupervised) and regression algorithm, with cross validation to prediction. It can be a simulation and has performance value to know how selected algorithm is performed. WEKA would not only provide a toolbox of learning algorithms, but also a framework in which researchers could implement new algorithms without having to be concerned with the supporting infrastructure for data manipulation and scheme evaluation.

2.6 R Library

R is an open source data analysis software for statisticians. The R programming language is used by data scientists, statisticians, formal scientists, physical scientists, social scientists, and others who need to make sense of data for statistical analysis, data visualization, and predictive modeling [12]. R Studio is one of recommended data analysis software's because R is extensible and has an excellent combination of freedom (both kinds), flexibility, and power [12]. In addition, R has growing capabilities in handling Big Data in distributed systems or in parallel; some examples include Distributed Storage and List (DSL), Hadoop Interactive (hive), Text Mining Distributed Corpus Plug-In (tm.plug.dc), Hadoop Steaming (HadoopSteaming), and Amazon Web Services (AWS.tools) [12]. Besides, R has visualization feature for analyzing the data and for presenting the results.

3. DATA COLLECTION AND GENERATION

In detecting the cyber bullying, researcher need data in the form of word, phrase [4], punctuation mark, emoticon, #tag, and cue word [6] that often used to perform cyber bullying. The data will be feature space design in the research. Feature space design is the result from extraction of corpora, collection of written or spoken texts. The corpora has theme about people reaction or respond to capital city governor election. The corpora would come from social media (Facebook, Path, Twitter, Instagram, YouTube, and comment of blogs) derived by R Studio and other in-house application, database and Comma-Separated Values (CSV) file. R Studio is an application that has feature such as; data mining and predictive analysis [12]. With this application, we can filter many feeds from twitter. In using this application, we will get twitter feeds with their attribute such as Created-At, From-User, From-User-Id, To-User, To- User-Id, Language, Source, Text, Geo-Location-Latitude, Geo-Location-Longitude, Retweet-Count, and Id. In this research, the attribute used is only the Text. So the storage will be filtered until it has text attribute only. How about other feeds from Facebook, Path, Instagram, YouTube, and comment of blogs? We collected the feeds by an in-house application. The attribute feeds for this feed will be same as the twitter feeds which was saved in the storage. In this research, we have 3 attributes: date, source, and

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text. Date is about when the feed is published in the social media. The source says about where the feeds is published whether it is twitter, Facebook, or others. Than text says about the feed or the sentence published. The all feeds that are stored or the corpora that will be assessed manually by linguist then the corpora will be values whether it is positive or negative, shown in the following Table, 1 as example.

Table 1: Example of Corpora Obtained from Social Media and Their Value

No.	Sentences	Bullying (Y/N)
1	*Anies yang haus kekuasaan begitu dipecat karena tidak becus mengelola dana sertifikasi di Kemendiknas sampai kelebihan Rp 23 triliun meloncat ke seberang musuh politik dan bergabung dengan pecundang Pilpres 2014 Prabowo dan PKS.* (Anies who was starving of power were fired for not being able to manage the certification fund at The Ministry of Education (Kemendiknas) until it excess 23 trillion rupiah which jumped across his political enemies and then joined the losers of 2012 President Election, Prabowo and PKS.	N
2	*Kampanye SARA adalah satu-satunya cara Anies menuai dukungan karena kalau berkoar tentang program, maka Ahok-Djarot telah membuktikan dan pasti Anies kedodoran.* (SARA campaign is the only way Anies gained supports because if you talk about the programs then Ahok-Djarot has proved and surely overpowered Anies.	N
4	*Kesalahan terbesar Prabowo adalah memberi Tunggangan kepada PECATAN MENTERI yang cuma,bermodalkan kata-kata MANIS dan INDAH.* (Prabowo's biggest mistake is to give support to fired minister who only has SWEET and BEAUTIFUL words.)	Y
5	*Kalau,Ahok - Djarot harus meneruskan kariernya sebagai PELAYAN warga Jakarta menata, kota....sedangkan untuk Anies dibiarkan saja menata kata untuk beretorika dan,berwacana* (If Ahok-Djarot had to continue their career as a citizens servent who manage Jakarta while Anises is left alone to arrange words to dreaming and imagining)	N
6	*Kecoa2 radikal pada kepanasan di komen ini ckckck* (The, radical cockroaches in this comment is mad ckckck)	Y
7	*Sesungguhnya,sistem Demokrasi hanyalah berhala lainnya.* (Indeed, the democratic system is just another *berhala*)	N
8	*Hebatnya, Anies manfaatkan partainya Prabowo, uangnya Sandiaga, Masjidnya JK, Anies kalah,(gak rugi), yang kalah telak itu Prabowo, Sandiaga, dan JK* (Amazingly, Anies tooke the advantage of Prabowo party, Sandiaga money, JK mosque, Anies lost instead the most defeated are Prabowo, Sandiaga, and JK)	N

If we look at the sentences in the Table 1 above, there are bullying sentence and not. In this case, there are 2 bullying sentences, number 4 and 6. The sentence number 4 has meaning about there is a politic actor which has hired a fired minister to be the capital city governor. Where the fired minister does not has any skill, instead he has bullshit, sweet and beautiful words only. These sentences has bullying context, because there are negative words such as fired minister *"PECATAN MENTERI"* and has sweet and beautiful words only, *"bermodalkan katakata manis dan indah saja* ". That is the reason why the sentence number 4 is a bullying sentence. How about sentence number 6? There are many radical capital city governors who do not like social media feed. In the sentence, the candidate is

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illustrated with radical cockroach *"kecoa radikal"*. A person who is described as animal is a bullying. The reason why the sentence belongs to bullying sentences are its negative words and the use of animal word to describe a person. There are many ways to produce a bulling sentence. In this research, we were looking for the component which has impact in producing the bullying sentence.

Otherwise, there are 6 of not-bullying sentences which are number 1, 2, 3, 5, 7, and 8. For example, the sentence number 1 means that there is a politic actor who has failed experience and then was fired because he did not manage certificated fund correctly. And now, he candidates himself as the capital city governor who joined the loser community. The sentence number 7 means that there is a statement consist of democratic word which is illustrated as a god. . The sentence number 2 is about Anies activity in capital city governor election. It says that Anies has SARA campaign because it is the only support he has because if he socialized his program, Djarot has overpowered him. If we see this sentence, it is just an information sentence, there is not any negative word that can be made as bullying sentence element. The sentence number 3 questioning the diversity and peace in our society. Because there are many communities feel superior, right, and being the role model. This sentence is only an information sentence, instead of bullying. The sentence number 5 is an advice sentence in which it advise Ahok to manage the word to be able to discuss and plan the city well. Then, for Djarot, he has to continue his career as a capital city (Jakarta) residents' servant in manage their city. The sentence number 7 is a statement sentence where it has opinion about democratic. Indeed the democratic system is another *berhala*. The sentence number 8 means that there is a politic actor who used community, money, and mosque to be a leader. These sentence is not a bullying sentence, it just an information sentence. It's not easy to assess it. But for a linguist, it is easy. Therefore, we need a linguist.

Every corpora must be assessed by linguist. Linguist is a person who has many experiences of writing and editing document that have selling price. In this research, there is a linguist and an editor who has been working in a media office group in 20 years. He has assessed many corpora. The result will be data set to produce the feature space. The feature space will be extracted from corpora that is being assessed. The feature space design will be made, like as Table 2 consists of 7 attributes: word, phrase, punctuation mark, emoticons, #tag, and cue word.

Table 2: Feature Space Design Will Be Used To Detect the Cyber Bullying.

Category	Object	Bullying	
		(+)	(-)
Word	*cari muka* (Making up)	V	
Word	*pecatan menteri* (fired minister)	V	
Phrase	*bermodalkan kata-kata manis* (only has sweet words)	V	
Punctuation Mark	!!!!	V	
Emoticon	*ROTL*	V	
#tag	*#perundungan* (bullying)	V	
Cue Word	*Ckckckck*	V	

The feature space design is the lists of attributes used to bully. The feature space design is the result of extraction process from 250 sentences derived from social media. We will see how bullying behavior at social media in capital city election event period. Every corpus will be showed how person bullied the other side in order to support their side. Now, many people are using social media as advertisement media especially at Indonesia because there are many social media users. Therefore, in the capital city election event, social media is used as a campaign media. There are many bullying content. In this research, we summarized the bullying content that are presented in social media to be the feature space design. The feature space design will be used in this research and probably it can be used in future research of cyber bullying detection.

Every corpora must has good written and grammar that is in accordance with Indonesia language rules. If the structure of the sentence is not good than it must be revised by the linguist without removing any component. This should be done, because if it is not, then it cannot be process, like this sentence:*"Haiiii..Buronan KPK, pede bingiiit mau jadi gubernuuuur!!!*". If this sentence is processed,

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there will be many words which do not contain any meaning such as;"*bingiiit*" and "*gubernuuuur*". This sentence needs to be fixed;"*bingiiit*" to be *"banget"* and *"gubernuuuur"* to be *'gubernur'*. This is the example of how feature space is extracted from bullying sentence. The sentence is '*Kesalahan terbesar Prabowo adalalah memberi tunggangan kepada PECATAN MENTERI yang cuma bermodalkan kata-kata MANIS dan INDAH'*. The sentence must be corrected before the extraction. The sentence should be '*Kesalahan terbesar Prabowo adalah memberi tunggangan kepada PECATAN MENTERI yang cuma bermodalkan kata-kata MANIS dan INDAH'*. So from this bullying sentence, the feature space will be extracted as the following Table 3.

Table 3: Example of Feature Space Is Extracted From the Bullying Sentence

Category	Object	Bullying	
		(+)	(-)
Word	*cari muka* (making up)	V	
Word	*pecatan menteri* (fired ministers)	V	
Phrase	*bermodalkan kata-kata manis* (only has sweet words)	V	
Punctuation Mark			
Emoticon			
#tag			
Cue Word			

4. FEATURE SPACE DESIGN

The feature space design is reported at previous chapter. The feature space list contains word, phrase, cue word, emoticon, #tag, and punctuation word. For detail, we can see at Table 4-8 and Figure 4.

Table 4: Feature Space - Word

Absurd (Absurd)	*Pura-pura* (pretending)	*Mainan* (toy)
Amplop (Envelope)	*Fatamorgana* (Fata Morgana)	*Maling* (Thief)
Basa-basi (conventional talk)	*Fasis* (fascist)	*Manja* (Spoiled)
Becus (capable)	*Fitnah* (slander)	*Melawak* (gagging)
Bego (stupid)	*Hoaker* (community that do not like ahok)	*Mencuri* (stealing)
Berantakan (mess)	*Hujat* (blasphemy)	*Miring* (oblique)
Beretorika (rhetoric)	*Jadi-jadian* (imitation)	*Miskin* (poor)
Bersandiwara (pretending)	*Jahat* (evil)	*Modus* (intention)
Biadab (Uneducated)	*Jiplak* (imitate)	*Munafik* (hypocrite)
Blak-blakan (straightfoward)	*Jongos* (waiter)	*Negatif* (negative)
Bloon (stupid)	*Kasar* (rude)	*Ngawur* (inconsequent)
Bodoh (stupid)	*Kebohongan* (lie)	*Nyinyir* (loquacity)
Brengsek (Jerk)	*Kecoa* (cockroach)	*Nyontek* (cheating)
Buncit (bloated)	*Kecurangan* (fraud)	*Omdo* *(garrulous)*
Busuk (Rotten)	*Kedodoran* (oversized)	*Otak* (brain)
Chaos (chaos)	*Berkedok* (pretending)	*Palsu* (fake)
Congek (Deaf)	*Keok* (defeated)	*Pecatan* (fired)
Congor (Snout)	*Ketakutan* (Scare)	*Pecundang* (Loser)
Copas (copy and paste)	*Berkoar* (shout)	*Pencitraan* (pretending)
Curang (Deceitful)	*Korban* (Victim)	*Penjilat* (crawler)
Delusional (delusional)	*Koruptor* (corruptor)	*Persetan* (whatever)
Dicap (Labelled as)	*Kuno* (odd)	*PHP* (gives false hope)
Dipecat (fired)	*Lawakan* (gag)	*Primitif* (primitive)

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Randahan (low)	*Rasis* (racists)	*Retorika* (Rhetoric)
Radikal (radical)	*Sewot* (furious)	*Sesat* (lose)
Sembako (Nine staple commodities)	*Sampah* (Trash)	*Provokasi* (provocation)
Pengecut (loser)	*Culas* (lazy)	*Kafir* (Non-moslem)
Cina (Chinese)	*Pemimpi* (dreamer)	*Provokator* (provocator)
Tolol (stupid)	*Siluman* (imitation)	*Waras* (Not crazy)
Topeng (mask)	*Sirik* (Envy)	*Zonk* (zonk)
Tipu (fraud)	*Sogokan* (bribe)	*Kegoblokan* (stupidity)

Table 5: Feature Space - Phrase

Amplop Beterbangan (envelopes are flying)	*Kampanye Sogokan* (fraud campaign)	*Tukang Berhayal* (dreamer)
Bagi-bagi sembako (sharing staple foods)	Kata-kata *manis* (sweet words)	*Umbar Janji* (give promises)
Baju pilkada (regitional head election shirt)	*Kecoa radikal* (radical cockroaches)	*Program* anomaly (anomaly program)
Basa-basi Medsos (social media conversation)	*Kekisruhan Politik* (political mess)	*Pemimpin Jantan* (gentle leader)
Berkata Manis (saying sweet words)	*Kumpulan Penjilat* (group of crawlers)	*Tebar Pesona* (flirting)
Bermulut Manis (having sweet mouth)	*Main Sembako* (playing staple foods)	*Tidak Becus* (uncapable)
Biang Permasalahan (troublemakers)	*Manusia Sampah* (trash people)	*Haus Kekuasaan* (starving for power)
Boneka pPartai (party doll)	*Menikmati Kehancuran* (enjoying the destruction)	*Kampanye SARA* (SARA campaign)
Cari Muka (making up)	*Menjilat Ludah* (licking the spit)	*Merasa Superior* (feels like superior)
Corong Asap (smoke funnel)	*Mental Jiplak* (imitated mentality)	*Merasa Paling Benar* (feels like the most rightful person)
Kampanye Hitam (black campaign)	*Miskin Integritas* (poor integrity)	*Menata Kata* (managing words)
Kampanye Jahat (evil campaign)	*Miskin Kreativitas* (poor creativity)	*Merangkai Kata* (constructing words)
Data Sesat (misguided data)	*Modal Topeng* (only has mask)	*Main Asal Pecat* (firing randomly)
Debat Teletubbies (teletubbies debate)	*Mulut Jamban* (toilet mouth)	*Otaknya Berisi Bisnis* (his brain contains business)
Duo Pencudang (duo losers)	*Mulut Nyiniyir* (loquacity mouth	*Otaknya Berisi Proyek* (his brain contains project)
Eksportir Kebencian (hate exports)	*Otak Tak Berisi* (brainless)	*Cuma Cengengesan* (only grinning)
hanya janji (promise only)	*pantesan dipecat* (deserves to be fired)	*gubernur boneka* (doll governor)
Hasil Jiplak (imitation result)	*Pecatan Menteri* (fired minister)	*Mental Jongos* (waiter mentality)
Haus Kekuasaan (starving for power)	*Pemilih Tertipu* (deceitful voter)	*Si Congor* (snouter)
Janji Manis (sweet promise)	*Pemimpin Amatir* (amateur leader)	*Jual Program* (selling program)
Janji Palsu (fake promise)	*Pikiran Primitive* (primitive minded)	*Kampanye Busuk* (rotten campaign)
Jongos Kroninya (cronies waiter)	*Pikiran Sempit* (narrow minded)	*Pilkada Chaos* (regional leader election chaos)
Program Copas (copy and paste		

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program)		

Table 6: Feature Space - Cue Word

ah	hio?	hah
akh	hoho!	haha
ciee	Jiah	haudeuh!
cihuy	jleb!	heh
ckck	kok?	hehe
duh	Lho	hem
ehem	Lol	heuheu
hadeh	Nyaha	wekek
oh	woy!	wkwk
owow	doang	pret!

Table 7: Feature Space - #Tag

#AdaAQUA (Is there any Aqua?)	*#aniestukangnyinyir* (Anies is a loguacity person)	*#gubernursembako* (staple foods governor)
#ahokkejangkejang (Ahok cramps)	*#AsalBukanAhok* (Anyone but Ahok)	*#merasapalingbhineka* (feeling the most rightful)
#ahoknyungseppp (Ahok falls over)	*#HaramPilihKafir* (choosing the non moslem is haram)	*#AhokSumberPerpecahan* (Ahok is the disunity cause)
#AhokPanikAhokKalah (Ahok is panic, Ahok lose)	*#KamiParaMunafik* (We are the hypocrites)	*#AHYTakutDebat* (AHY afraid to debate)
#ahokpastitumbang (Ahok must fall)	*#OOTSembakoAhok* (Ahok's staple foods)	*#tepokjidat* (patting the forehad)
#Ahoksumbermasalah (Ahok is troublemaker)	*#SalamWaras* (sane greeting)	*#gubernurmieinstant* (instant noodle governor)

Table 8: Feature Space - Punctuation Mark

!!??	???	!!	??!!
(?)	????	!!!	?
??	!		

Figure 4: Feature Space – Emoticon

This feature space is used as a keyword to search for training and testing datasets. Once the dataset was collected, the dataset was prepared for the classification process. The dataset was processed by the proposed method that has been designed.

5. PROPOSED METHOD FOR THE DEVELOPMENT

This is a proposed algorithm as a framework or model which will was used for Indonesia cyber bullying detection. The framework or model consists of many processes:

1) Taking the direct data from social media by R Studio, data only focus on people reaction or respond sentence in capital city governor election. The sample data should be passed from the oversizing and oversampling process. This process is the advice of Farisia research [3]. Farisia said that SVM cannot do the classification well if the sample data is not passed from oversizing and oversampling process. In the data, the positive and negative data must have right portion. It is very important because Farisia is failed to use SVM for her research [3].
2) Sentiment Filter in which only sentence which includes word, phrase, cue word, punctuation mark, emoticon, and #tag in future space is stored [5]. The future space has been explained at the previous chapter. We also removed every sentence which includes 'RT' (Retweet) word.
3) Dividing dataset into 2 groups; training (2/3) and testing (1/3) dataset.

   (Preprocessing Text by Rapidminer)

4) Removing the Noise such as username, hyperlink, people tagging, comment tagging, and location tagging (only text of R Studio structure) [3].
5) Unigram Tokenizing, breaking up a sequence of string into pieces [3].
6) Evaluating the written and grammar of text, evaluating every text based on Online Kamus Besar Bahasa Indonesia (KBBI) [19], if the

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text is not listed and does not have any meaning, it was discarded. If the text is not listed but has meaning than it fixed manually by the linguist.

7) Transform Case; transform all letter to lower letter [3].
8) N-Gram Tokenizing
9) Remove StopWord, using Tala StopWord List.
10) If the unigram is emoticon or punctuation mark, go to step 12 else go to step 11[6].
11) Remove Duplicate, replace multiple occurrences of same type of word, phrase, cue word, and #tag with a single appropriate word, phrase, cue word, and #tag [3].
12) If emoticon is presented, transform emoticon to the emoticon text then find the intensity of emoticon. Set Emoticon=1 if the emoticon is listed in emoticon feature space, otherwise set "emoticon=0" [6]. If the emoticon is more than one, we calculated and set the emoticon by summing the emoticon.
13) If punctuation mark is presented, find the intensity of punctuation mark that has been listed in punctuation mark feature space and set Punctuation Mark=1[6]. If the punctuation mark is more than one, we calculate and set punctuation mark by summing the punctuation mark.
14) If sentence contains #tag, word, phrase, and cue word which is listed in feature space then set the listed of feature space = 1[6]. If the listed feature space is more than one, we calculate and set the listed feature space by summing it.
15) Classifying the sentences as per rules given and return the appropriate bullying class [6].
16) If sentence has at least two of the following feature cue words (CW) OR word (W) OR phrase (P) than see Table 4 and return bullying into non-bullying.
17) If sentence has at least two of the following feature punctuation marks (PM) OR emoticons (E) OR #tag (T) than see Table 9 and return bullying into non-bullying. The value (V) of Table 9 are: positive if that has bullying content of the feature space and negative if that has feature space but it does not include bullying content.
18) If sentence has at least one of the following feature cue words OR words OR phrases OR punctuation marks OR emoticons OR #tag than see Table 10 and return bullying into non-bullying. The value of Table 10 are: positive if that has bullying content of the feature space and negative if it has feature space but does not include bullying content.

Table 9: Classes of Bullying Sentences by Feature Space Quantity

W	P	CW	E	PM	T	NUMBER OF	V
0	0	0	0	0	1	1	0
0	0	0	0	0	1	>1	1
0	0	0	0	1	0	1	0
0	0	0	0	1	0	>1	1
0	0	0	1	0	0	1	0
0	0	0	1	0	0	>1	1
0	0	1	0	0	0	1	0
0	0	1	0	0	0	>1	1
0	1	0	0	0	0	1	0
0	1	0	0	0	0	>1	1
1	0	0	0	0	0	1	0
1	0	0	0	0	0	>1	1

Table 10: Classes of Bullying Sentences by Combination of Feature Space

W	P	CW	E	PM	T	V
0	0	0	0	0	0	0
0	0	0	0	0	1	0
0	0	0	0	1	0	0
0	0	0	0	1	1	1
0	0	0	1	0	0	0
0	0	0	1	0	1	1
0	0	0	1	1	0	1
0	0	0	1	1	1	1
0	0	1	0	0	0	0
0	0	1	0	0	1	1
0	0	1	0	1	0	1
0	0	1	0	1	1	1
0	0	1	1	0	0	1
0	0	1	1	0	1	1
0	0	1	1	1	0	1
0	0	1	1	1	1	1
0	1	0	0	0	0	0
0	1	0	0	0	1	1

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0	1	0	0	1	0	1
0	1	0	0	1	1	1
0	1	0	1	0	0	1
0	1	0	1	0	1	1
0	1	0	1	1	0	1
0	1	0	1	1	1	
0	1	1	0	0	0	1
0	1	1	0	0	1	1
0	1	1	0	1	0	1
0	1	1	0	1	1	1
0	1	1	1	0	0	1
0	1	1	1	0	1	1
0	1	1	1	1	0	1
0	1	1	1	1	1	1
1	0	0	0	0	0	0
1	0	0	0	0	1	1
1	0	0	0	1	0	1
1	0	0	0	1	1	1
1	0	0	1	0	0	1
1	0	0	1	0	1	1
1	0	0	1	1	0	1
1	0	0	1	1	1	1
1	0	1	0	0	0	1
1	0	1	0	0	1	1
1	0	1	0	1	0	1
1	0	1	0	1	1	1
1	0	1	1	0	0	1
1	0	1	1	0	1	1
1	0	1	1	1	0	1
1	0	1	1	1	1	1
1	1	0	0	0	0	1
1	1	0	0	0	1	1
1	1	0	0	1	0	1
1	1	0	0	1	1	1
1	1	0	1	0	0	1
1	1	0	1	0	1	1
1	1	0	1	1	0	1
1	1	0	1	1	1	1
1	1	1	0	0	0	1
1	1	1	0	0	1	1
1	1	1	0	1	0	1
1	1	1	0	1	1	1
1	1	1	1	0	0	1
1	1	1	1	0	1	1
1	1	1	1	1	0	1
1	1	1	1	1	1	1

For simulation, we used this sentence; *@Netmedi Pendukuuuung AHY IKUUUT MENDUKUUUNG PECATAN MENTERI pada putaraaan ke-2 CC: hahaha !!! *ROTFL* *ROTFL* #SalamWaras https://www.kompasiana.com/*. For the linguist, this sentence is bullying sentence which belong to cyber bullying. This sentence says that there is a community who is supporting a fired minister. In this sentence, we focus on the 'fired minister)'. The 'fired minister' words is a negative word. It will be a positive word when it is changed into 'former minister' word. If we see the word value of this sentence, the 'former minister' word better than 'fired minister' word. If we used proposed algorithm for detecting this sentence, the simulation of pre-processing data show as Table 11. And the corpora will detect at step 18 because this corpora has many term "pecatan", "pecatan menteri", "hahaha", "!!!", "*ROTFL**ROTFL*", ,and "#SalamWaras" than the value of sentence is positive, bullying sentence (positive + positive + positive + positive + positive + positive + neutral = positive, show as Table 5).

Table 11: Simulation How the Data is Pre-Processing with Proposed Method

Process	Before	After
Get Direct Data from Social Media	Pendukuuuung AHY IKUUUT MENDUKUUUNG PECATAN MENTERI pada putaraaan ke-2 hahaha !!! *ROTFL* *ROTFL* #SalamWaras https://www.kompasiana.com (Supporters of AHY SUPPORT THE FIRED MINISTER at the 2nd round hahaha !!! * ROTFL * * ROTFL *Sane greeting* https://www.kompasiana.com)	
Dataset Assessment by Linguist	Label: Neutral	Label: Bullying
Sentiment Filter	Pendukuuuung AHY IKUUUT MENDUKUUUNG PECATAN MENTERI pada putaraaan ke-2 hahaha !!! *ROTFL* *ROTFL* #SalamWaras https://www.kompasiana.com (AHY supporters support the fired minister in the second round hahaha!!! *ROTFL* *ROTFL* #Sanegreeting…….)	

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Preprocessing Text		
Remove Noise	Pendukuuuung AHY IKUUUT MENDUKUUUNG PECATAN MENTERI pada putaraaan ke-2 hahaha !!! *ROTFL* *ROTFL* #SalamWaras https://www.kompasiana.com (AHY supporters SUPPORT THE FIRED MINISTER in the second round hahaha!!! *ROTFL* *ROTFL* #Sanegreeting)	Pendukuuuung AHY IKUUUT MENDUKUUUNG PECATAN MENTERI pada putaraaan ke-2 hahaha !!! *ROTFL* *ROTFL* #SalamWaras (AHY supporters SUPPORT THE FIRED MINISTER in the second round hahaha!!! *ROTFL* *ROTFL* #Sanegreeting)
Unigram Tokenizing	Pendukuuuung AHY IKUUUT MENDUKUUUNG PECATAN MENTERI pada putaraaan ke-2 hahaha !!! *ROTFL* *ROTFL* #SalamWaras (AHY supporters SUPPORT THE FIRED MINISTER in the second round hahaha!!! *ROTFL* *ROTFL* #Sanegreeting)	//Pendukuuuung //AHY //IKUUUT //MENDUKUUUNG //PECATAN //MENTERI //pada //putaraaan //ke-2 //hahaha //!!! //*ROTFL* //*ROTFL* //#SalamWaras (AHY supporters SUPPORT THE FIRED MINISTER in the second round hahaha!!! *ROTFL* *ROTFL* #Sanegreeting)
Evaluate the Written and Grammar	//Pendukuuuung //AHY //IKUUUT //MENDUKUUUNG //PECATAN //MENTERI //pada //putaraaan //ke-2 //hahaha //!!! //*ROTFL* //*ROTFL* //#SalamWaras (//Supporters//AHY//JOIN//TO SUPPORT//FIRED//MINISTER//in//round//the second//hahaha//!!!//*ROTFL*//*ROTFL*//SaneGratitude…….)	//Pendukung //AHY //IKUT //MENDUKUNG //PECATAN //MENTERI //pada //putaraan //ke-2 //hahaha //!!! //*ROTFL* //*ROTFL* //#SalamWaras (//Supporters//AHY//JOIN//TO SUPPORT//FIRED//MINISTER//in//round//the second//hahaha//!!!//*ROTFL*//*ROTFL*//SaneGratitude)
Transform Case	Pendukung AHY IKUT MENDUKUNG PECATAN MENTERI pada putaraan ke-2 hahaha !!! *ROTFL* *ROTFL* #SalamWaras	pendukung ahy ikut mendukung pecatan menteri pada putaraan ke-2 hahaha !!! *rotfl* *rotfl* #salamwaras (AHY supporters SUPPORT THE FIRED MINISTER in the second round hahaha!!!)*ROTFL* *ROTFL* #Sanegreeting)
Unigram Tokenizing	pendukung ahy ikut mendukung pecatan menteri pada putaraan ke-2 hahaha !!! *rotfl* *rotfl* #salamwaras (ahy supporters support the fired minister in the second round hahaha!!! *rotfl* *rotfl* #sanegreeting)	//pendukung //ahy //ikut //mendukung //pecatan //menteri //pada //putaraan //ke-2 //hahaha //!!! //*rotfl* //*rotfl* //#salamwaras (ahy supporters support the fired minister in the second round hahaha!!! *rotfl* *rotfl* #sanegreeting)
Remove StopWord	//pendukung //ahy //ikut //mendukung //pecatan //menteri //pada //putaraan //ke-2 //hahaha //!!! //*rotfl* //*rotfl* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rotfl*//*rotfl*//#sanegreeting…….)	//pendukung //ahy //mendukung //pecatan //menteri //putaraan //ke-2 //hahaha //!!! //*rotfl* //*rotfl* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rotfl*//*rotfl*//#sanegreeting)
Filter Emoticon and Punctuiation Mark	//pendukung //ahy //mendukung //pecatan //menteri //putaraan //ke-2 //hahaha //!!! //*rotfl* //*rotfl* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rotfl*//*rotfl*//#sanegreeting)	
Remove Duplicate	//pendukung //ahy //mendukung //pecatan //menteri //putaraan //ke-2 //hahaha //!!! //*rotfl* //*rotfl* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rotfl*//*rotfl*//#sanegreeting)	//pendukung //ahy //mendukung //pecatan //menteri //putaraan //ke-2 //hahaha //!!! //*rotfl* //*rotfl* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rotfl*//*rotfl*//#sanegreeting)

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Transform Emoticon to Emoticon Text	//pendukung //ahy //mendukung //pecatan //menteri //putaraan //ke-2 //hahaha //!!! //*rotfl* //*rotfl* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rotfl*//*rotfl*//#sanegreeting)	//pendukung //ahy //mendukung //pecatan //menteri //putaraan //ke-2 //hahaha //!!! //*rollingonthefloor laughing* //*rollingonthefloor laughing* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rollingonthefloorlaughing*//*rollingonthefloorlaughing*//#sanegreeting)
Tranform term to nominal	//pendukung //ahy //mendukung //pecatan //menteri //putaraan //ke-2 //hahaha //!!! //*rollingonthefloorlaughing* //*rollingonthefloorlaughing* //#salamwaras (//supporters//ahy//join//to support//fired//minister//in//round//the second//hahaha//!!!//*rollingonthefloorlaughing*//*rollingonthefloorlaughing*//#sanegreeting)	
Bigram Tokenizing	pendukung ahy mendukung pecatan menteri putaraan ke-2 #hahaha !!! *rollingonthefloor laughing* *rollingonthefloor laughing* #salamwaras (ahy supporters support the fired minister in the second round hahaha!!! //!!!//*rollingontheflorlaughing*//*rollingonthefloorlaughing*//#sanegreeting)	\\pendukung ahy \\ahy mendukung \\mendukung pecatan \\pecatan menteri \\menteri putaraan \\putaraan ke-2 \\ke-2 hahaha \\hahaha !!! \\!!! *rollingonthefloor laughing* *rollingonthefloor laughing* *rollingonthefloor laughing* *rollingonthefloor laughing* #salamwaras (ahy supporters support the fired minister in the second round hahaha!!!//!!!//*rollingonthefloorlaughing*//*rollingonthefloorlaughing*//#sanegreeting)
Tranform term to nominal	\\pendukung ahy \\ahy mendukung \\mendukung pecatan \\pecatan menteri \\menteri putaraan \\putaraan ke-2 \\ke-2 hahaha \\hahaha !!! \\!!! *rollingonthefloorlaughing* *rollingonthefloorlaughing* *rollingonthefloorlaughing* *rollingonthefloorlaughing* #salamwaras (ahy supporters support the fired minister in the second round hahaha!!! //!!!//*rollingonthefloorlaughing*//*rollingonthefloorlaughing*//#sanegreeting)	
N-Gram		
Classification		
Evaluation by Recall, Precision, and F-measure		

6. RESULT AND DISCUSSION

In this paper, we want to combat the cyber bullying in Indonesian capital city election by using tool. The section I has described the background of this paper about why cyber bullying detection is needed. The section II of this paper discusses about the literature review, concept and method used to make model for combatting the cyber bullying. Not only concept and method, we also must have many capital city election cyber bullying data from social media to know the habit of cyber bullying in Indonesia. In the section III of this paper, it discusses how to collect the capital city election cyber bullying data from social media. From the data we extracted many key words which support the sentence to be cyber bullying sentence. The key word lists will be collected to be feature space design that can be used for this work. The feature space has reported at previous work []. The section IV discusses about the feature space list used for this research. The section V introduced the formulation of customs obtained that is used to make the proposed algorithm/model. The proposed algorithm was used as the cyber bullying detection tool. The proposed algorithm is a combination from previous similar works added by some recommendation in our research context and scope. And this section describes how the proposed algorithm used to classify and calculates its performance (accuracy, precision, recall, F-Measure).

In this work, we will do two experiments with proposed algorithm and feature space design. The experiments have goal to know how proposed algorithm and feature space design influences to detection. The experiment was performed in three processes, those are training, validation, and testing. There are three experiments which 10-fold cross validation was applied in each experiment [6]. Each process (training, validation (k-10 from training), and testing) has different corpora of which the corpora is divided 2/3 and 1/3. So how

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the performance of classification is measured in this work. We have disorder matrix to calculate F-measure, precision, accuracy, and recall. It described the performance of the classification model on a set of test data for which the true values are known. All the measures except area under the curve can be calculated by using left most four parameters, show as Table 12.

Table 12: Confusion Metrics

		Predicted Class	
Actual Class		Class = Yes	Class = No
	Class = Yes	True Positive	False Negative
	Class = No	False Positive	True Negative

In the confusion matrix, true positive (correctly predicted positive values) and true negatives (correctly predicted negative values) are the observations that are correctly predicted. In this work, we want to minimize false positives (when actual class is no and predicted class is yes) and false negatives (when actual class is yes but predicted class in no) to has good performance. The four parameters will be used to calculate the accuracy, F-measure, precision, and recall. Accuracy (A) is the most intuitive performance measure and it is simply a ratio of correctly predicted observation to the total observations,

$$\text{Accuracy} = \frac{(TP+T\ )}{(TP+TN+FP+F\ )} \quad (5)$$

Precision (P) is the ratio of correctly predicted positive observations to the total predicted positive observations, TP/(TP+FP).

$$\text{Precision} = \frac{(TP)}{(TP+F\ )} \quad (6)$$

Recall (R) is the ratio of correctly predicted positive observations to the all observations in actual class - yes, TP/(TP+FN).

$$\text{Recall} = \frac{(TP)}{(TP+FN)} \quad (7)$$

F1 (F-measure) Score is the weighted average of Precision and Recall,

$$\text{F} - \text{measure} = \frac{2(Recall*Precision)}{(Recall+Precision)} \quad (8)$$

There are three experiments to calculate the performance of proposed method:

1. Experiment setup 1:

Initially we tried to find the influence of word, phrase, cue word, #tag, emoticon, and punctuation mark for detecting the cyber bullying sentences. For this experiment, we will setup experiment like in the following Table 13.

Table 13: Experiment Setup 1

Detail Experiment 1	
Total sentence	1500 sentences (1000 training data and 500 testing data)
Classifier setting	SVM with RBF HyperPipes Tree J.48
Kernel Target class	bullying and non-bullying
Result of experiment	F-measure, precision, recall, and accuracy

The Table 14 value informed how word, phrase, cue word, #tag, emoticon, and punctuation mark influence the detection process.

Table 14: Performance Metric of Experiment Setup 1

ALGORITHM	DATA SET	PERFORMANCE METRIC				ROC
		A	P	R	F1	
HYPER PIPES	TRAINING	25.3%	0.817	0.253	0.117	0.507
	TESTING	20.8%	0.845	0.208	0.094	0.510
SVM Kernel RBF	TRAINING	76.1%	0.727	0.761	0.669	0.625
	TESTING	80.8%	0.653	0.808	0.722	0.585
Tree J-48	TRAINING	75.9%	0.707	0.759	0.685	0.525
	TESTING	80.6%	0.742	0.806	0.735	0.515

2. Experiment setup 2:

Initially, we tried to find the influence of word and phrase (N-Gram), cue word, #tag, emoticon, and punctuation mark for detection of cyber bullying sentences. For this experiment, we will setup experiment like in the Table 15.

Table 15: Experiment Setup 3

Detail Experiment 1	
Total sentence	1000 sentences
Classifier setting	LibSVM with C-SVM kernel, RBF type, C = 0.5, gamma = 0.009
Kernel Target class	bullying and non-bullying
Result of	F-measure, precision, recall,

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experiment	and accuracy

The Table 16 value will inform how word and phrase (N-Gram), cue word, #tag, emoticon, and punctuation mark influence in detection process.

Table 16: Performance Metric of Experiment Setup3

FEATURE	A	P	R	F1	ROC
Ngram, #tag Absent (A)	71.27 %	0.508	0.713	0.593	0.5
Ngram, #tag Present (P)	92.86 %	0.862	0.929	0.894	0.5
Ngram, emoticon (A)	74.91 %	0.561	0.749	0.642	0.5
Ngram, emoticon (P)	80.65 %	0.65	0.806	0.72	0.5
Ngram, Punctuation mark (A)	77.15 %	0.595	0.772	0.672	0.5
Ngram, Punctuation mark (P)	73%	0.533	0.73	0.616	0.5
Ngram, Cue Word (A)	74.42 %	0.554	0.744	0.635	0.5
Ngram, Cue Word (P)	84.29 %	0.71	0.843	0.771	0.5
Ngram, Phrase (A)	75.48 %	0.57	0.755	0.649	0.5
Ngram, Phrase (P)	77.33 %	0.598	0.773	0.674	0.5
Ngram, Word (A)	77.33 %	0.598	0.773	0.674	0.5
Ngram, Word (P)	75.99 %	0.577	0.76	0.656	0.5

The result of the experiment will inform how the model is effective in detecting the cyber bullying. In this research, the method used is combination of many algorithms from prior researches [6][4][3]. The main goal of the research to form feature space design and verify with proposed method. The proposed method is to know how the feature space design influences the detection. For researcher, the prior algorithm [6][4][3] can be the master model because their performance was already proven.

In this case, we use tools to process purposed algorithm. We have three tools for this; Rapidminer, RStudio, and WEKA. The collecting data from social media that was used Rapidminer and other in house applications. The data was stored in the storage, database and csv file. The storage has 3 field only; date, source, and text. Why we use Rapidminer for collecting data because Rapidminer has specific library for twitter. For other sources, we used an in house application. Why use an in house application? Because we must collect the data from many sources such as Facebook, Path, Instagram, youTube, and the comment of blogs. After the data was collected, we processed the data by using Rstudio. We have R library in RStudio. In RStudio, we have many processing like as: sentiment filter, transform case, remove noise, remove duplicated, stemmer, and tokenizing. Why the RStudio was used in pre-processing text because RStudio has many library that can support the pre-processing text very well. When data is ready to be classified, we used WEKA application. The WEKA has many classification libraries used to classify sentence for detecting the bullying sentences. In this research, we used SVM algorithm with RBF kernel and K-10 fold cross validation. With WEKA application, we only dragged and dropped every elements that is used. Then set up various parameters to support the classification. Every tool used in this work was purposed tools from similar researches.

Every concept, method, and tool used in this research are purposed from similar researches. In this work, the big challenge is the process of feature space design. Feature space design is very unique for the use of corpora, events, and context. For concept, method, and tool, we can refer to similar works. Many similar researches have good performance of their works like Farisia (2017), Dinakar (2011), Nahar (2013), and Desai (2016). They also present many information for the next similar researches.

7. CONCLUSION

In this paper, we discussed the cyber bullying problems in Indonesia and why Indonesian need a tool to combat them. We compared the result of previous similar researches and we followed some recommendations in our research context and scope. This paper has produced feature space design and proposed algorithm that will be model or tool for detecting the cyber bullying. The best accuracy of this model is SVM kernel RBF (80.8%). In this model, #tag has high contribution to detect cyber bullying, the accuracy is 92.86%. The tool (this model) has limitation because it just has feature space from obtained corpora in the research. But the tool can give contribution to delimitation and prevention of cyber bullying in Indonesia. Because until now, the work has focus in delimitation and prevention cyber bullying in Indonesia that is still small. And that the bullying phenomenon occurs frequently, one of them is

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cyber bullying at 2017 capital city governor election (PILKADA DKI 2017).

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