Twitter Mining: The Case of 2014 Indonesian Legislative Elections

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Abstract

Twitter is an online micro blogging and social network which not only for communication with others but twitter can be used for business, administration, or political campaign. This paper concern about twitter for political campaign, we take one case in Indonesian legislative elections. In April 2014, Indonesia has held legislative elections. Fifteen political parties have been participated to this election. Each parties has unique strategic for campaign including social media campaign. In this paper we interested with one of political party which very active in social media campaign especially in Twitter, Partai Keadilan Sejahtera (PKS) or Prosperous Justice Party. This party has a lot of supporters and haters are active tweeting on Twitter about the goodness and badness of this party. This thing begs the question that "Who they are? It is really the voice of Indonesia or just tweets from twitter campaign accounts".

This paper tried to answer above question by presenting the result of analysis with empirical data. We collected all tweets which related with this party and then extract the data and classify to two types of twitter accounts: real and campaign accounts. We use some features and Naïve Bayes as method for classification. We observe the difference between real and campaign accounts in terms of the tweeting behavior and account properties. We applied text mining methods to know what the meaning of the messages that they bring on their tweets.

Keywords: Twitter mining; social network; classification; text mining

1. Introduction

In this year (2014), Indonesia has two of elections, legislative election and president election. Indonesia follows democratic system so it has many of political parties. Each political party has unique strategy for campaign. Most of them use online media such as Facebook, Twitter, and YouTube video for campaign. In this paper we interested about social media campaign especially on Twitter. Twitter is not only micro-blogging service but also provides some features like real time trending topics and other features. Twitter provides "#" called "hashtag" it can used by user for giving some topics of their tweets. When many of people use the same hashtag, it will raise the possibility of the hashtag become a trending topics. The campaign schedule for the legislative election was from March 16 until April 5 2014. On that time each party has strategy for campaign include in social media campaign but we interested with one of parties, PKS. The reasons why we are interested with this party is because PKS very active in social media campaign especially in Twitter campaign. PKS has many opposition or haters that they always tweeting about weakness of this party. On other

side, PKS also has many supporters that they always tweeting about the goodness of this party.

The supporters of this party use Twitter hashtag #SayaPilihPKS. It is mean "I choose PKS". This hashtag became trending topic at 8:36 AM-22 Mar 2014 GMT+7 but only in Indonesia region not worldwide trending topics. On the other side, the haters of this party use the hashtag #TolakPartaiPoligami. It means "We refuse party which has polygamy chairman". This hashtag like a sarcasm because the chairman of this party has more than one wife. This incident was published in several Indonesia online news media such as Liputan 6 [1], Tribun [2], and Republika [3]. Finally this hashtag became worldwide trending topic at 9:30 PM, 20 Mar 2014 GMT+7. Our objective is to know who are tweeting both of hashtags and what the meaning of message that they bring. We want to classify to two types: real account and campaign account. In this case, real account means the account created by user for using Twitter such as for communication or tweeting something but not for spamming, promotion or campaign. We can determine real accounts or campaign accounts base on some features such as: creation date, tweet contents, period of tweeting, followers and friends, etc. For example, we found any account which always tweeting the same meaning content for specific purpose, so we think this is not real twitter account. In this paper, campaign account is the account that used by someone for political campaign purpose especially related with PKS. Actually there are some differences between real account and campaign account such as the age of twitter accounts, the number of followers and following (twitter account properties), content of tweets, tweeting ratio and *etc*. In this paper we present about the result of our experiment as follows:

1. We present empirical evaluation such as the total number of tweets and retweet, total number of twitter accounts which have been participated.
2. We use 9 features from previous work and 5 new proposed features, we find the most important features for our dataset and removing unperformed features.
3. To our dataset we applied Naïve Bayes classifier which has 98% accuracy.
4. Finally we know who are tweeting both of hashtags, 69 % of accounts who tweeting #TolakPartaiPoligami hashtag came from campaign accounts as well as #SayaPilihPKS hashtag has 41 % campaign accounts who participated to tweeting this hashtag.
5. We present about the meaning of messages that they bring on their tweet by analyzing tweets content using standard text mining method to our dataset.
6. We also present what kind the devices that they use for sending their tweets from campaign and real accounts.

2. Previous Related Work

Research on Twitter has been commonly with various topics. Jansen *et al.* [1] mentioned that Twitter is an important tool for communication in marketing. Thelwall *et al.* [2] research about reaction and public sentiment of popular events. Becker *et al.* [3] observed about real world event identification based on twitter trending topics. There are many papers also about twitter in political issues. Small [4] mentioned in their research about Twitter in political campaigning and election. Wigand [5] presents some positive findings from the use of Twitter in terms of overcoming the limits of traditional communications between people with government stakeholders. They found

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[1] www.liputan6.com
[2] www.tribunnews.com
[3] www.republika.co.id

that USA federal and local governments adopt Twitter faster than state agencies. Cho and Park [6] conducted in social networking and semantic content analysis of the Twitter account of a large South Korean Ministry. They mentioned that Twitter in government could function as an effective information distribution because Twitter can make mutual communication and direct conversation although with some limitations. We also found many of papers related with twitter accounts classification but most of them concern on spam and non-spam twitter account classification. Kwak *et al.* [7] filtered tweets from users who have been on Twitter for less than a day as well as tweets that contain three or more trending topics. They made classification between spam and non-spam account and then reported spam on the twitter data they collected. Yard *et al.* [8] studied the behavior of a small group of spammers. They found that the spammers have different behavior with non-spammers user such as replying tweets, followers, and friends. Wang [9] collected thousands users on Twitter and used classification to distinguish the suspicious behaviors from normal user. Zi Chu *et al.* [10] collected thousands Twitter users. They proposed features and techniques to classify Twitter users to three types: bot, human, or cyborg (human and bot). J. Song at al. [11] proposed new approach for classification between spam and non-spam Twitter users using sender and receiver relationship. Benevenuto *et al.* [12]. In their work, they collecting a large dataset and then they classify spam and non-spam users. They also provide some features, evaluate it using X2 statistic. C Yang [13] analyzing evasion tactics of twitter spammers and then they provide robustness features for solve it. They also evaluated 24 features for twitter users classification then make rank from low until high robustness. Trending topics are valuable to informs user what is the current trend in Twitter. We already mention about Thelwall *et al.* [2] and Becker *et al.* [3] researches. They use twitter trending topics for their researches. G. Stafford *et al.* [13] gathered over 9 million tweets in Twitter trending topics over a 7 days period. They want to know effect of spammers in Twitter trending topics. They use Bayes classifier method to classify spam tweets. They found that spammers not drive the trending topics in Twitter. This research similar with our work, the different is Grant Safford *et al.* [13] concern on question "whether spammers can manipulate and drive twitter trending topics?" but in our work we concern to classify who are tweeting the hashtag. We want to know who they are and how many real accounts or campaign accounts but not only that we also focus on what kind of message that they bring on theirs tweets.

3. Experiment Detail

In this part we will describe about how we get and extract the dataset and how we create ground truth.

3.1. Data Collection and Extraction

We collected the dataset around 7 days. Figure 1 shows that number of tweets distribution per days, we can see the #TolakPartaiPoligami hashtag on March 20 the number of tweets almost 60,000 tweets and on that day this hashtag became trending topics. As well as the #SayaPilihPKS hashtag, the highest number of tweets is on March 22, almost 25,000 number of tweets. Total numbers of tweets are 222,444 tweets from #TolakPartaiPoligami hashtag and 48,135 tweets from #SayaPilihPKS hashtag. Total all of tweets are 270,579. We observe not all tweets data are "tweet" but most of them are "retweet". So we consider dividing and counting how many tweets data and retweeting data. The #TolakPartaiPoligami hashtag has 222,444 tweets consisting of 98,927 (44%)

tweets and 123,517 (56%) retweets and #SayaPilihPKS hashtag has 25,367 (52%) tweets and 22,768 (47%) retweets. Based on this data we know that retweets data is more than tweets data.
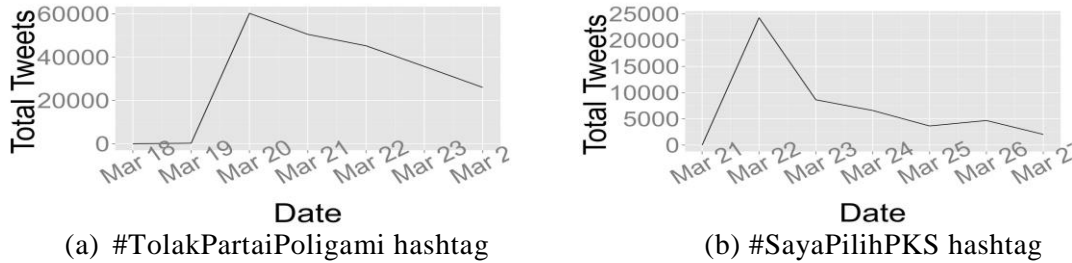

(a) #TolakPartaiPoligami hashtag   (b) #SayaPilihPKS hashtag

Figure 1. Tweets Distribution

In this dataset we found most of twitter accounts they are tweeting more than once. Our purpose is wanted to know who are tweeting both of hashtags. We have to count how many accounts that participated so for doing this job we proposed Algorithm 1 for picking and counting twitter username from dataset. Actually this algorithm came from MapReduce, we modifying it according to our goal. We applied Algorithm 1 to the dataset and the result is the total of tweets data only came from 16,970 twitter accounts.

3.2. Ground Truth Creation

We split the dataset to two parts are dataset I for ground truth and dataset II for real testing. We take 10,000 tweets which only came from 1,680 twitter accounts for dataset I. We classified and gave hand-labeled to real and campaign accounts manually one by one, the result can be seen on Table 1.

3.3. Choosing Features and Classification Methods

We use features from previous work that have been purposed by Benevenuto *et al.* [12] and C. Yang *et al.* [13]. They identified and provided the following features as being useful for detecting spam in Twitter. Benevenuto *et al.* [12] provide 10 features and C. Yang *et al.* [13] also provide 24 features but some of their features is same. Because of our purpose is not to classify between spam and not-spam so we have to determine which of the features were the most relevant to our task and dataset. We use 14 features (9 features from previous work and we propose 5 new features) that can be seen in Table 2.

```
Algorithm 1 Pick twitter username from dataset
  Input dataseta : raw data (username, ..., tweet)
  AccountMapping (String key, String rawdata)
  for all username in rawdata do
      EmitIntermediate (username, "1")
  end for

  AccountReducing (String key, String Value[1..m])
  int acc_count = 0
  for all v in Value[1..m] do
      account_count += ParseInt(v)
  end for
  Emit(key, AsString(acc_count))
```

Table 1. Hand Labeled Dataset I Overview

Real Accounts	Campaign Accounts	Total
1,479	201	1,680

To classify we employed the popular machine learning algorithms, which is Naïve Bayes. To evaluate the effectiveness of the classifiers we use standard information retrieval metrics: precision, recall, and accuracy with k-Fold cross validation, k=10.

4. Result and Discussion

4.1. Features Evaluation

We analyze 14 features from previous research which related with our goal and whether it could be employed to our dataset. We applied the Information Gain to our dataset (dataset I) then we make ranked the effectiveness. Table 3 shows the result of the rank top ten features evaluation. The total of features that we use is 14 features but the last four features did not have good value and did not affect the accuracy when we remove it. The four features that we removed are: 1) average number of hashtags per tweet; 2) location data 3) protected status; 4) characters length of description profile. From this result now we know the most important features in our dataset for the classification.

The most important features are the age of twitter accounts. It is understandable, when we make a little observation with the twitter campaign accounts most of them created on January or February 2014, two or three months before campaign schedule. We thought this accounts will active tweeting about politics until the Indonesia presidential elections finished. Figure 2 shows the plotting of distribution twitter accounts with the age of twitter accounts. The x-axis is the number of days and y-axis is the density. Red curve is for campaign account and blue curve is for real account. The average of campaign accounts age (red dashed line) is 69 days (around 2 months) and on the other side, most of real accounts (blue dashed line) they has average age around 700 days (almost 2 years).

Table 2. List of our Features

No	Features	Used in
1	Average number of hashtag per tweet	[12],ours
2	Location data (accounts have location information)	ours
3	The age of twitter account	[12],[13],ours
4	Hashtag ratio per day	[12],ours
5	Tweet ratio per day	ours
6	Protected status (true or false)	ours
7	Account reputation $(\frac{followings}{followers})$	[13],ours
8	Number of all tweets	[12],ours
9	API ratio per day	[12],ours
10	URL ratio per day	[12],ours
11	Number of followings	[12],[13],ours
12	Number of followers	[12],[13],ours
13	Mention ratio per day	ours
14	Characters length of description prole	ours

Table 3. Features Evaluation: Information Gain

Value	Rank
0.45	The age of twitter account
0.41	Number of followings
0.40	Number of all tweets
0.38	Mention ratio(day)
0.37	Number of followers
0.35	Hashtag ratio(day)
0.33	Tweet ratio(day)
0.18	Reputation
0.06	API ratio(day)
0.03	URL ratio(day)

The next important features are number of followers and followings. Figure 3 shows the twitter real and campaign account distribution. We have three figures, the main figure is account distribution based on x-asis is number of followers and y-axis is number of followings. The another figures on top is number of followers distribution and figure on the right side is number of followings distribution of real and campaign account. X-axis is number of followers and y-axis is density. Most of campaign accounts have more number of followers and number of followings than the real accounts. We thought it is acceptable, normally people like us use twitter for communication, connecting, and sharing to our friends. So common people in general they do not care about gaining more followers except they are public figure, artist, or they have another purpose. For other features can be seen in Table 4.
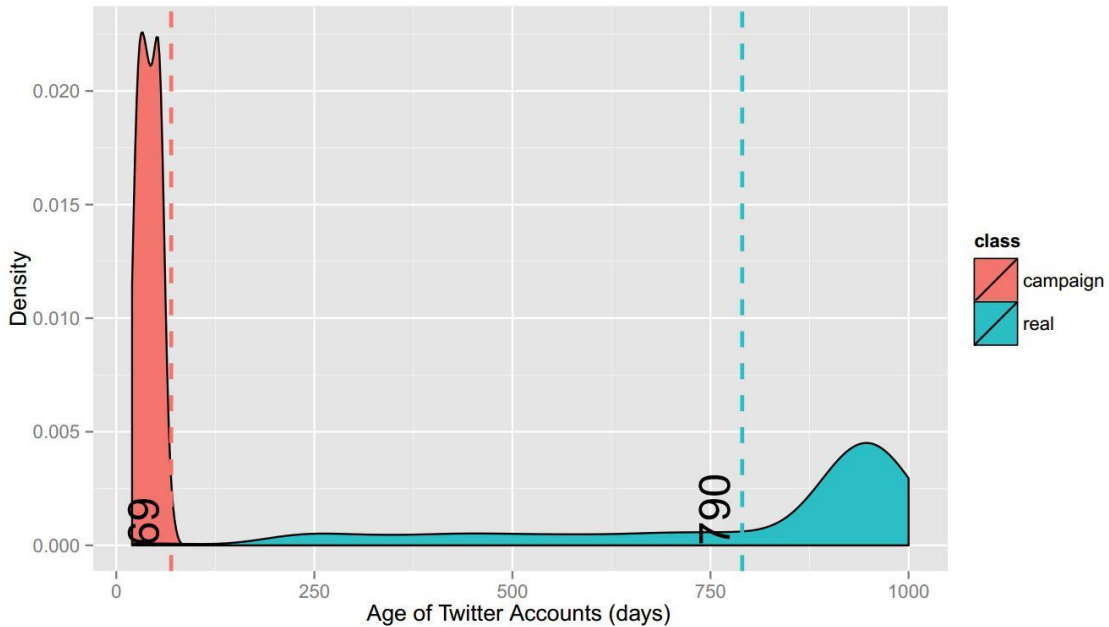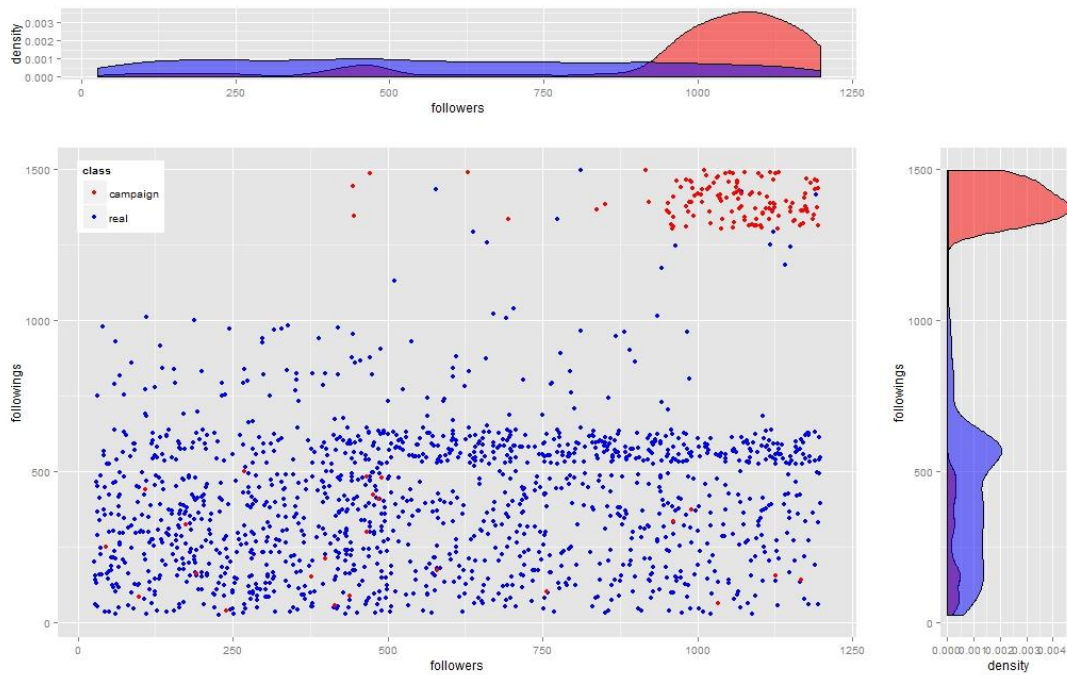

Figure 2. Age of Twitter Account Distribution

Figure 3. Followers and Followings Distribution for Real and Campaign Accounts

Table 4. Features Summary (min/avg/max)

Features	Real Account	Campaign Account
Number of total tweets	55/5079/10000	1604/1805/1996
Tweets rate (days)	1/10/25	1/20/31
Hashtag ratio (days)	0/5/19	0/14/21
Mention ratio (days)	1/3/11	5/8/10
Account reputation	0.01/1.3/24	0.06/1.3/5.5
API ratio (days)	0/1/10	1/5/10
URL ratio (days)	0/3/20	0/9/20

4.2. Classifier Performance Evaluation

Table 5 shows the confusion matrix obtained from our Naïve Bayes classifier on the dataset I. From 1,680 twitter accounts on dataset I, Naïve Bayes has 12 classification error for classifying real accounts and 15 error for classifying campaign accounts.

Table 5. Confusion Matrix

		Predicted	
		Real Account	Campaign Account
True	Real Account	1467	12
	Campaign Account	15	186

Table 6. Classifier Performance

	Real Account	Campaign Account
Precision	0.99	0.92
Recall	0.98	0.94
Accuracy	0.98	0.98

Table 6 shows the information retrieval metrics for the classifier. We have high precision and recall for classifying real account, 99% and 98%. As well as for campaign account we have 92% precision and 94% recall. The accuracy of both (real and campaign account classification) is pretty good, 98 %.

4.3. Who are Tweeting

After we check the performance of our classifier and we get the satisfied result, now we have to applied our classifier to dataset II. From The dataset II #TolakPartaiPoligami hashtag the total tweets are 215,444 came from 9,651 twitter accounts. The second hashtag #SayaPilihPKS, total tweets are 45,135 came from 5,639 twitter accounts. The whole tweets in dataset II only came from 15,290 twitter accounts.

(a) #TolakPartaiPoligami hashtag   (b) #SayaPilihPKS hashtag

Figure 4. Percentage of Campaign and Real Accounts

The results of our classifier which use Naïve Bayes can be seen in Figure 4. #TolakPartaiPoligami hashtag has been classified to 6,621 (69%) campaign accounts and 3,030 (31%) real accounts. #SayaPilihPKS hashtag has 2,334 (41%) campaign accounts and 3,305 (59%) real accounts.

4.4. Text Mining

Other big question is what kind of message that they bring in their tweets?. Based on that question, we tried to applied text mining in our dataset to find the most of words that they used. The steps that we use as follows:
1. First we retrieving tweet content from dataset.
2. Transforming text to the corpus (we use tm package in R). In this step we make all of words to lowercase, removing punctuation, removing numbers and removing stopwords.
3. Stemming words (we use Nazief and Andriani algorithm [14] for words stemming Indonesian language), building a document term matrix and finding terms and associations.
4. Last, after we building a document term matrix we can plot the most importance of words using wordcloud plot.

We have a problem with stemming method because of twitter is tool for non-formal communication so many of them use non-formal words and abbreviated words. Figure 5

shows the most important words from the all tweet content and the terms meaning can be seen on Table 7. We have top 9 terms for each hashtag. First rank of terms in #TolakPartaiPoligami hashtag is Cow (cattle), it means when this hashtag was trending topic, PKS chairman, Lutfi Hasan Ishaaq was exposed to corruption scandal (cattle import scandal) so it is related with other terms in the fifth, sixth, and seventh mentioned about Corruption, Chairman and Lutfi Hasan Ishaaq. The another term in this hashtag is about polygamy, we can see in the second term "wife" means they discuss about wife because someone who is polygamy he has more than one wife. As well as for the others terms (3.Islam; 8.Polygamy; 9.Prophet) also related with polygamy. They assume doing polygamy is allowed by islam and it is follow the prophet. So the conclusion for the #TolakPartaiPoligami hashtag is they (haters) attack this party using two issues. First is about corruption scandal in this party because the chairman of this party became suspect of cattle import scandal. Second is about polygamy itself, could not be denied that the chairman of this party both of them (previous and now) they are doing polygamy.
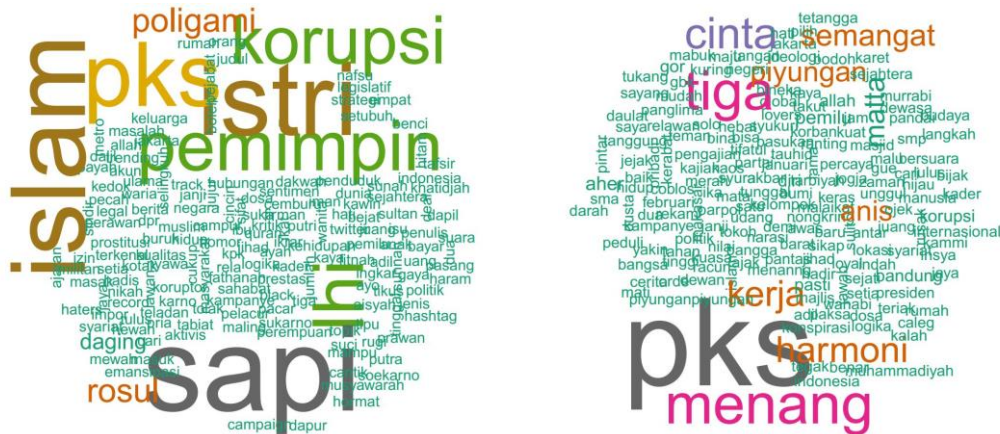
(a) Word cloud #TolakPartaiPoligami hashtag   (b) Word cloud #SayaPilihPKS hashtag

Figure 5. Word Cloud #TolakPartaiPoligami and #SayaPilihPKS

The first rank term in #SayaPilihPKS hashtag is PKS (Name of this party). Second term is about "win", so they who are tweeting this hashtag they use many "win" words. For the third term is "three" means the number of this party in this legislative election. For the fourth, fifth, sixth, terms, if we join these words being "love work harmony" means this is slogan of this party to love simultaneously (harmony) work. The next terms is "piyungan" which one of subdistrict in Bantul Yogyakarta. We curious about this term, what is relation between PKS and piyungan. It turns out PKS piyungan is the most active PKS online news portal [4]. The last terms are "spirit" and "Anis Matta", we found many of messages to motivate others using word "semangat" (keep spirit) and Anis Matta is current chairman of this party. So we can conclude, they who are tweeting this hashtag, #SayaPilihPKS they discuss about this party. We thought they talking about the goodness of this party because as we can see they mention about the slogan of this party. We also can see they talking about "win" and persuade others to choose number three (the number of this party in legislative election).

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[4] www.pkspiyungan.org

Table 7. TOP Word Cloud Terms Meaning

Rank	#TolakPartaiPoligami	#SayaPilihPKS
#1	Sapi (Cow, Cattle)	PKS (Prosperous Justice Party)
#2	Istri (Wife)	Menang (Win)
#3	Islam (Religion)	Tiga (Three)
#4	PKS (Prosperous Justice Party)	Cinta (Love)
#5	Korupsi (Corruption)	Kerja (Work)
#6	Pemimpin (Chairman)	Harmoni (Harmony)
#7	LHI (Lutfi Hasan Ishaq)	Piyungan (Name of place)
#8	Poligami (Polygamy)	Semangat (Keep spirit)
#9	Rosul (Prophet)	Anis Matta (Current chairman of PKS)

4.5. Tweeting Devices Distribution

Twitter supports a variety of way to post tweets such as use application for android, web mobile, web, and third party application like tweetdeck, *etc*. The name of application appears below a tweet prefixed by "*from*" and in our dataset we have those kind of data. Table 8 shows the rank of the above tweeting device by categories. Most of real accounts they use mobile phone for sending their tweets. Almost 80% real accounts they use twitter for (android, blackberry, iphone), TweetCaster and mobile web. Only 20% they are use PC for sending tweets (TweetDeck and Web) and the last only small amount using API (1.1%). In this case API means for those third-party applications not registered or certificated by Twitter.

In contrast the top tools used by campaign account are TweetDeck, more than 45% they use PC for sending tweets. Almost 37% they sending tweets use mobile phone. Automation tweets tools such as API and tweet wordpress have pretty high number, API has 13% and tweet wordpress 6.5%.

Table 8. Tweeting Devices

Rank	Real Account	Campaign Account
#1	Twitter for Android (29.4%)	TweetDeck (19.26%)
#2	Twitter for Blackberry (21.3%)	Twitter for Android (17.45%)
#3	Mobile Web (16.7%)	Twitter for Blackberry (13.98%)
#4	Web (14.5%)	TweetCaster (13.64%)
#5	TweetCaster (9.42%)	API (13.26%)
#6	TweetDeck (6.27%)	Tweet Wordpress (6.56%)
#7	Twitter for Iphone (1.25%)	Web (6.21%)
#8	API (1.12%)	Mobile web (5.37%)
#9	Others (0.04%)	Others (4.27%)

5. Conclusion

Based on this research the data from Twitter could not be used as a basis of truth because not all tweets on the Twitter derived from the real accounts, it could be from a bot, cyborg or campaign accounts. This paper describe about it, we collected all tweets from the two kinds of hashtags that total all of them are more than 250 thousand tweets which only came from around 15 thousand twitter accounts. Based on Naïve Bayes classifier #TolakPartaiPoligami hashtag that became worldwide trending topics came from 69% campaign accounts as well as the #SayaPilihPKS hashtag which became an Indonesian regional trending topics came from 41% campaign accounts.

Acknowledgements

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