

Exploration of Southern Violence Using Frequent Itemset Mining

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Abstract

The unrest of violence in the southernmost provinces of Thailand happened over a decade. It affects both property and human life. The main objective of this study will explore information that will suit the problem-solving of the southernmost unrest. Secondary data were collecting between the year 2004 to the year 2020 from the Deep South Coordination Center, Prince of Songkla University, Pattani Campus. A total of 3,366 events of unrest in Mueang Yala, a district of Yala province were selected as the study data. Two main variables of unrest characteristics including number of week and attack type were obtained as a study variable. Apriori algorithm analysis were applied as association rule of attack type of unrest analysis. The pattern of this frequent itemset will show the association attack type of the unrest in order to prevent the severity of unrest affect.

Keywords: Machine learning, association rule, Apriori, frequent itemset mining, unrest

1. Introduction

The modern world is currently undergoing and continuing with the conflict. It has been changed from a large ratio of internal conflict to be irregular warfare, unrest, or incident. The act of conflict is shown as the misunderstanding or disagreeing of one party to another party. The conflict may involve the government and small group of the protestor. Some other acts of conflict may cause terrorism, which has power to against the other party that had more control in the country. The undergoing of the conflict and terrorist attacks were a big threat to the population. The act of terrorism may impact their quality of life and disruption to the various part of economics, society, psychology, philosophy, and some political management in the nation (Firdaus et al., 2006) and (Kumar et al., 2020). Terrorism defines as the intentional indiscriminate used and illegal power or make the violence of a group for making terror among the civilian. There are several types of weapon used that terrorist group used to attack the target group including explosive device, suicide bombing, shooting, hostage taking, mortar and rock attacks and other complex attacks (Donald et al., 2004).

The Institute for Economics and Peace reported that the global terrorist index in the overall number of terrorist attacks in the year 2019 was 0.34 percent of the deteriorated score when comparing to the year 2020. Such that, 81 countries are improving, while 80 worsening. The peacefulness of the Asia-Pacific of the year 2020 was slightly decreased by 0.2 percent on average when comparing to others (Institute for Economics and Peace, 2006). The factors of the peacefulness worsening in this region were driven by the increasing number of deaths from three main categories including internal conflict, military expenditure, and UN peacekeeping funding.

Thailand is one of the 81 countries that improving in a terrorist attack. Thailand was the 114th rank in the global and 16th rank in the region where the overall score is located to 2.245 and -0.007 of score change (Institute for Economics and Peace, 2006). The situation of terrorism in Thailand considered as an internal conflict, which is called an incident of unrest and it is mostly located in the southernmost provinces. The southernmost provinces unrest belongs to the small of the active group who against the government. The unrest occurred in the four bordering provinces to Malaysia: Pattani, Yala, Narathiwat, and Songkhla. Furthermore, there were only four districts of Songkhla province that included the unrest area. The three southernmost provinces unrest is signified as a continuing situation that happened long-time since the origin in the year 1948 (Pongsudhirak, 2007). It became a more complex situation and increased the violence, which is may due to the continuing unrest occurring especially in the year 2007 (Eso et al., 2020). The southernmost unrest affects the local population and their properties. The unrest also affects to family problems; widows, disabled, and orphans, which due to the loss of the parents, spouses, or any family parts.

The severity of the southernmost unrest of Thailand was significantly increased from 55 percent in the year 2002 up to 94 percent in the year 2006. Such that the unrest was progressively occurred the violence and caused to have deaths from the local population (Asia, 2017). The violence of the southernmost unrest persists with several formats of the unrest type. The unrest type of the southernmost provinces incorporated with the motorcycle bombing, shooting, school arson, nail trapping on the road, and road blocking. There are several studies represented the diversity of attack types and the weapon used in every time of attacking activities. The number of injure or victim depends on the attack types and the weapon used in each occurring event. The direct attack of blast explosive weapon including the bomb-blast was likely to have victims than another weapon as presented in (Gataa & Muassa, 2011) (Hafling, 2014) and (Moyes, 2012). Bombing was also the other type of weapon used that used by terrorist as mentioned in (Madelyn et al., 2011). The victims may happen by the attacking of terrorist that used the combination of weapon as stated in (Bhabdarwar et al., 2012). While, the gunshot was the high form of weapon used to attack that cause to have victims than other type of attack form (Eso et al., 2020) (Koper et al., 2018) (Liem, 2018) (Omoke, 2017) and (Chirkiatsakul, 2014).

Characteristics of the civil unrest events were involved in varies including area, zone, time, and form of the weapon used of the happened event. The civil unrest can happen in any geographical area and may be. More likely to happen in the area of dense population. While the common area of unrest events are public places, religious or government buildings (Liem, 2018), and in the rural areas (Glaeser & Shapiro, 2021) and (Khongmark et al., 2013). The attack that caused to have more fatality are more likely to happen in the daytime between 08.00 am to 08.00 pm [19]. While the form of suicide bombing is more likely to happen in the night-time (Sandler, 2015).

In every time of southernmost unrest of Thailand occurring were formed in several forms of attack. The form of attack that happened was motorcycle bombing, trapping bombing, shooting, nails sprinkling on the road, felling trees to black the road, government office arson or firing, and others. Those forms of attack were happened in various areas and only occurred to the interested group. Moreover, the effect of attacks may cause to property assets, human or both. The affection of the asset property represented the number of ruined property assets. While the affection of humans represented both in the number of victims and no-victims. The report of deep south watch in Jitpiromsri (2019) reported the behavior of the southernmost unrest in between the year 2004 to 2019 found three frequent unrest types occurring was 81 percent are shooting, 10 percent are bombing, and 3 percent are bruised. Most of the southernmost unrest events were done by one-sided attacks; the attack was caused only one party that do not know who is the real attacker that create an unrest. Moreover, the severity of attack in the past 16 years were affected to both of target groups: soft target and hard target. The soft target referred to who had no ability to attack back or weakness including civil population, while the hard target referred to who had more ability to attack back or strong enough to protect them from the attacker.

The attacking form of southernmost unrest was not only happened with a single form at one time in one area, but they may frequently happen with various forms at a time in a different area. The events of the southernmost unrest were complicated and complex events that could not be projected as the exact event, which may happen. Most of the unrest events happen at the night-time between 08.00 pm to 09.00 pm (Marohabout et al., 2005). The southernmost unrest attack form, which may happen in every time of attack. The frequent attack formats are consisting of motorcycle bombing, sprinkling of nails, and second bomb trapping then, or set the fire on any government offices, the hidden bombing, and second-bomb trapping. There may also include the attack of shooting, sprinkling nails, and the hidden bombing then.

More than that, the unrest of the southernmost provinces is the difficulties of regional and national economic growth and community development. The unrest events affect the existing problems including the variation of government locally practice, poverty, low and lack education, and unemployment. Equally, the worse effects of the southern unrest include the physical and mental health problem and leading to an increase in the number of orphans, widows, and disabled. Job mobility is the key point that indicated most of the young people get employment in the neighboring country Malaysia and left the children behind to leave them with the elderly of a family. To mitigate those problems, the government has to settle good plan management and design relevant problem solving with associate decision making. Accordingly, the southernmost unrest attack forms are considered as an interesting point of the study to explore the loss rate. This study result may become an advantage as a piece of baseline information to the government for the southernmost unrest problem-solving to be an awareness of the future happening unrest and to handle policy making by the relevant organization for determining the peacebuilding.

2. Related Work

Association rule has been first proposed by (Agrawal, 1993). This has been one of the most widely used in data curation techniques as given example of the market basket analysis. An example of the basket analysis which represented in if/then statement; “if the customer buys bread, he or she is likely to buy jam or milk also”. Thus, the percentage of this probability being true is depend on the confidence level and supports. This rule was widely used in marketing (Pavel & Jana, 2015) (Kaur & Kang, 2016), inventory management (Chan & Pang, 2011), better customer relationship (Kehinde, 2018) (Minaei-Bidgoli & Akhonzadeh, 2010), and product placement tactic (Isti & Annury, 2010) (Didugu, 2021).

Apriori is the algorithm of generating the association mining algorithm. The key concept of Apriori involves with the concept of frequent item, frequent itemset, and association rules, and antecedent and consequent (Scheffer, 2001). The frequent item concept displays the higher number of occurrences that greater than the minimum support of the threshold. The frequent itemset concept represents the set of items that exist the minimum support of the threshold. The association rules activate along with the confidence and support threshold and generate the rules which success above. While the antecedent and consequent characterizes the item in the dataset and the cooccurrence where the minimum support and minimum confidence are supported the antecedent of the rule.

The study of Khalifa et al. (2019) represented the terrorist attack in Egypt between the year 1970 to 2016. The study shown ten highlighted insight of terrorist attack description where the Egypt government produce the decision making in the terrorist problem solutions. Another study of Dimitoglou & Rotenstreich (2007) represented the variation of the future incidents which is carried out the outbreak signature consistent with the effects of a biological warfare attack. The association rule displayed the result of the study was a reasonable to detect the rule and there was more work to address the relevant issues of both emergency response and biological warfare.

5. Theoretical Framework

The illustration of theoretical framework in Figure 1 of the study were consisting of input element, processing method, and output representation.

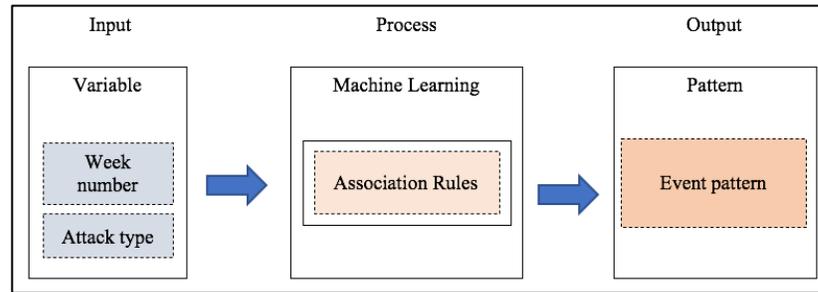


Figure 1 Conceptual framework

5.1 Input

As referred earlier in the study of Liem (2018), the input element of this study consists of week number where represented the week number in each year which is covered from the year 2004 to 2020. The attack type is the type of weapon used to attack in each southern unrest including shooting, bombing, arson, and others.

5.2 Process

The processing method represents the machine learning part that will be applied to this study. The machine learning technique; an association rule and Apriori algorithm. The association rule explores the relationship of the interrelationship and the dependence between thing in the dataset. The association rule of this study will use the shopping basket problem analysis technique in order to identify the frequent itemset among the goods in the shopping basket. While the Apriori is a basic algorithm that used for controlling the exponential growth of the itemset candidate by using support pruning technique for cropping the itemset candidate.

5.3 Output

The output of this study represents the pattern of event where generated form the Apriori algorithm.

6. Methodology

6.1 Data source

The secondary data were obtained from the Deep South Coordination Centre (DSCC), Prince of Songkla University (PSU), Pattani Campus. The data were collected and recorded as a daily unrest event that happened in the three southernmost provinces of Thailand.

6.2 Methods

The illustration of the Figure 2 shows the procedure of the study by beginning with the analysis of unrest behavior through the dataset. Data collection and preprocessing is applied to cleaning the data, exploring the missing data and visualizing the dataset.

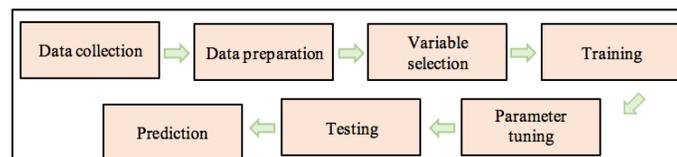


Figure 2 Processing step

Machine learning and pattern recognition by looking the association rule of the interrelationship among the data. The next step of this study is to explore which algorithm is suitable for southernmost unrest loss rate.

7. Finding & Discussion

7.1 Descriptive statistics & analysis

There are four types of attack in eight districts in Yala province. The attack types were consisted of shooting (46.6%), bombing (42.8%), arson (3.2%), and others (7.3%). Shooting mostly occurred in Mueang Yala, Bannang Sata, and Raman (6.4%, 6.0%, and 4.9% respectively). Bombing mostly occurred in Mueang Yala, Bannang Sata, and Yaha (16.4%, 3.1%, and 2.3% respectively). Arson mostly happened in Mueang Yala, Bannang Sata, and Than To (7.1%, 7.1%, and 5.2 respectively). While other type of attack that mostly occurred in Mueang Yala, Bannang Sata, and Raman (6.6%, 3.5%, 2.8% respectively) as presented in Table 1.

Table 1: Frequency of attack type in Yala province

District of Yala Province	Type of Attack (%)			
	Shooting 3,944 (46.6)	Bombing 3,625 (42.8)	Arson 274 (3.2)	Others 621 (7.3)
Bannang Sata	959 (6.0)	392 (3.1)	77 (7.1)	112 (3.5)
Betong	113 (0.7)	196 (1.6)	19 (1.8)	40 (1.2)
Kabang	105 (0.7)	42 (0.3)	5 (0.5)	14 (0.4)
Krong Pinang	240 (1.5)	220 (1.8)	12 (1.1)	54 (1.7)
Mueang Yala	1,020 (6.4)	2,056 (16.4)	77 (7.1)	213 (6.6)
Raman	775 (4.9)	273 (2.2)	18 (1.7)	89 (2.8)
Than To	240 (1.5)	158 (1.3)	56 (5.2)	39 (1.2)
Yaha	492 (3.1)	288 (2.3)	10 (0.9)	60 (1.9)

7.2 Frequent itemset

The frequent itemset of this study has been proposed with the filtering of “Mueang Yala” district where is under the variable of “District of Yala Province”.

items	transactionID
[1] {4:Others}	200403
[2] {4:Others}	200404
[3] {1:Shooting, 4:Others}	200407
[4] {1:Shooting}	200409
[5] {4:Others}	200411
[6] {4:Others}	200412
[7] {1:Shooting}	200413
[8] {1:Shooting}	200414
[9] {3:Arson}	200415
[10] {1:Shooting, 3:Arson}	200416
[11] {1:Shooting}	200418
[12] {3:Arson}	200421
[13] {1:Shooting}	200422
[14] {3:Arson}	200424
[15] {1:Shooting, 2: Bombing}	200425
[16] {1:Shooting}	200427
[17] {1:Shooting}	200428
[18] {3:Arson, 4:Others}	200429

Figure 3 Southernmost unrest itemset

There were 3,366 records as a total data of this filtered variable. The data were transposed into transaction data where consist of frequent item set of the southernmost unrest event as shown in

the Figure 3. The item of this transaction dataset represented the unrest were happened in the three southernmost provinces. The item of this selected variable shown that there are 539 transactions in four items. The Four items may consist of a single format, two formats, three formats, and four formats of the unrest type in a week. These items of the unrest found that 412 items were shooting, 171 were bombing, 127 were others, and 57 were arson. The element length of the items was distributed in 351, 149, 38, and 1 in the size of one, two, three, and four.

7.3 Apriori algorithm

The Apriori algorithm was applied with the exploring of the association rules. This study shown that 18 rules of if/then statement were generated which is based on the 0.001 of the minSup (minimum support) and 0.1 of minCof (minimum Confidence). The generated rules represented in the Figure 4.

	lhs	rhs	support	confidence	coverage	lift	count
[1]	{}	=> {3:Arson}	0.10575139	0.1057514	1.00000000	1.00000000	57
[2]	{}	=> {4:Others}	0.23562152	0.2356215	1.00000000	1.00000000	127
[3]	{}	=> {2:Bombing}	0.31725417	0.3172542	1.00000000	1.00000000	171
[4]	{}	=> {1:Shooting}	0.76437848	0.7643785	1.00000000	1.00000000	412
[5]	{3:Arson}	=> {4:Others}	0.01298701	0.1228070	0.10575139	0.5212046	7
[6]	{3:Arson}	=> {2:Bombing}	0.02968460	0.2807018	0.10575139	0.8847851	16
[7]	{3:Arson}	=> {1:Shooting}	0.06679035	0.6315789	0.10575139	0.8262647	36
[8]	{4:Others}	=> {2:Bombing}	0.05936920	0.2519685	0.23562152	0.7942165	32
[9]	{2:Bombing}	=> {4:Others}	0.05936920	0.1871345	0.31725417	0.7942165	32
[10]	{4:Others}	=> {1:Shooting}	0.13358071	0.5669291	0.23562152	0.7416864	72
[11]	{1:Shooting}	=> {4:Others}	0.13358071	0.1747573	0.76437848	0.7416864	72
[12]	{2:Bombing}	=> {1:Shooting}	0.19666048	0.6198830	0.31725417	0.8109635	106
[13]	{1:Shooting}	=> {2:Bombing}	0.19666048	0.2572816	0.76437848	0.8109635	106
[14]	{2:Bombing, 3:Arson}	=> {1:Shooting}	0.01855288	0.6250000	0.02968460	0.8176578	10
[15]	{1:Shooting, 3:Arson}	=> {2:Bombing}	0.01855288	0.2777778	0.06679035	0.8755686	10
[16]	{2:Bombing, 4:Others}	=> {1:Shooting}	0.04823748	0.8125000	0.05936920	1.0629551	26
[17]	{1:Shooting, 4:Others}	=> {2:Bombing}	0.04823748	0.3611111	0.13358071	1.1382391	26
[18]	{1:Shooting, 2:Bombing}	=> {4:Others}	0.04823748	0.2452830	0.19666048	1.0410043	26

Figure 4 Association rules of unrest event

	lhs	rhs	support	confidence	coverage	lift	count
[1]	{2:Bombing, 4:Others}	=> {1:Shooting}	0.04823748	0.8125000	0.05936920	1.0629551	26
[2]	{}	=> {1:Shooting}	0.76437848	0.7643785	1.00000000	1.00000000	412
[3]	{3:Arson}	=> {1:Shooting}	0.06679035	0.6315789	0.10575139	0.8262647	36
[4]	{2:Bombing, 3:Arson}	=> {1:Shooting}	0.01855288	0.6250000	0.02968460	0.8176578	10
[5]	{2:Bombing}	=> {1:Shooting}	0.19666048	0.6198830	0.31725417	0.8109635	106
[6]	{4:Others}	=> {1:Shooting}	0.13358071	0.5669291	0.23562152	0.7416864	72
[7]	{1:Shooting, 4:Others}	=> {2:Bombing}	0.04823748	0.3611111	0.13358071	1.1382391	26
[8]	{}	=> {2:Bombing}	0.31725417	0.3172542	1.00000000	1.00000000	171
[9]	{3:Arson}	=> {2:Bombing}	0.02968460	0.2807018	0.10575139	0.8847851	16
[10]	{1:Shooting, 3:Arson}	=> {2:Bombing}	0.01855288	0.2777778	0.06679035	0.8755686	10
[11]	{1:Shooting}	=> {2:Bombing}	0.19666048	0.2572816	0.76437848	0.8109635	106
[12]	{4:Others}	=> {2:Bombing}	0.05936920	0.2519685	0.23562152	0.7942165	32
[13]	{1:Shooting, 2:Bombing}	=> {4:Others}	0.04823748	0.2452830	0.19666048	1.0410043	26
[14]	{}	=> {4:Others}	0.23562152	0.2356215	1.00000000	1.00000000	127
[15]	{2:Bombing}	=> {4:Others}	0.05936920	0.1871345	0.31725417	0.7942165	32
[16]	{1:Shooting}	=> {4:Others}	0.13358071	0.1747573	0.76437848	0.7416864	72
[17]	{3:Arson}	=> {4:Others}	0.01298701	0.1228070	0.10575139	0.5212046	7
[18]	{}	=> {3:Arson}	0.10575139	0.1057514	1.00000000	1.00000000	57

Figure 5 Strong association rules of unrest event sorted by confidence

Figure 5 represented the 18 rules of the unrest in “Mueang Yala” district. The first five strong rules were described below:

- (1) {Bombing, Others} then {Shooting} where (sup = 0.04, conf = 0.81, and lift = 1.06)
- (2) {} then {Shooting} where (sup = 0.76, conf = 0.76, and lift = 1.00) and
- (3) {Arson} then {Shooting} where (sup = 0.06, conf = 0.63, and lift = 0.82)
- (4) {Arson, Bombing} then {Shooting} where (sup = 0.02, conf = 0.63, and lift = 0.82)
- (5) {Bombing} then {Shooting} where (sup = 0.20, conf = 0.62, and lift = 0.81)

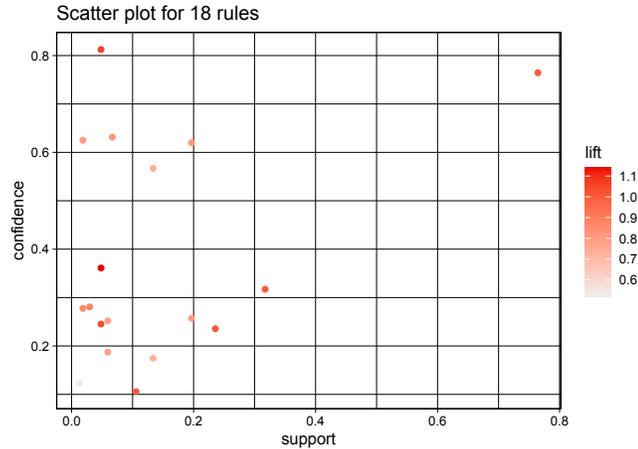


Figure 6 Scatter plot of “Mueang Yala” unrest

Figure 6 shown the distribution of the unrest rules of Mueang Yala district where 18 rules generated from the confidence and support values. This plot shown that {Bombing, Others} then {Shooting} was only one rule had a strong association rule where the confident more than 0.8 and { } then {Arson} was only one weak association rule where the confident was 0.11.

8. Conclusion and Future Recommendation

With the chronical problem of unrest in the southernmost provinces of Thailand, this is considered as the analysis of frequent itemset of the Mueang Yala district of Yala province, south of Thailand. The frequent itemset and Apriori algorithm model that used to explore the association of unrest event. The result shown that frequent itemset was shown an appropriated relation each unrest event. For the future work, we suggest in two main concepts. First, it is interested to apply this model with all districts of three southernmost provinces of Thailand including Pattani, Yala, Narathiwat, and four neighboring districts of Songkhla province. Second, this study could be applied with different machine learning algorithm.

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