

Stance Classification on PTT Comments

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Abstract

With the development of social media and online forums, users have grown accustomed to expressing their agreement and disagreement via short texts. Elements that reveal the user's stance or subjectivity thus becomes an important resource in identifying the user's position on a given topic. In the current study, we observe comments of an online bulletin board in Taiwan for how people express their stance when responding to other people's post in Chinese. A lexicon is built based on linguistic analysis and annotation of the data. We performed binary classification task using these linguistic features and was able to reach an average of 71 percent accuracy. A linguistic analysis on the confusion caused in the classification task is done for future work on better accuracy for such task.

1 Introduction

The wide spread of social media has given organizations and individuals new channels to understanding public opinion. Opinions are expressed via public debate forums and on various platforms, such as Facebook, Twitter, and even Youtube. These opinions reveal how users feel about an event, a person, or any focus of discussion. One expression in Taiwan, 測風向 *cè fēngxiàng* "to test the direction of the wind" is used by netizens when an article online inquires how the public feels about a topic. The phrase perfectly demonstrates how online discussions reflect the public's reaction to certain event or certain individual, often a political figure. In Taiwan, the mass media often resort to online forums as a source of understanding how the public responds

to political events like new policy and candidates running for elections.

Online discussion forums and social media give citizens an easier access to information and more power in shaping what information or idea gets passed on. Users of these online forums participate in a process of framing discussions and forming opinions. As Walker et al. (2012) pointed out, these debates involve not only the expression of opinions but also the formation of opinions. Through posting articles online, users talk about their beliefs on what is true or not, what is important, and what should be done. Their shared opinions thus stimulate more discussions. These users play an important role on how the discussions are framed and shape the form of the arguments.

One characteristics of these forums is that users usually have to express their position in a very short text. This implies that stance classification on short text would be different from identifying stance on a document level. Thus, we find it important to identify "elements" that reveal user's subjectivity in these short texts. Such resources would assist in identification or classification of attitudes and is applicable in all tasks that involves differentiating between factual information and opinionated utterances.

In the current study, we observe stance-taking language and arguing behavior from online comments and from previous studies in both English and Mandarin. The hope is to provide linguistic patterns and analysis that would assist in automated classification on stance. In the following sections, we will introduce previous works done on related topic of interest, discuss our work on tagging and classifying PTT comments, present the result of our classification task, and an analysis on classification errors that could shed light on future tasks on short text stance classification.

2 Related work

The importance of social media has been captured in Shirky's study on the political power of social media. He asserts that regular citizens, nongovernmental organizations, firms, and governments are all actors in social media. Social media has become an active part in political movements all over the world (Shirky, 2011).

This increasing importance and the accessibility of online data have triggered interests in related research to achieve automated methods in understanding affections and opinions. Previous research has made efforts on differentiating factual information from opinionated information. Opinionated information reveals a person's private states through the use of subjective language. Private state is a term that covers a person's overall attitude, including opinions, evaluations, emotions, and speculations (Quirk et al., 1985). Identifying these cues could assist automatic tasks on detecting attitudes online by providing resources (Wiebe et al., 2005).

Wiebe et al. (2004) extracted subjective cues by combining manually annotated subjective elements and expanding it with collocations and clustering method. Somasundaran et al. (2007) inspected dialogues in meetings to detect arguing and sentiment. In the annotated data, sentiment includes emotions, evaluations, judgements, feelings, and stances. Arguing refers to cues that indicate the speaker's attempt to convince one another.

The extracted subjective cues are utilized in classification of texts online for users' stance, defined as "an overall position held by a person toward an object, idea, or proposition" (Somasundaran et al., 2009). Stance classification deals with two sided debates and seeks an automated approach to categorization whether a person is for or against the topic discussed (Hasan and Ng, 2013).

In Somasundaran and Wiebe's study in 2010, they tested a combined feature set of arguing based features and sentiment based features. Arguing based features included arguing trigger expressions and modal verbs. Sentiment lexicon compiled by Wilson et al. in 2005 was used as sentiment based features. They reached an average accuracy of 64 percent classifying online debates based on the lexicon.

Anand et al. (2011) combined the feature set with metalinguistic features like word length and number of characters and approach arguing language with dependency parsers that capture words and its modifying targets. An average accuracy of 65 was reached. Hasan and Ng (2013) takes into account features like the author's position towards other issues and the stance of the immediate preceding post as predictors for stance classification and raised the accuracy up to 74%.

Faulkner (2014) incorporated generalized stance proposition subtrees and "Wikipedia Link-based Measure" to capture the relations between topics. The combined feature set was able to achieve an average accuracy of 80 percent on students' argumentative essays.

Although previous studies on stance classification has proven that classifier trained on unigrams could be a baseline that is hard to defeat and that identification on stance could be difficult for human annotators, adjustment according to the nature of the data set could help improve the results of the classification. Previous studies have mainly focused on document-level stance (Faulkner, 2014) or online debate forums (Anand et al., 2011; Hasan and Ng, 2013). Less attention has been placed on short text comments. However, we believe subjective elements is important in these texts full of sarcasm, typing errors, and colorful use of language (Malouf and Mullen, 2008). The aim of the current study is to establish related resources in Mandarin from short text comments online and to examine whether these linguistic cues assist in stance classification.

3 Methodology

3.1 Data collection

The corpus in the current study was collected from an online forum used in Taiwan, PTT. PTT is the most popular online bulletin board in Taiwan (Shea, 2006). It allows users to share their opinion by posting articles and responding to other's posts. The platform is divided into boards with different topics. Each board is centered on certain field of discussion. For example, the board "Boy_Girl" is a board users discuss relationships between boys and girls.

In PTT, users give response to other users' posts with comments. Comments are tagged by the users

with their own attitude, whether towards the issue discussed, the author of the post, or previous responses comments left by other users. Three tags are available, including “push”, “boo”, and “arrow”. “Push” indicates that the author has a positive attitude towards either the original post or previous comments; “boo” is used when expressing a negative or opposing view; “arrow” is used when no certain attitude is chosen.

The data collected are extracted from three boards that are popular on PTT, including “Gossiping”, “Boy_Girl”, and “WomenTalk”. The boards are chosen with consideration to the amount of data and to the nature of discussion. Some of the boards, though popular enough, may only allow “push” and “arrow” comments or may not be discussion-oriented. In order to identify the patterns used in push comments and boo comments, boards with more opinionated discussions are preferred.

Each line of comment in PTT is limited to 27 Chinese characters. Comments that exceeds 27 characters would be shown in a second line with an automatically assigned “arrow” at the beginning of the line. As a result, for comments that lasts more than one line, only the beginning line would be shown with the original tag while the rest of the lines would begin with an arrow. Since comments are extracted line by line with its tag at the beginning of each line and categorized as such, we cannot distinguish comments tagged with “arrows” by the original user from comments that exceeds one line. In order to avoid confusion between opinionated comments over one line and neutral comments that are originally tagged with arrows, the current study extracts only comments that are tagged with “push” and “boo” and focus on binary classification on opinionated sentences. Table 1 shows the details of the corpus used in the study.

		Number of comments	Number of tokens	Number of token types
Gossiping (6 months)	Push	3786034	28341656	11538420
	Boo	1222735	9000728	493926
Boy_Girl (12 months)	Push	998327	10006638	462780
	Boo	53376	508778	66186
WomenTalk (12 months)	Push	167473	1655771	121794
	Boo	36381	354672	47904

Table 1. Corpus information

3.2 Annotation criteria

Since comments on these forums are used as a way for users to express their opinion, to oppose to others’ ideas, and to justify their reasons for believing in or not believing in something (Wilson and Wiebe, 2005; Wilson, 2008; Somasundaran et al., 2007), the lexicon used in the classifier is compiled with a set of categories that are related to stance-taking and arguing. Following previous studies, we look for linguistic cues that indicate the author’s opinion or position on the discussed topic. The following are categories included in the annotation. In the tagging process, the identified “element” is not restricted to the word level. Considering the fact that subjectivity is often revealed in a common phrase or expression, function words are also included in the tagged set. For example, expression like 最好是 *zuihǎoshi*

“it’d better be” is treated as an element used to reject other people’s opinion.

3.2.1 Arguing cues

Phrases and syntactic patterns that are indicative of opinionated sentences are manually identified from 5000 random comments tagged with push and boo, individually. Reynolds and Wang’s (2014) categorized comments on PTT into 9 categories, including *questions*, *reply*, *clarification*, *interpretation*, etc. We narrowed the categories down to 6 categories, including *question-answering*, *confirmation*, *counterargument*, *clarification*, *suggestion*, and *encouragement*. Expressions that carry one of these six functions would be included as an arguing cue. The annotated outcome is combined with the sixteen categories of arguing cues in MPQA opinion corpus (Wiebe et al., 2005; Somasundaran et al., 2007) as features for arguing cues.

Neutral question answering usually happens when users enquire information on something and is often non-opinionated. It often contains only a proper noun and with no specific cues. Sometimes users would include example-giving as part of their answer. Markers used at such circumstances would include phrase like 像是 *xiàngshì* “like”. Confirmation contains expressions used to agree with previous propositions, such as 同意 *tóngyì* “agree”. Counterargument is used when the user opposes to or challenges either the original post or previous comments. An example cue of counterargument would be 你怎麼知道 *nǐ zěnmē zhīdào* “how do you know”. Clarification is used when the focus of the comments shifts from one part to another and is sometimes used for similar purpose as a counterargument. An example of a comment used to clarify is shown in example (1) below, with the arguing cue underlined.

- (1) 你 爸爸 這樣是
nǐ bàba zhèyàngshì
 your father this is
 錢奴 , 不是
qián nú, bùshì
 miser not
 企業家 ...
qǐyèjiā
 entrepreneur
 “Your father is a miser, not an entrepreneur.”

Suggestion is used when the user provides a solution or advice for the poster or other users. It is similar to neutral question answering but it usually involves more personal point of view. A typical cue in this category would be 建議 *jiànyì* “suggest”. Encouragement refers to the expressions of sympathy and support, which is very common on some boards. Users may use cues like 拍拍 *pāipāi* “patting” or 加油 *jiāyóu* “cheer up” to show their understanding of what the poster is going through.

3.2.2 Subjective elements

Following previous studies, words that are indicative of the author’s stance on the discussed topic are included in the lexicon. Our definition of subjective elements is similar to the one brought up by Wiebe in 1994, which identifies a subjective element as an element that is potentially subjective,

meaning that it can subjective in a certain context. Most of the words included are noun phrases and verb phrases that are evaluative, including both *explicit subjective elements* and *expressive subjective elements* (Wiebe et al., 2005; Wilson, 2008). Criticism and appraisal are given as tags to each of the phrases, indicating positive and negative evaluation.

Explicit subjective elements refer to phrases that explicitly show the attitude of the speaker, such as 討厭 *tǎoyàn* “hate” and 反對 *fǎnduì* “against”. *Expressive subjective elements* refer to expressions that reveal one’s attitude without explicitly naming that attitude. For example, in the sentence “the report is **full of absurdities**”, the phrase full of absurdities is used to express negative evaluation on the report (Wiebe et al., 2005).

In this category, *expressive subjective elements* are considered more interesting because some of the words might not be negative when it occurs individually or in other contexts. However, users on PTT form their habitual use of language to express their attitudes towards something without directly giving an evaluation. For example, the original definition of the word 公主 *gōngzhǔ* “princess” refers to a member in the royal family, but in PTT, it is a negative evaluation which refers to girls who rely on their boyfriends to take perfect care of them, cater to their every need, and gets mad over trivial matters. These expressions involve users’ world knowledge and is often used in sarcasm and irony (Wiebe et al., 2005). Identifying these elements would help us identify whether a comment or an evaluation towards the posted article contains positive or negative attitude.

3.2.3 Metadiscourse markers

Metadiscourse has been included in previous studies (Vande Kopple, 1985; Hyland, 1998; Hyland, 2002; Hyland and Tse, 2004; Dafouz-Milne, 2008) as a crucial part of persuasive writing. It reveals the author’s strategic arrangement of the text base on his intention to persuade and his understanding of the potential readers. According to Halliday (1973), the three macrofunctions of language include ideational function, interpersonal function, and textual function. The categorization of metadiscourse markers corresponds to two of the three functions, interpersonal and textual. Textual metadiscourse refers to the structure of the

text. How the author arranges his text might affect the readability persuasiveness of the text. Interpersonal metadiscourse, on the other hand, refers to how the author positions himself in the text and how he includes his readers. Following Hyland’s study (1998), ten categories are included

as metadiscourse markers: *logical connectives, frame markers, endophoric markers, evidentials, code glosses, hedges, emphatics, attitude markers, relational markers, and person markers*. Examples and definition of each category is given in the following table.

Textual Metadiscourse		
Logical connectives	Express semantic relation between main clauses	所以 <i>suǒyǐ</i> ‘therefore’
Frame markers	Explicitly refer to discourse acts or text stages	先 <i>xiān</i> ‘first’
Endophoric markers	Refer to information in other parts of the text	我剛才說的 <i>wǒ gāngcái shuō de</i> ‘what I just said’
Evidentials	Refer to source of information from other texts	指出 <i>zhīchū</i> ‘pointed out (in the show)’
Code glosses	Help readers grasp meanings of identical material	換言之 <i>huànyánzhī</i> ‘in other words’
Interpersonal Metadiscourse		
Hedges	Withhold writer’s full commitment to statements	可能 <i>kěnéng</i> ‘possibly’
Emphatics	Emphasize force or writer’s certainty in message	絕對 <i>juéduì</i> ‘definitely’
Attitude markers	Express writer’s attitude to propositional content	同意 <i>tóngyì</i> ‘agree’
Relational markers	Explicitly refer to or build relationship with reader	你 <i>nǐ</i> ‘you’
Person markers	Explicit reference to author(s)	我們 <i>wǒmen</i> ‘we’

Table 2. Categories of Metadiscourse Markers

During the annotation process, we find that there may be overlapping categories for arguing and for metadiscourse. One element could also have more than one function in comments. Our approach is to keep all categorization as part of the resources. Examples showing the arrangement of the data can be found in Table 3. The second column shows its category in metadiscourse, and the third column shows its category in MPQA arguing lexicon. The

fourth column shows its category in the six types of comments. The fifth column shows its annotated prior subjectivity, which is the polarity of the word when it stands alone. The last column show its polarity in the extracted corpus, which is acquired by comparing the element’s relative frequency in push and boo comments. The combined annotated lexicon includes a total of 4582 entries.

entry	metadiscourse	arguing	commenting	prior sub	calculated sub
感覺		assessment	question-answering; encouragement	neu	pos
不然	logical connectives	conditional	counterargument; suggestion	neu	pos
當然	emphatics	emphasis	confirmation; counterargument	neu	pos
好像	hedges		counterargument	neu	pos

Table 3. Examples of the subjective lexicon

3.3 Building the classifier

The combined lexicon is used as feature set for

identifying the stance of comments. In the current study, three sets of features are used in building the classifier. The first set of features contains subjective elements acquired through

manually annotating the data. For subjective elements, we assume negative evaluation reflects negative attitudes that more likely occur in boo comments while positive evaluation is associated with push comments. The second set of features includes the C-LIWC wordlist of positive and negative emotions (Huang, 2012). In this set, positive emotion words are associated with push comments while negative emotions are associated with boo comments. As for the rest of the cues, which may occur in both positive and negative context, we use relative frequency as a way of deciding whether it is representative for a certain position or not. Using the following calculations, if the number is higher than 0.70, the expression (which could be a subjective element, an entity, or even a disclaimer) would be judged as a feature for identifying that particular stance.

$$\frac{\text{Relative frequency of the segment in boo/push comments}}{\text{Relative frequency of the segment in all comments}}$$

The calculation is done after all of the scarce words are removed from the data. We used the third quantile of frequency as the threshold for scarce words. Thus, in all three sets of data, words that occur only once are removed. Relative frequency of data from each board is calculated individually. The combined wordlist is then used as features for an SVM classifier¹.

4 Result and discussion

In order to make a comparison, a baseline was done using segmented words as features for the SVM classifier. The feature set raises the accuracy on WomenTalk from 55 percent to 75 percent. The classification on Boy_Girl data also improved by 13 percent. What's worth noticing is that the

¹ The classifier used here is released by CLiPS, Computational Linguistics and Psycholinguistics Research Center and is available on <http://www.clips.ua.ac.be/pages/pattern-vector#classification>

accuracy of Gossiping data dropped by 2 percent. Table 3 shows the results of the classifier.

Table 3. Results using the combined feature set

	Baseline	SVM Classifier
Gossiping	0.69	0.67
Boy_Girl	0.57	0.70
WomenTalk	0.55	0.75
Average	0.60	0.71

The numbers show that the feature set can successfully assist in the classification of texts in Boy_Girl and WomenTalk. However, the accuracy of classification on Gossiping data perform two percent lower than baseline. There are a few possibilities to why there would be a difference between these three sets of data.

1. The degree of diversity of the topics

The three boards, though all discussion oriented, involves the exchange of information in different topics. For Boy_Girl board, most of the topic is centered on romantic relationships. As for WomenTalk board, most of the discussions focus on things that girls care about, such as products for women, boyfriends, etc. These two boards might have a clearer group of users than Gossiping, where all kinds of questions could be relevant. The topics cover from debates on international political events to opinions on superhero characters. In previous studies in English (Hasan and Ng, 2013; Hasan and Ng, 2014; Faulkner, 2014), domains are usually selected and separated so that the classification is performed on one central idea, such as gay rights or death penalty. The variety of topics might be a reason why classification on Gossiping data is less accurate than the others.

2. Different language use due to the different culture of the board

Since each board on PTT has its own purpose of discussion, every board attracts different group of users and forms its unique "culture". In general, speakers on Gossiping board is more direct and more quick to criticize than users on the other two boards, as indicated by the different proportions of push comments and boo comments in the three boards. The difference might suggest that boo comments on WomenTalk and Boy_Girl would

have a higher degree of disagreement than the ones on Gossiping, which makes it harder to differentiate push and boo comments on Gossiping. Other than possible differences among the boards, error analysis is also done by randomly selecting comments that are mistakenly tagged by the classifier. The result shows that the following mistakes are most common.

1. Context dependent comments

Since comments on PTT are usually left very short so that people can grasp the idea at a quick glance, a lot of words are often omitted in comments. The other users would have to judge the stance of the comment by combing the information they get from the original post and the self-tagged stance. Thus, two kinds of confusion might arise when we have to judge the stance of the comment without its context, including the original post and previous comments.

First type of error occurs when the target of the comment is not the original poster but the person or event of which the poster is attacking. For example, when a boyfriend complains about his girlfriend who always threatens to break up with him whenever they have a fight, other users might leave comments criticizing that girlfriend. But since they agree with the original poster's position, which is a negative attitude towards the girlfriend's behavior, the tags they give to their comments are usually "push". For our classifier, this would cause confusion because the linguistic behavior corresponds to negative evaluation, which is usually associated with "boo" comments. As a result, these comments would be categorized as "boo" comments. The following is an example of this type of error.

(2)	很	不	喜歡	那種
	<i>hěn</i>	<i>bù</i>	<i>xǐhuān</i>	<i>nàzhǒng</i>
	very	not	like	those.kind
	婚前	就在	說	離婚
	<i>hūnqián</i>	<i>jiùzài</i>	<i>shuō</i>	<i>lihūn</i>
	before.marriage	already	say	divorce
	後	怎樣	怎樣	的
	<i>hòu</i>	<i>zěnyàngzěnyàng</i>		<i>de</i>
	after	how	DE	people

"I really don't like those people who already starts talking about what would happen when they get a divorce before even getting married"

In example (2), the comment expresses a negative attitude towards people who appears to be planning their divorce before even getting married.

Confusion may result because the target of the comment could be the person the original post was criticizing or it could be the original poster him/herself. That target could only be identified with consideration of what was originally written in the post.

The second type of error involves comments that are very short and give very little clue on their stance. The expressions that occur in these comments can be either positive or negative, depending on the speaker's intention. An example of this type of expression would be 天啊 *tiān a* "Oh my goodness", which could be used to express surprise in both positive or negative context. Since we cannot examine "how" the user says it in his/her mind and can only rely on the relative frequency of these phrases in comments, it also results in confusion.

2. Sarcastic comments

It is not uncommon for users to use sarcasm to express their stance online. On PTT, users might use very positive sentences and give it a negative tag to indicate that the comment was sarcastic. These negative comments might be mistaken by the classifier as "push" comments. The following example illustrates how a negative comment might be mistakenly tagged as "push" comment.

(3)	當了	鄉民	這麼	多
	<i>dāngle</i>	<i>xiāngmín</i>	<i>zhème</i>	<i>duō</i>
	be	PTT.user	this	many
	年，	我	終於	搶到
	<i>nián</i>	<i>wǒ</i>	<i>zhōngyú</i>	<i>qiǎngdào</i>
	year	I	finally	get
	頭噓	了	好	感動
	<i>tóu xū</i>	<i>le</i>	<i>hǎo</i>	<i>gǎndòng</i>
	first.booLE	so	touched	

"After being a PTT user for so many years, I am finally the first one to leave a boo comment in an article! I am so touched."

The comment includes the emotion 好感動 *hǎo gǎndòng* "so touched", which appears to be a positive emotion. But human readers would be able to tell that the comment was sarcastic because of the mention of 頭噓 *tóu xū*, which is used in PTT to refer to the first boo comment in an article. Thus, this comment was tagged with "push" by the classifier.

3. Intentionally vague comments

On PTT, in order to avoid directly referring to a person name or avoid directly saying swear words

or negative expressions, users sometimes use characters that have similar pronunciation or similar form to replace the original characters. These would result in segmentation errors and it would be very difficult to categorize because each user might have his/her own choice of characters and there isn't an exhaustive list of such words. They may also use underlines or spaces to replace the original negative expressions when the rest of the sentence makes it clear what the word should be in that position. This omission would also make it harder to categorize the comment.

Example (4) includes the phrase 甘吟釀 *gānyínniàng*, which does not exist in Chinese vocabulary but the sounds of these words are similar to the swear words 幹拎娘 *gànlīnniáng* “you mother fucker”. The person who left this comment chose to use these words instead of the conventional characters. Other users, when reading this comment, would still be able to judge what the comment intends to express. However, the classifier might judge this new “word” to be a proper noun and this may cause some mistakes.

In example (5), the underlined part is an omission of the original word 中二 *zhōng èr*. This term is used as a negative representation for juvenile behavior and mindset common among teenagers. The word could not be identified by the classifier because the omission results in segmentation error.

- (4) 甘吟釀 的 欠
gānyínniàng *de* *qiàn*
gānyínniàng DE asking.for
 噓 ~ ~ ~
xū
 boo
- (5) 圍巾 醜 原 PO
wéijīn chǒu *yuán* *PO*
 scarf ugly original poster
 — 二 結案
 — *èr* *jié'àn*
 (underline) two case.close

The other type of vague comments are produced because of the structure of PTT comments, users sometimes try to complete other people's comments by positioning their comments at certain position. These comments would only make sense when processed in combination with the rest of the comments, also known as “floors” on PTT.

4. Others

Sometimes it is very difficult to identify why the original poster would choose certain tag. This could be a result of the user's own tagging mistake, or it could also be individual differences. In example (6), the comment was tagged with “boo” while the beginning of the sentence is the word push. Both the classifier and human readers would consider this sentence to be a push comment rather than a boo comment. This could be a result of the user's own tagging error. Thus would not be considered a very important issue in the current study.

- (6) 推 投幣式 女友
tuī *tóubìshì* *nǚyǒu*
 push coin-op girlfriend
 “I agree with coin-operated girlfriend”

To further improve the classifier, the following approaches could be taken into consideration. According to Riloff and Wiebe (2003), it is important to incorporate large amount of data because infrequent words can sometimes be strong subjective clue. Thus, it might be helpful to expand the coverage of annotated data. Context of the comments should also be taken into account. If the classifier is able to capture the relationship between the target and the comment being given, the errors caused by context dependent comments could be solved.

5 Conclusion

The purpose of this study is to compile lexical resources in Mandarin on arguing and stance-taking and to test the applicability of these resources in machine training on stance classification. We explored related linguistic categories on how users express their stance in online comments and established three sets of features that we believe reveals speaker's subjectivity. An experiment on classifying online comments shows that the annotated wordlist could assist in the classification by raising up to 20 percent of accuracy. In order to further improve automatic classification, an analysis on the errors of our classification task is provided. Possible linguistic issues such as identifying the targets of the comments, the overall culture on the boards discussed, sarcastic comments, and problems resulting from vague comments requires further studies.

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