Searching Word Definitions in WordNet Based on ANEW Emotion Labels

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***Abstract*—Emotion detection is the process of extracting emotion from human expression. Emotions may be expressed by facial expression, speech and even written text. The Affective Norms for English Words (ANEW) is a corpus that has been used in researches involving emotion detection. ANEW provides the score of valence, arousal, and dominance for each word. However, no information about the word definition is provided in ANEW. The goal of this research is to identify the correct definition of every word in ANEW as additional informations to improve its accuracy.**

Keywords—emotion; affective norms; word sense disambiguation;

I. INTRODUCTION

The Affective Norms for English Words (ANEW) is a collection of words that developed by Margaret M. Bradley & Peter J. Lang in 1999 [1]. ANEW has 1030 words and their emotion components, such as valence, arousal, and dominance value. ANEW has been used to calculate emotion in song titles, lyrics and even weblogs [2].

Affective Norms for English Words (ANEW) is the dataset that is often used for research on the dimensional model [3]. The dimensional model describes emotions in a dimensional vector space [4]. In ANEW itself, there are three-dimensional values: valance, arousal and dominance. Valence and arousal represent personal emotions, while dominance shows the relationship between people and their environment. In vector space, the range of valence value from negative into positive and arousal has a value from low until high [4]. Although most research focuses only on one-dimensional model [5], here this research will use two-dimensional model of emotions: valence and arousal.

Emotion detection of text has been considered important in analyzing personal emotion [6]. While ANEW has been used in a lot of these research, an improvement still can be made to improve its accuracy. For example, at the moment, ANEW only contains words without information about their senses and definitions. This can be a problem because some words actually have multiple senses and definitions. When using ANEW, we can potentially use the wrong emotion value of a word in ANEW that has completely different meaning in our context even though they appear as the same word.

The idea of this paper is to narrow down the definition of each ANEW word so that such problem cannot happen.

II. METHODOLOGY

A. Labelling

Firstly, we will need to add an emotion label to each word in ANEW. This can be achieved by calculating their valence and arousal means. There are a lot of kinds of emotion classification [7]. One of them is known as Thayer's model [8].

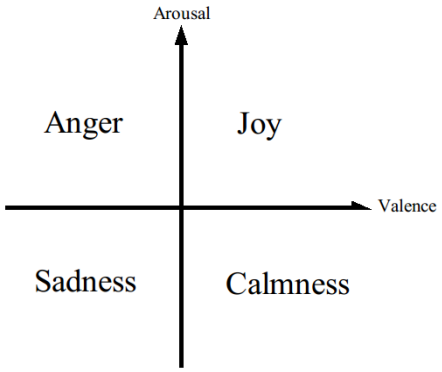
This experiment uses Thayer's model for the emotion labels because it has emotion classes with clear limits on dimension spaces [8]. Thayer's model supports four classes of emotion (joy, anger, sadness, calmness), but this experiment will only use three of them (joy, anger, sadness) due to dataset availability.

The table below shows the examples of word in ANEW. While, the figure below shows how Thayer's model in a diagram.

TABLE 1. Affective Norms for English Words (ANEW)

	Description	Valence	Arousal
	grin	7.40	5.27
	honest	7.70	5.32
	gripe	3.14	5.00
	honey	6.73	4.51
	guillotine	2.48	6.56

FIGURE 1. Thayer's model



B. *Dataset*

Dataset is gathered from ISEAR Databank (International Survey on Emotion Antecedents and Reactions), a project directed by Klaus R. Scherer and Harald Wallbott in 1997. ISEAR is a dataset that contains sentences and their respective emotion labels. Out of seven major emotions (joy, fear, anger, sadness, disgust, shame, guilt) in ISEAR, this experiment will use only three of them (joy, anger, sadness). This dataset will later be used as sample sentences to add contexts to our ANEW words before we can find the definitions.

After giving each ANEW word an emotion label, we can add sentences from this dataset to our ANEW words. For each word in ANEW, we will attach a sentence from ISEAR that contains the word and has the same emotion label.

It is important to note that not all words in ANEW will have sample sentences from ISEAR. In later steps, we will only use words that have sample sentences.

Here is some examples of ISEAR sentences.

TABLE 2. ISEAR databank

	Sentence	Label
	During the period of falling in love, each time that we met and especially when we had not met for a long time.	joy
	When I was involved in a traffic accident.	fear
	When I was driving home after several days of hard work, there was a motorist ahead of me who was driving at 50 km/hour and refused, despite his low speed to let me overtake.	anger
	When I lost the person who meant the most to me.	sadness
	The time I knocked a deer down - the sight of the animal's injuries and helplessness. The realization that the animal was so badly hurt that it had to be put down, and when the animal screamed at the moment of death.	disgust

C. *POS Tagging*

For each sample sentence, we will need to find POS of each word in the sentence. By doing this, we can get the POS of all ANEW words in each of their sample sentences.

POS is important so that we can narrow the word definition by only searching definitions that match the POS and ignoring the rest.

D. *Find Word Definition with WordNet*

WordNet is a lexical semantic database for the English language [9]. WordNet consists of the definitions for all English words and their relation called *synset*. With WordNet, we can search for all definitions for each word in ANEW with the POS tags that we have calculated earlier. However, WordNet usually will match multiple definitions for each word.

At this point, we must choose one from these definitions which match our sample sentence the best. Such problem is called Word Sense Disambiguation (WSD). Word Sense Disambiguation is a problem to remove ambiguity and to find the meaning of words in a particular context [10]. One example of a WSD algorithm is called Lesk algorithm.

Lesk algorithm is a classical WSD algorithm introduced by Michael E. Lesk in 1986 [11]. A simplified version of Lesk algorithm has been adapted in WordNet and can be used to find the definition of an ambiguous word [12]. Lesk algorithm will calculate the similarity between our sentences and WordNet definitions and will result in one definition that has the best similarity to our sentence.

In the end, we will have one definition for each word in ANEW.

E. *Testing*

We need to test our methods and calculate the accuracy. A simple testing method would be to gather the definition and all sentence examples (from WordNet) that we have obtained earlier and then for each word in that sentence, if the word exists in ANEW, we calculate its valence and arousal value and then calculate the average.

Here is the formula to calculate the average valence and arousal of a text. Here, v_i and a_i denote respectively the valence and arousal value for each word in ANEW. f_i denotes the frequency of occurrence of those words in the text.

$$v_{text} = \frac{\sum_{i=1}^{n} v_i f_i}{\sum_{i=1}^{n} f_i} \quad v_{text} = \frac{\sum_{i=1}^{n} v_i f_i}{\sum_{i=1}^{n} f_i} \tag{1}$$

$$a_{text} = \frac{\sum_{i=1}^{n} a_i f_i}{\sum_{i=1}^{n} f_i} \quad a_{text} = \frac{\sum_{i=1}^{n} a_i f_i}{\sum_{i=1}^{n} f_i} \tag{2}$$

The resulting valence and arousal average then can be used to find the emotion label based on Thayer's model.

Lastly, we need to compare these emotion labels with the emotion labels that we have calculated in the first method earlier.

III. EXPERIMENT

Initially, we used all 1030 words in ANEW and labelled them with emotion labels (joy, anger, sadness). Since we only used three emotion labels from supposedly four, we had a few words that did not have labels.

TABLE 3. Emotion labelling

Valence	Arousal	Emotion
>= 5	>= 5	joy
< 5	>= 5	anger
< 5	< 5	sadness

TABLE 4. Emotion labelling on ANEW

	Description	Valence	Arousal	Emotion
	grin	7.40	5.27	joy
	honest	7.70	5.32	joy
	gripe	3.14	5.00	anger
	honey	6.73	4.51	-
	guillotine	2.48	6.56	anger

After finding sample sentences for each ANEW word. We ended up with 189 words that had sample sentences and were ready for the next step.

TABLE 5. Adding sample sentences

	Description	Emotion	Sentence
	guilty	anger	A chief was unjustly punished on an autumn bri...
	hope	joy	My friend took me to Civo Stadium to watch and...
	hospital	joy	I felt it when on duty in the hospital I under...
	hug	joy	When I get a hug from someone I love.
	happy	joy	At a friend's birthday party with some of my c...

Using sample sentences we gathered, we could find the POS tag of each ANEW word in its respective sentence.

TABLE 6. POS tagging

	Description	Emotion	Sentence	POS
	guilty	anger	A chief was unjustly punished on an autumn bri...	JJ
	hope	joy	My friend took me to Civo Stadium to watch and...	NN
	hospital	joy	I felt it when on duty in the hospital I under...	NN
	hug	joy	When I get a hug from someone I love.	NN
	happy	joy	At a friend's birthday party with some of my c...	JJ

Afterwards, we attempted to get WordNet *synset* for every word. However, when finding POS tags earlier, there was a case when WordNet failed to find a word definition that matched the POS tag. This could happen because of the incorrect POS tag. The total number of dataset decreased to 171 words.

TABLE 7. Obtaining definitions

	Description	Emotion	POS	Synset
	guilty	anger	JJ	guilty.a.01
	hope	joy	NN	promise.n.02
	hospital	joy	NN	hospital.n.02
	hug	joy	NN	hug.n.01
	happy	joy	JJ	happy.a.01

Finally, we did the testing process using Formula (1) and (2) we defined earlier. The test resulted in a new emotion label for every word. By comparing these results with the initial labels, we could conclude the correctness of this method.

However, in the testing process, there was also a case when the word definition and its WordNet examples were too brief to test against the words in ANEW. We excluded these instances in further steps.

TABLE 8. Emotion testing

	Description	Emotion label	Test result	Verdict
	guilty	anger	anger	correct
	hope	joy	joy	correct
	hospital	joy	anger	incorrect
	hug	joy	joy	correct
	happy	joy	joy	correct

In the end, we counted how many instances were predicted correctly. Out of 149 words that have been successfully tested, 99 of them resulted in a correct emotion label. We concluded that the final accuracy was 99/149 = 66.44%.

IV. CONCLUSION

Our experiment has successfully tested 149 words and predicted the correct emotion labels for 66.44% of our dataset.

The word definitions could be used as additional informations when using ANEW in a research with the hope of better accuracy.

However, there are still rooms for improvement for this research to achieve the more accurate definition of every word in ANEW.

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