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Text-based emotion classification using emotion cause extraction

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ABSTRACT

In recent years, increasing impact of social networks on people's opinions and decision making has attracted lots of attention. Microblogging, one of the most popular social network applications that allows people to share ideas and discuss over various topics, is taken as a rich resource of opinion and emotion data. In this paper, we propose and implement a novel method for identifying emotions in microblog posts. Unlike traditional approaches which are mostly based on statistical methods, we try to infer and extract the reasons of emotions by importing knowledge and theories from other fields such as Sociology. Based on the theory that a triggering cause event is an integral part of emotion, the technique of emotion cause extraction is used as a crucial step to improve the quality of selected features. First, after thorough analysis on sample data we constructed an automatic rule-based system to detect and extract the cause event of each emotional post. We build an emotion corpus with Chinese microblog posts labeled by human annotators. Then a classifier is trained to classify emotions in microblog posts based on extracted cause events. The overall performance of our system is very promising. The experiment results show that our approach is effective in selecting informative features. Our system outperformed the baseline noticeably in most cases, suggesting its great potential. This exploration should provide a new way to look at the emotion classification task and lay the ground for future research on textual emotion processing.

1. Introduction

Microblogging is a form of blogging that allows users to publish brief text posts (usually with a strict length limit of not more than 200 characters) (Kaplan & Haenlein, 2011). Microbloggers post about a wide range of topics including daily life, comments on movies or books and opinions on social events. Because of the simplicity and casualness, the number of microbloggers has been growing rapidly in recent years. Since users are able to update their content quickly, microblogging services also act as a hub of real-time news. Organizations such as companies, charity groups and departments of government use microblogging as a tool for marketing and public relations as well. Microblogging services are gradually becoming a platform where information, ideas and opinions converge. Nowadays, many people make their decisions under the influence of the microbloggers they follow. Microblog posts are considered as rich sources of emotion and opinion data (Pak & Paroubek, 2010). It is of great interest to mining user emotions in a microblogging community for the purpose of public opinion tracking, content filtering and customer relationship management (Zhang, Zeng, Li, Wang, & Zuo, 2009).

Emotion processing in text is currently a hot and active area in the field of Natural Language Processing (NLP). Textual emotion detection or classification is one task that many scholars and researchers concentrate on. Though the details may vary, the general goal is the same – to detect and recognize the type of emotion, for example, *happiness*, *anger* and *surprise*, conveyed by the target document (Mihalcea & Liu, 2006). Traditionally, due to the statistical classification nature, the most common practices adopted by researchers are mainly statistics-based models. Feature selection methods like InfoGain and χ^2 Test and classifier algorithms like Support Vector Machine (SVM) and k-nearest neighbor (k-NN) are some of the traditional ways for text classification tasks. However, those approaches are very limited in two ways. First, complicated sentences with negation or rhetorical questions cannot be handled well. Second, information of deeper levels, such as the why and how this specific emotion rises are neglected. However, they are very interesting information and sometimes can better reflect the emotion. If we think about how a typical person feels and understands the emotion within a piece of article, we will notice that it is often factors which are not statistically significant, such as the events, the reaction of people, that truly define

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our perception of emotion. It is intuitive to take such information into consideration when classifying emotions in posts people put on the web.

Among many elements regarding how emotions rise, expressed and perceived by others, the triggering event are often considered one of the most crucial ones. Many scholars in various disciplines have been studying the relation and interplay between emotions and cause events. From a Psychological point of view, there are theories (James, 1884) believe that the cause event itself should be an integral part of emotional experience. In the field of Sociology, Kleres (2011) proposed "narrative analysis" as a methodological approach to systematically analyze emotions by finding out what happens. Lee, Chen, and Huang (2010a) designed a rule-based system to detect emotion causes. Even though those researches do not concentrate on the task of automatic emotion classification, they lay the ground for us.

In this study, we take a fresh approach on classifying textual emotions. We propose a method to classify emotions using the emotion cause extraction technique, based on the combination of cross-disciplinary knowledge and careful investigation on microblog data. We consider it as a novel method because are unaware of any previous emotion classification works using this technique. We focus on identifying emotions based on posts extracted from the website Weibo, the most popular and influential Chinese microblogging community. We take emotion cause events as our entrance point to overcome some of the drawbacks of traditional approaches. Emotions and reactions triggered by the same event are assumed to be similar, so the errors caused by rhetoric can be reduced. Also, deep-level information is taken into account. The experiment results show that the our system can extract emotion cause events from microblog posts with a good accuracy. Based on an efficient cause event extraction, the emotion classification results of our system improves noticeably.

The rest of this paper is structured as follows. Section 2 discussed the related work on emotion analysis including traditional methods and new explorations. Section 3 gives a brief introduction of the Chinese microblogging platform Weibo, and describes the proposed method using emotion cause extraction technique. In Section 4, experiment results of the two stages of our approach are reported and discussed. Section 5 presents the conclusions and our future work.

2. Related work

We present and briefly introduce related work on the task of emotion processing in this section.

2.1. Emotion classes

There are mainly two types of classification, binary classification (coarse-grained classification of sentiment polarity) and multi-class classification (fine-grained classification multiple classes) (Plutchik, 1980; Turner, 2000).

Most prior research work concentrated on binary classification, i.e. positive and negative. However, a multi-class classification system that reveals more detailed information usually has more practical interest. For example, commercial advertisements will be pushed more accurately and less annoyingly if user's specific emotion status is known. Understanding more about users' current feelings will also help social network websites to create a atmosphere that is warmer and friendlier. Even though right now there is no common agreement among many theories on multi-class emotion classification, several basic emotion types are generally assumed. Some primary emotion classes such as joy and anger are intuitive and commonly-found in similar researches. In our research, to achieve a balance between performance and richness of classes, we adopted the Ekman and Friesen (1971)'s list of six basic emotions (happiness, anger, disgust, fear, sadness, surprise). It should be noted that there is no line separating right and wrong. The set-up of emotion classes should be designed case by case.

2.2. Textual emotion classification

Generally speaking, the research and application of emotion processing in text is still in a very preliminary stage. The inherent ambiguity and subtlety of natural languages are some of the many factors that make this task very challenging, especially in an social network environment where sentences are often incomplete or incoherent. There are many researches concerning recognizing and classifying emotions in different types of text, such as news reports, children's fairy tales, product reviews and customer feedbacks. Generally there are two common approaches to this task, namely a rule-based one and a machine-learning-based one. A rule-based system that tags emotions in news headlines was proposed and implemented by Chaumartin (2007). It computes word's sentiment polarity according to linguistic knowledge and predefined rules. Even though this system achieves a high accuracy, the recall is rather low. When it comes to the machine-learning-based approach, Tan and Zhang (2008) explored four feature selection methods (MI, IG, CHI and DF) and five learning methods (centroid classifier, K-nearest neighbor, winnow classifier, Naive Bayes and SVM) in an empirical study. The experiment results show that IG and SVM perform best. They also point out that classifiers severely depends on domains and topics. Tokuhisa, Inui, and Matsumoto (2008) adopts the k-nearest-neighbor (k-NN) method and a two-step classification model. Based on a very big amount of data extracted from the web, this system significantly outperformed the baseline. There are also variations in terms of the approach and dataset. Ghazi, Inkpen, and Szpakowicz (2010) compared hierarchical and flat classification. Tang and Chen (2011) modeled emotion mining from the writer perspective, reader perspective and the combined perspective using a Plurk dataset. Ye, Zhang, and Law (2009) incorporated sentiment classification techniques into review mining and reached accuracies of over 80% with a large training dataset. Kontopoulos, Berberidis, Dergiades, and Bassiliades (2013) proposed a more efficient sentiment analysis of Twitter posts using ontology-based techniques.

Our work is different from the others. We first import some knowledge of human emotions from other fields such as Sociology, and investigate the posts on Weibo to reveal some connections between the cause events and certain types of emotion. Based on the framework proposed by Lee et al. (2010a), we also developed a emotion cause extraction subsystem that applies well to microblog data. In addition, we do not stop at just detecting the emotion causes. The emotion cause extraction subsystem, which efficiently mines deep-level emotional information, is integrated as a part of our emotion classification system, resulting in an improved classification result. Our exploration will provide a brand new way to look at the problem of emotion processing.

3. Emotion classification using the emotion cause detection technique

The basic idea behind our approach is looking for features that are "meaningful" to emotions instead of simply choosing words with high co-occurrence degree. Fig. 1 depicts the general framework of our emotion classification method. In the following subsections, we expand on the important parts of our system to explain how we classify emotions in microblog posts with emotion causes.