ABSTRACT

According to the concept of emotional intelligence, a person exhibits truly intelligent behavior if he is able to understand emotions of other persons and reciprocate with proper responses. In the drive for developing intelligent machines, this new paradigm of intelligence, emotional intelligence is being taken into consideration. The area of human computer interaction (HCI) focuses on developing intuitive interfaces for enabling natural communication between human and computing systems. The naturalness of communication depends on the recognition and expression of emotions. Thus, in very recent days, efforts are being put forward for developing natural interfaces that are emotionally intelligent.

Emotion can be expressed through different modes of communication like facial expression, vocal or speech expression, different bio-signals etc. Apart from these modes, language is another important mode through which emotions are often communicated. Thus, the interfaces that use natural language as the communication mode must understand the emotional contents in the users' interactions. As compared to emotion recognition from facial and speech expressions, the problem of emotion recognition in linguistic expressions has not received much attention.

The problem of emotion classification in natural language text is the task of classifying text segments (word, sentence, paragraph or document) into different emotion categories like happiness, sadness, fear etc. Emotion in text can be studied in two different views. The first view adheres to the emotions expressed by the writer in a text segment and the second view concerns about the emotions that may be evoked in a reader's mind in response to a text stimulus. In this work, we focus on the second view where for a given sentence the task is to identify the emotions that are possibly evoked.

We have adopted a supervised machine learning based text categorization approach to solve the said task. In order to perform supervised classification, a corpus of sentences has been collected. Sometimes the news articles are written in such a way that they evoke some emotions in readers' minds. This is why the news domain has been selected as the corpus source in this study. The collected corpus is annotated with basic emotion categories. As evocation of multiple emotions is possible, fuzzy and multi-label classification is most natural where a sentence may evoke multiple emotions simultaneously with different degrees of membership in respective emotion categories. Accordingly, a fuzzy and multi-label annotation scheme has been adopted.

As emotion is a very subjective entity, the responses of the readers may vary. Thus, corpus annotated by a single reader or annotator may not be reliable to develop emotion classifiers. In order to circumvent the problem of subjectivity, the corpus has been annotated by multiple annotators independently. The reliability in annotation has been determined

by measuring the extent of agreement among the annotators. Two types of classification tasks have been addressed in this work. The first task determines whether a sentence evokes a particular emotion or not, i.e., a crisp classification. On the other hand, the second task determines to what extent a particular emotion is evoked, i.e., a fuzzy classification. In this work, we have computed the reliability in crisp or categorical annotation by means of a proposed agreement measure. The reliability in fuzzy annotation has been measured using a standard reliability measure, Cronbach's alpha. The gold standard corpus for training and validating the emotion classifiers has been generated using proposed aggregation techniques.

As there are a limited number of studies regarding emotion evocation, the features suitable for emotion classification has not been explored much. As words present in the sentences are the most obvious features, they have been considered in the baseline study. Besides word feature, two new features have been proposed. The polarity based features consist of the polarity of the subject, object and verb phrases of the sentences. As the evocation of emotion depends on the reader's understanding the text, semantics based features has also been considered. The methods for extracting these features have been proposed.

The generated gold standard corpus has been used to develop emotion classifiers. The emotion classification task has been performed in two frameworks: crisp multi-label and fuzzy multi-label classification framework. Three different research questions have been addressed in this work. The first investigation has been performed to find the most discriminating feature combination for emotion classification. In this study, it is observed that polarity and semantics based feature combination performs best. Experiments have been performed to identify important word and semantics based features by using statistical feature selection technique. It has been observed that for both word and semantics based features, the feature selection technique helped in achieving better performance. Finally, performances of the emotion classifiers developed with different multi-label classification techniques have been compared to find the best method. Performance of the fuzzy emotion classifier has been observed to be higher as compared to the crisp emotion classifiers.

Keywords: emotion classification, corpus reliability, multi-label classification, fuzzy classification, feature selection, text categorization, natural language processing.