

Emotion Recognition: Detecting Emotions from Textual Documents, Blogs and Audio Files

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ABSTRACT : With the rapid growth of the World Wide Web and due to increasing amount of textual information such as blogs, discussion forums, review sites available on the web. Now a days the area of emotion detection is considered as an active research field. Textual data has proven to be the main tool of communication in human-machine interaction and the use of social networking sites is one of the approaches for putting views of user. In order to make it as human and real as possible, this communication is constantly improving. In this paper, we propose a novel approach to recognize emotions based on keyword spotting technique along with the concept of ontology. An emotion estimation from the textual documents, data entered by user on blogs like twitter, along with the audio is taken and emotions is extracted from it. Because text, either written or spoken, is the unrivaled way to express one's feelings and emotions, it is the best quality to design for building efficient emotion recognition systems. However, researches on building text-based emotion recognition systems are progressing slowly compared to face or voice based systems. In order to improve the textual methods of communication such as text files, textual documents, tweets, it is needed to analyse the emotion of user by studying the input text and emotions of the user.

Keywords- Audio, Blogs, Emotions, Emotion Recognition, Keyword Spotting Technique, Ontology.

I. INTRODUCTION

Human emotion recognition by analyzing textual documents appear challenging but it is found many times useful and essential as well due to the fact that most of the times textual expressions are not only direct using emotion words but, it also includes words which does not express any emotions in text document.

Human Emotions may be expressed in many ways like person_s speech, face expression and written text known as speech, facial and text based emotion respectively[1] .In case of recognizing emotion from a piece of text document or a blog, any human can do this better than a machine. Only problem is he or she takes time.

Recognizing user's emotions is a major challenge for humans and machine as well. On one hand, people may not be able to recognize or state their own emotions at certain times. On the other hand, machines need to have accurate ground truth for emotion modelling, and also require advanced machine learning algorithms for developing the emotion models. Hard sensing methods and soft sensing methods have been traditionally used to recognize the emotion of a user. With hard sensing methods, sensors provide the data sources that may be relevant to emotion recognition such as audio.

The detection of the emotion of the sentence is the most important step in emotion recognition. This process of extracting the text containing emotion deals with finding the emotion class from the sentence. As proposed previously, in order to find the emotion from nearly all sentences the method of extraction of emotional class is used. This detection of emotion class is divided into two approaches.

First, detection of emotion class using affective word. Second, using context level processing of a sentence. The

emotion class is nothing but those words which distinctly denotes the emotional expressions of the sentence to a Particular emotion. Emotion words are taken as a feature. The features that represent the emotion of a sentence are derived by using the emotion dictionary. First the emotion words for each emotion class such as happy, sad, angry, fear are selected and then synonyms of these keywords are searched to prepare the affective words.

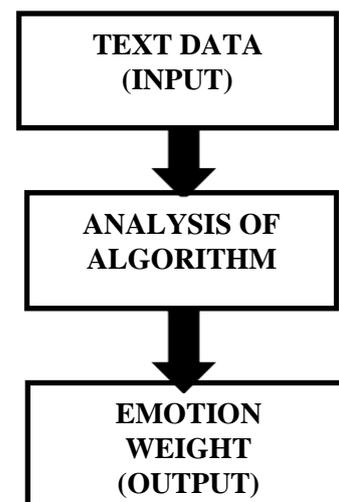


Fig-1 : Basic steps in Emotion Finder

Some of the methods that were used to find out the emotional state of a person are:

Keyword Spotting Technique

The keyword spotting technique can be described as the technique of finding occurrences of the keywords from a given text documents. Many algorithms to analyze a sentiment and emotions have been suggested in the past. In the context of emotion detection, this method is based on certain keywords that are predefined. These emotion words are categorized into keywords such as happy, angry, fear, disgusted, sad and surprise. Occurrences of these keywords can be found using some of the algorithms and based on that the given text document is assigned with an emotion class. -Today was a great day|| is considered as positive, it is likely to assign the same classification For example a sentence like -Today wasn't a great day at all.|| Keyword spotting also depends on the actual affect of words and not for a sentence.

Sometimes, a sentence conveys more by their meaning instead of affect adjective words. For ex the following sentence -My husband just wants to take custody of my children away from me|| states strong emotions, but uses no affect keywords, and therefore is ineffective.

Lexical Affinity Method

Detecting emotions based on related keywords is easy to use and straight forward method. Keyword spotting technique is extended into lexical affinity method which assigns a probabilistic 'affinity' for a particular emotion to arbitrary words apart from picking up emotional keyword.

For example, lexical affinity might assign a 70-percent probability to the word |accident| indicating a negative effect, as in |bike accident| or |hospitalized by accident|. There are two main issues in this method. First, sentences such as -I escaped an accident|| and sentences with other meanings such as -I met you by accident|| creates a problem in lexical affinity, as they work only on the word level. Second, this method is often biased towards a particular type. Due to which it becomes difficult to build and reuse the same model for different systems.

Learning-based Detection

In machine learning methods, the emotion is detected by using classification approaches based on a training dataset. Based on previous history, similar kind of document which was used earlier is searched. Strapparava et al [3] developed a system that used several interpretations of Latent Semantic Analysis used to detect emotions in text when there is no affect word. However, this method has a low accuracy because it is not context sensitive and lacks the semantic

analysis of the sentence. Burget R. et al. [4] proposed a framework that depends heavily on the pre-processing of the input data and assigning it using a classifier. The pre-processing was done at the word and sentence levels, and

was used to calculate the relation between each term and each emotion class.

They achieved an average accuracy of 80% for 1000 Czech news headlines using SVM with 10 fold cross validation. However their method was not tested on English dataset. Also it is not context sensitive as it only considers emotional keywords as features. Dung et al exploited the idea that emotions are related to human mental states which are caused by some emotional events. This means that the human mind starts with initial mental state and moves to another state upon the occurrence of a certain event. They implemented this idea using Hidden Markov Model (HMM) where each sentence consists of multiple sub-ideas and each idea is considered an event that causes a transition to a certain state. By following the sequence of events in the sentence, the system determines the most probable emotion of the text. The system achieved an F-score of 35% when tested on the ISEAR dataset (International Survey on Emotion Antecedents and Reactions), where the best precision achieved was 47%. The low accuracy was mainly due to the fact that the system ignored the semantic and syntactic analysis of the sentence, which made it non-context sensitive.

Hybrid Methods

In hybrid methods, emotions are detected by using a combination keyword spotting method and learning patterns collected from training datasets, in addition to information from different sciences, like human psychology. Extracting emotions from a text that does not contain keywords belonging to any emotion is addressed as the problem by few works.

Wu et al. proposed an approach for emotion mining at sentence level based on detecting predefined semantic labels and attributes of the sentence, then emotions classification based on psychological patterns of human emotions called emotion generation rule (EGR).

II. LIMITATIONS

From above discussion there are few limitations [9]:

i) Ambiguity in Keyword Definitions:

Detecting emotion using keyword-based is a simple and easy way to detect associated emotion, but there could be multiple and vague meanings of a particular keyword, as the meaning of several keywords change according to their different usages. For e.g. -I met with an accident today|| and -I escaped an accident today|| have different emotions as the usage of -accident|| is different in both the sentences.

ii) Incapability of Recognizing Sentences without Keywords:

Keyword-spotting technique always searches for some specific set of keywords. Therefore, sentences which does not contain any keyword shows that they do not belong to any emotion at all, which is obviously wrong e.g. -I cleared

the first round and -Hooray! I cleared the first round shows the same emotion (joy), but the sentiment in former sentence could not be detected without -hooray, if -hooray is the only keyword to find the emotion.

iii) Lack of Linguistic Information:

Keyword-based approaches always search for some specific set of keywords. Therefore, lack of linguistic information does not help in finding any emotion. For e.g. -I passed my exam today and -Hooray! I passed my exam today imply the same emotion (joy), but in former sentence linguistic term like -hooray is missing and hence recognizing emotion of this sentence would be difficult.

III. PROPOSED WORK

The proposed architecture is based on keyword based approach along with the concept of emotion word ontology. Ontology is an explicit specification of conceptualization. Emotion ontology is developed by an open source ontology editor called Protégé. Ontology contains almost all the words that contribute to a specific emotion. It is stored in a tree like structure. Here we use Emotion Word Ontology which consists of both words and emoticons. The emotion word ontology consists as follows:

- **Keywords:** Keywords include intensity modifiers and negations. Intensity modifiers are the words which specifies the intensity of an emotion such as very, too, exclamatory marks etc., Negations are the words which negate an emotion such as not, isn't etc.
- **Emoticons:** Emoticons are pictorial representation of a facial expression using numbers, letters, symbols and punctuation marks usually written to express a person's feelings. Even they are included in the emotion word ontology.
- **Data:** It consists of the dictionary words which expresses the emotion of a person.

Since here we use the negations and intensity modifiers the disadvantages of the previous traditional methods are overcome in this system.

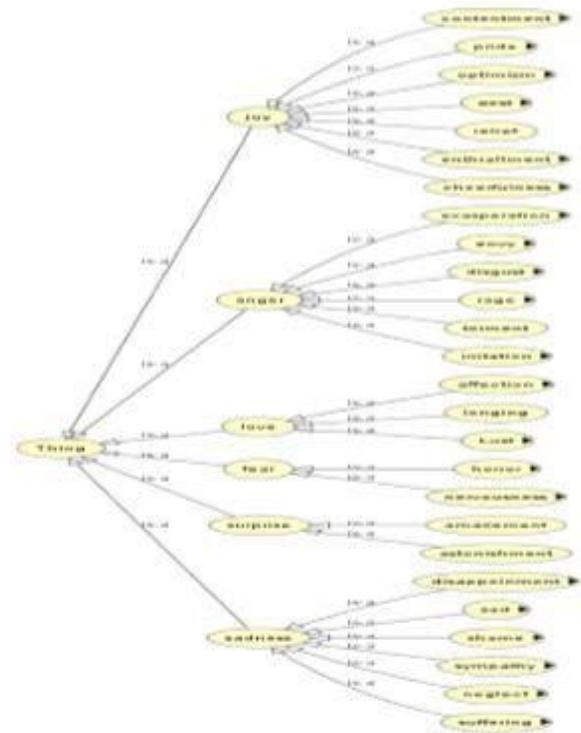


Fig-2 : Emotion Ontology

Algorithm:

- Step 1: Read input text
- Step 2: Split the input text into sentences
- Step 3: For each sentence,
 - 3.1: Search for Punctuations at the end of sentence. If found add it to result.
- Step 4: Split the sentence into words
- Step 5: For each word
 - 5.1: If it is emoticon add it to results
 - 5.2: If it is an emoword.
 - 5.2.1: check the previous word for intensity modifiers and negations. And assign the emotion appropriately.
- Step 6: Output will be emotion class.

Here we take text document as input and split it into sentences and then we check for punctuations such as "!", "?!" which denotes some emotions if found we add those emotions to the result and then we further divide the sentences to words and check for emoword (words that express some emotions) and add those to the result.

The algorithm makes use of three utilities:

- **Heuristic Utility:** It contains methods to find the coefficients of exclamatory mark, question mark, smiles etc.
- **Parsing Utility:** It breaks the paragraph into sentences and sentences into words.

- **Lexical Utility:** It checks whether the word is emotion word or not.

Using the algorithm and the emotion word ontology we process three types of input data:

- **Text:** The text data is directly given as an input. The input for text can be taken from newspaper articles, documents, files etc.
- **Tweets:** The tweets are extracted from the twitter using a twitter handler and the tweets are given as input. We use the Alchemy API which is used to provide the web services by communicating with twitter to retrieve tweets.
- **Audio:** The audio input is converted to text using speech processing tool and then given as input which is then used for recognizing emotions.

IV. CONCLUSION

It has been seen that the Text-based emotion recognition plays an important role for humans to interact with computers while analysing the email for emotions, writing letters, emotion-based search engine that ranks documents according to the emotion requested by the user or giving feedback to any product in the era of new versions of web.

Thus emotion detection from text acts as an important research field in affective computing. In this paper, existing system research of emotion recognition based on textual data is analyzed and drawbacks of existing methods are reviewed.

The emotion class (happy, sad, anger, fear, disgust, surprise) is recognized from the textual document apart from that recognizing the polarity of sentiment (positive/ negative/ neutral) from blogs takes place. Emotion recognition system architecture is proposed to improve detection of emotions in an efficient manner. Proposed system is based on keyword spotting technique that contains rich features of ontology. The advantage of our system is that it does not only detect the emotions from textual documents, but it also takes twitter blogs and audio as input. The audio input is first converted into the text using speech processing tool and then core algorithm is applied to find the emotions.

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