

# Multi-Class Hierarchical Emotion Classification using Twitter Data: A Survey Paper

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**Abstract:** *Community networks have revolutionized the way in which people communicate. Information available from social networks is valuable for analysis of user opinion, looking at the response to policy change or the enjoyment of an ongoing event. Now a day's witnessing an information explosion with aid of many micro-blogging toolkits like the Twitter. This paper presents an overview of recent research on complex sentiment analysis and sentiment dynamics analysis problems. Additionally, we suggest the solution for the model of the twitter data classification associate to their problem. Among the text classification and their emotional orientation discovery is also part of this domain. In this paper sentiment based text classification is introduced. This paper provides the key issues addressed and their promising solution for future design and implementation.*

**Keywords:** *Sentiment Analysis, Tweeter, Social Media, Classification, Multiclass Label, Classifier.*

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## 1. INTRODUCTION

Rapid development of social media, which we have observed in recent years, has drastically transformed the way in which people communicate, obtain information and express their opinion. Social media has become ubiquitous and plays an increasingly important role in today's business, political and social spheres [1]. Social networks have become very popular in recent years because of the increasing proliferation and affordability of internet enabled devices such as personal computers, mobile devices and other more recent hardware innovations such as internet tablets. In general, a social network is defined as a network of interactions or relations, where the nodes consist of actors, and the edges consist of the relations or interactions between these actors []. A generalization of the idea of social networks is that of information networks, in which the nodes could comprise either actors or entities, and the edges, denote the relations between them. Social media sites provide great venues for students to share joy and struggle such as Twitter, Facebook, and Youtube, outlet emotion and stress and seek social support [3]. On various social media sites, students converse and share their everyday encounters in an informal and casual manner.

Social media is a popular network through which user can share their reviews about various topics, news, products etc. People use internet to access or update reviews so it is necessary to express opinion. Sentiment analysis is to classify these reviews based on its opinion as either positive or negative category. In multiclass-multilabel classification, the goal is to assign one or more labels to each instance in an instance space. Each label associates an instance with one of k possible classes. An example of a multiclass-multilabel problem is document categorization, which is the problem of associating each document in a corpus with one or more topics Multiclass-multilabel problems are also common in other fields, such as computer vision and computational biology [4]

Multiclass label sentiment analysis has been first introduced by Liu, B [5]. It is also known as opinion mining and subjectivity analysis is the process to determine the attitude or polarity of opinions or reviews written by humans to rate products or services. Sentiment analysis can be applied on any textual form of opinions such as blogs, reviews and Microblogs. Microblogs are those small text messages such as tweets, a short message that cannot exceed 149 characters. These microblogs are easier than other forms of opinions for sentiment analysis [6]. Multiclass emotion

analysis can be done on a document level or a sentence level. In the first case, the whole document is evaluated to determine the opinion polarity, where, the features describing the product/service should be extracted first. Whereas, the second one, the document is divided into sentences each one is evaluated separately to determine the opinion polarity [5].

Multi-class sentiment analysis aims to utilize this information by using more than two classes of sentiment. Whereas traditional sentiment analysis determines whether a text is positive or negative (polarity), multi-class sentiment analysis uses categories or clusters such as excited, happy, bored and angry to better understand the emotions expressed in the text [7]. In contrast with traditional single-label classification which is to classify an instance into one of labels, multi-label classification is to classify an instance into a set of labels.

## 2. BACKGROUND

This section provides the understanding about the basics of the sentiment analysis of multi-class label classification to deal with the twitter data classification.

### A. Sentiment Analysis

Sentiment analysis is defined [8] as an interdisciplinary area which comprises of natural language processing, text analytics and computational linguistics to identify the sentiment expressed in text. Sentiment analysis can be defined as a process that automates mining of attitudes, opinions, views and emotions from text, speech, tweets and database sources through Natural Language Processing (NLP). Sentiment analysis involves classifying opinions in text into categories like "positive" or "negative" or "neutral". It's also referred as subjectivity analysis, opinion mining, and appraisal extraction. The words opinion, sentiment, view and belief are used interchangeably but there are differences between them.

- ✓ *Opinion*: A conclusion open to dispute (because different experts have different opinions)
- ✓ *View*: subjective opinion
- ✓ *Belief*: deliberate acceptance and intellectual assent
- ✓ *Sentiment*: opinion representing one's feelings

Sentiment Analysis is a term that includes many tasks such as sentiment extraction, sentiment classification, and subjectivity classification, summarization of opinions or opinion spam detection, among others. It aims to analyze people's sentiments, attitudes, opinions emotions, etc. towards elements such as, products, individuals, topics, organizations, and services [9].

Sentiment Analysis has a following phase for processing the user emotion on the basis of their text:

- ❖ **Tokenization**: In tokenization phase the message is segmented for proper analysis. The data that is collected from websites for sentiment analysis contain HTML and XML markup, Twitter markups (names, Hashtags), Capitalization, Numbers should also be handled in these phase.
- ❖ **Feature Extraction**: When the input data is too large to be processed then transforming the input data into the set of feature is called feature extraction. If the features extracted properly than it is expected that will perform the desired task
- ❖ **Classification**: In sentiment analysis we have to identify the class of sentiment

### B. Classification

Classification is a supervised data mining technique that involves assigning a label to a set of unlabeled input objects. Based on the number of classes present, there are two types of classification:

- ❖ Binary classification – classify input objects into one of the *two* classes.
- ❖ Multi-class classification – classify input objects into one of the multipleclasses.

Unlike a better understood problem of binary classification, which requires discerning between the two given classes, the multiclass classification is a more complex and less researched problem [3].

### C. Tweet Classification

On Twitter, tweets are presented to the user in a chronological order. This format of presentation is useful to the user since the latest tweets from the user's followers are rich on recent news which is generally more interesting than tweets about an event that occurred long time back. But the major drawback of this approach is that tweets arrive at a furious rate. Merely, presenting tweets in a chronological order may be too overwhelming to the user. Also, if the user has many friends out of whom, few tweet at a rapid rate compared to other friends, the dominant friend takes a lot of the user's space. Hence, tweets from the lesser dominant friends may be lost in the overwhelming tweet stream. Due to these issues, there is a need to separate the tweets into different categories and then present the categories to the user.

To begin with, we identified seven generic categories (classes) that the users may be interested in. We choose these categories to be as diverse as possible and ideally hope that almost all the tweets can be classified into one of seven chosen categories. Therefore, based on the user intentions on

Twitter [9] such as daily chatter, conversations, sharing information, URLs, and reporting news, we come up with the following seven classes:

- Neutral News
- Personal News
- Opinionated News
- Opinions
- Deals
- Events
- Private Messages

#### D. Multi-Class Classification

Multiclass classification, for some aspects, is very simple. There are some interesting issues in multiclass classification that are the stepping stone to more advanced topics in machine learning, such as structure predictions. Multiclass classification, for some aspects, is very simple. There are some interesting issues in multiclass classification that are the stepping stone to more advanced topics in machine learning, such as structure predictions. Supervised classification algorithms aim at producing a learning model from a labeled training set. A multi-class classifier is able to classify into more than 2 outcomes (classes). It is a synonym with multinomial classification. Thus, multinomial logistic regression is a multi-class classification.

However, multi-label classification it is not. Multi-label classification assumes that one observation can be labeled with (classified as) more than one category/label/class, while multi-class does not (only one class allowed for an instance) [10] [11].

### 3. LITERATURE SURVEY

In this section, we provide the existing efforts and related study that are contributing in the small text data processing and accurate Multi class label sentiment analysis:

Micro blogging today has become a very popular communication tool among Internet users. Millions of users share opinions on different aspects of life every day. Therefore micro blogging web-sites are rich sources of data for opinion mining and sentiment analysis. Because micro blogging has appeared relatively recently, there are a few research works that are devoted to this topic. In this paper, **R C Balabantaray et al. [12]** are focusing on using Twitter, the most popular micro blogging platform, for the task of Emotion analysis. Authors will show how to automatically collect a corpus for Emotion analysis and opinion mining purposes and then perform linguistic analysis of the collected corpus and explain discovered phenomena. Using the corpus,

we will build an Emotion classifier that will be able to determine the emotion class of the person writing.

Public opinion analysis for micro-blog post is a new trend, and wherein emotional tendency analysis on micro-blog topic is a hot spot in the sentiment analysis. According to the characteristics of contents and the various relations of Chinese micro-blog post, **Quanchao Liu et al. [13]** construct the dictionaries of sentiment words, internet slang and emoticons respectively, and then implement the sentiment analysis algorithms based on phrase path and the multiple characteristics for emotional tendency of micro-blog topics. Using micro-blogs' forwarding, commentaries, sharing and so on, Authors take a future step to optimize the algorithm based on the multiple characteristics. According to the experimental results, this approach greatly improves the performance of emotional tendency identification on micro-blog topic.

**Ali Hassan et al. [14]** extends binary support vector machines to multiclass classification for recognizing emotions from speech. Authors apply two standard schemes (one-versus-one and one-versus-rest) and two schemes that form a hierarchy of classifiers each making a distinct binary decision about class membership, on three publicly-available databases. Using the OpenEAR toolkit to extract more than 6000 features per speech sample, we have been able to outperform the state-of-the-art classification methods on all three databases.

Emotion state tracking is an important aspect of human computer and human-robot interaction. It is important to design task specific emotion recognition systems for real-world applications. In this work, **Chi-Chun Lee et al. [15]** propose a hierarchical structure loosely motivated by Appraisal Theory for emotion recognition. The levels in the hierarchical structure are carefully designed to place the easier classification task at the top level and delay the decision between highly ambiguous classes to the end. The proposed structure maps an input utterance into one of the five-emotion classes through subsequent layers of binary classifications. Authors obtain a balanced recall on each of the individual emotion classes using this hierarchical structure. The performance measure of the average unweighted recall percentage on the evaluation data set improves by 3.3% absolute (8.8% relative) over the baseline model.

In this paper, **Shuhua Monica Liu et al. [16]** propose a multi-label classification based approach for sentiment analysis. To the best of our knowledge, this work is the first to propose to use multi-label classification for sentiment classification of microblogs. The proposed prototype has three main components, text segmentation, feature extraction, and multi-label classification. Raw segmented words and sentiment features based on the three different sentiment

dictionaries, Dalian University of Technology Sentiment Dictionary, National Taiwan University Sentiment Dictionary and HowNet Dictionary, are the features and the bag of words is the feature representation. A detailed empirical study of different multi-label classification methods on sentiment classification is conducted to compare their classification performances. Specifically, total 11 state of the art multi-label classification methods are compared on two microblog datasets and 8 evaluation metrics are used. The effects of the three sentiment dictionaries for multi-label classification are empirically studied and compared, which, to the best of our knowledge, have not been performed. The performed empirical comparisons show that Dalian University of Technology Sentiment Dictionary has the best performance among the three different sentiment dictionaries.

#### 4. PROBLEM AND SOLUTION DOMAIN

##### A. Problem Domain

The proposed work is motivated from the research article reported in [17]. In this article the authors suggested the following future extension of the work or the limitations of traditional system [17].

- ✓ First, author employs ICTCLAS package to segment Chinese posts, but because of more oral expressions in blogs, the effect of Chinese word segmentation is not very well.
- ✓ Second, due to the complexity of feature space in the process of classification, need to perfect the algorithm of feature extraction and feature selection.
- ✓ Third, ECA algorithm is designed based on the limited factors, although it has certain rationality, it could be improved in the future.

##### B. Solution Domain

In order to improve the issues in social media text analysis technique the following solutions are need to incorporate.

- ✓ In place of Chinese posts in this work we are considering the English posts for sentiment analysis, therefore to parse the data NLP Stanford API is used.
- ✓ To compute the features of the text NLP parser based part of speech features are computed for individual sentences. This helps to encode the sentences into the part of speech symbols and can be used understand the patterns and composition of the sentences.

Finally the part of speech based features are used with the improved ECA algorithm which is a multiple class classifier which is used to classify the emotions.

#### 5. CONCLUSION

Data mining offers the supervised and unsupervised learning concept to analyses the data and classifies or categorize in a predefined groups of data. The algorithms enable us to use the computer based algorithms to analyze the data automatically without any human efforts. Social networking sites are increasingly encouraged and attracting attention of people for creating social relation and collaboration in society. The large amount of information contained in Twitter web site makes it an attractive source of data for opinion mining and subjectivity classification. Therefore a significant amount of literature is collect for the problem and solution formulation. The main aim of the work model is to find the accurate method for Multi-class classification for twitter data analysis.

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