Emotion Recognition Of Twitter Posts In Real-Time: A Survey

Anjali Deshpande, Ratnamala Paswan

Abstract—Emotions are considered of utmost importance as they have a key responsibility in human interaction. Nowadays, social media plays a pivotal role in the interaction of people all across the world. Such social media posts can be effectively analyzed for emotions. Previous research in this field was based on simple bag-of-words models with lexicons. Latest work on Twitter data was carried out using deep learning by considering only the hashtags of the posts. Our proposed method focuses on the analysis of real-time Twitter posts with the help of data mining and machine learning techniques. The overall aim is to accurately recognize the various emotions that a particular tweet expresses semantically.

Index Terms—Emotion recognition, Machine learning, Social media, Text Mining, Twitter, Unison Model.

1 INTRODUCTION

Emotions can be defined as mental states that are associated with certain chemical changes within the nervous system. Emotions automatically come into play when a person interacts with someone else. Hence, they are considered an important aspect of communication, both online as well as offline. A few years ago, people used to interact with each other via speaking or by writing letters. However, since the previous decade, there has been a major splurge in the use of social media platforms for communication and expression of opinions, feelings or sentiment by the people. Social media can be roughly defined as certain applications or websites that allow users to create and share content expressing their feelings or opinions with each other and also interact with each other. Social media platforms can be thought of as web-based drivers of such social media that enable their development and deployment. Emotion recognition has tremendous applications in the form of psychological disorders detection such as anxiety or depression in individuals or measuring the public mood of a community regarding a particular topic (trending topics, electoral posts, etc.). Also, recognizing emotions is very crucial in human-computer interaction systems and their applications. As most of the people today leverage social media platforms such as Twitter, Facebook, Instagram, etc. on a large scale to express their emotions or views regarding a particular topic, they can be thought of as huge storehouses of emotion data. By systematically analyzing this data, user emotions can be accurately determined. Even though it is fairly easy for humans to determine whether the author of a particular post was happy, sad, surprised, etc., it is quite difficult for a computer to do so due to various factors such as ambiguity of expression of the author, lack of background knowledge, use of sarcasm, etc. Also, due to the huge amount of textual data that is generated on a daily basis, it is required to build automated systems for the analysis of the same.

- Anjali Deshpande is currently pursuing Masters degree program in Computer Engineering at the Department of Computer Engineering, Pune Institute of Computer Technology affiliated to the Savitribai Phule Pune University, Pune, India. E-mail: anjalideshpande2696@gmail.com.
- Ratnamala Paswan is an assistant professor at the Department of Computer Engineering, Pune Institute of Computer Technology affiliated to the Savitribai Phule Pune University, Pune, India. E-mail: rspaswan@pict.edu.

Paul Ekman has defined six basic emotions viz. anger, disgust, fear, joy, sadness and surprise [1]. An extension to it was given by Robert Plutchik with an addition of two supplementary emotions viz. anticipation as well as trust [1] as shown in fig. (1). Thus, a Profile of Mood States (POMS) was proposed. It is a psychological instrument that gives a six-dimensional representation of the emotional states of an individual [1].

![Fig. (1): Wheel of emotions by Robert Plutchik [16]](image)

Previously, some work has been carried out on emotion detection on social media data using opinion mining [2]. However, emotion recognition faces certain challenges in the form of limited length of a post or ambiguous expression of the user. The main focus of previous studies in this area was on using lexicons and machine learning methods for analysis. The performance of these methods depends upon quality of extracted features as well as emotion lexicon used. Our proposed system is a Profile of Mood States (POMS) representing a twelve-dimensional emotional-state view harnessing a total of approximately 65 adjectives combining basic as well as supplementary emotions. Each of these twelve dimensions represents an emotion. We are utilizing Twitter posts for this purpose. Traditional previous studies mostly focused on the detection and classification of single
emotion or a couple of emotions using one-vs-all classification models. Building a multiclass classification model is desirable as we can predict multiple classifications at the same time using a single model. This, in turn, allows for a more in-depth analysis. The motivation behind this work is that we can timely detect the level of stress of a person based on the emotions identified. Also, long-time monitoring of latest real-time emotional data helps in detecting the public mood of a community regarding a particular topic. As previous systems only considered static data, deployment in real-time applications becomes extremely difficult. Hence, the analysis of real-time data is taken into consideration. The proposed model aims to develop a single model for predicting multiple emotion classifications at the same time simultaneously, achieving good results. We take into consideration basic emotions as well as their synonyms for classification purposes. We aim to perform semantic analysis on the Twitter data streamed in real-time.

2 LITERATURE SURVEY

N. Colneric and J. Demsar [1] made use of hashtags of Twitter posts to create three emotion-labelled data sets that correspond to various basic as well as certain supplementary emotions. They made use of CNN and compared its performance with traditional bag-of-words model. A single model for prediction of multiple emotion classification at the same time was proposed. Improved performance using the new hashtag emotion lexicon. The model detected six basic as well as two additional emotions. However, it didn’t take into account the derivatives or synonyms of words for detecting emotions. Also, the work was done only on static twitter data collected and stored into a database. Only the hashtag in the tweet was considered for analysis instead of the entire tweet. S. M. Mohammad and S. Kiritchenko [2] state that hashtags corresponding to emotions are good labels of emotions in tweets that can be obtained without human intervention. They also created a huge corpus of word–emotion associations which was the first of its kind. Mainly worked with six basic emotional categories by creating one-vs-all classifiers for each of these six emotions. SVM with sequential minimal optimization was used for automatic detection of personality from tweets. This led to an overall increase in classification performance. However, it also suffered from a drawback the synonyms of the emotion words were not considered during the analysis process. B. Plank and D. Hovy [3] proposed that certain personality traits correlate with linguistic behaviour of individuals. They made use of social media as a source of data for detection of the various personality traits. Logistic regression was used for analysis and features predictive of personality traits were found out. Thus, a lexicon of approximately 1 million English tweets associated with Myers-Briggs gender-personality type was created. However, the model only detected two personality distinctions viz. Introvert-Extrovert and Thinking-Feeling with high reliability. Other personality traits were seldom detected accurately. X. Liu et al. [4] propose a Multi-Task DNN for representation learning, combining semantic classification and semantic information retrieval tasks. The proposed MT-DNN model maps arbitrary text queries and documents into a low dimensional latent space using semantic vector representations. It outperforms strong baselines across all web search and query classification tasks. Future scope of improvement mentioned the application of this method to various other knowledge sources. O. Irsoy and C. Cardie [5] explored application of deep recurrent neural networks to the task of sentence-level opinion mining. Evaluated deep Recurrent Neural Networks (RNNs) against traditional RNNs having a single hidden layer. The result indicated that RNNs outperformed previous traditional methods. However, it didn’t have access to any other features other than word vectors as pre-training was not carried out for this model. S. M. Mohammad et al. [6] analyse electoral tweets for sentiment, the emotion, the purpose or intent behind the tweet and the style of the tweet. A two-step process was initiated that was appending text for the emotions, the categories, the style as well as the sentiment and classifiers for finding out these categories. For this purpose, they made use of SVM with 10-fold cross-validation. Also developed supervised classifiers for detecting emotional state, the purpose as well as the stimulus behind the users’ tweets. The advantage of this model was that it automatically classified tweets into emotional categories. However, it mostly handled the emotions concerned with only disgust or trust without consideration of past tweets. Also, it didn’t automatically identify other semantic roles of emotions such as the extent of displayed emotion, the reason behind displaying such emotion as well as the subject towards which the emotion has been displayed. J. Schnebly and S. Sengupta [7] studied the hazardous bots infesting Twitter. Proposed a generalized model that can detect existing Twitter bot accounts with 90.25% accuracy with random forest. This model achieved very high accuracy in terms of classification. They also stated that this generalized model could be deployed for accurate use directly after training. The main advantage was that this model worked well with Twitter data. Y. Hegde and S. K. Padma [8] carried out the sentiment analysis of Kannada documents. Used random forest ensemble of classifiers to identify the sentiment. This model handled the multiclass labels as well as detected the sentiment polarity of comparative and conditional statements. Improved the overall performance of sentiment analysis of Kannada documents previously carried out. Also, the overall accuracy was improved from 65% to 72% indicating the efficiency of the proposed model. Future scope was indicative of working with larger datasets as well as NLP techniques. J. Golbeck et al. [9] gave main focus on the personality of the Twitter users. They stated that a person’s personality is relevant for interaction with others especially on social media platforms. Presented a method of predicting a user’s personality through their Twitter profile. Regression using ZeroR Gaussian processes with 10-fold cross-validation were used for analysis. The model predicted a person’s personality based on the scores given to the factors viz. agreeableness, openness, extraversion, conscientiousness and neuroticism as these collectively determine a person’s personality. However, this method analysed users based only on their Twitter data and a small dataset. Sepandar D. Kamvar and Jonathan Harris [10] developed an emotional search engine called as “We Feel Fine” which aims to collect the world’s emotions to help people better understand themselves and others. It crawls the content on the web in a continuous manner and extracts sentences that indicate the word “feel”. It also considers some other parameters such as the gender, age, and location of the people concerned. Used Time-series analysis for this purpose. This gave rise to an immersive interface that allowed exploration of items on the web on a sentiment level. This enabled a qualitative data analysis. However, this process mostly focused on emotion visualization rather than detection. Johan Bollen, Huina Miao and Xiaojun Zeng [11] developed a model that predicted the stock market conditions using the tweets posted.
on Twitter. They stated that public mood is related to the economic decisions taken by the people at large. They used two tools to analyse the tweets viz. “OpinionFinder” and “Google-Profile of Mood States”. The former analysed the tweet as positive or negative whereas the latter measured six-dimensional emotion (Vital, alert, happy, kind, calm, sure). They further analysed the correlation of public mood measured by the previously mentioned tools and the closing value of Dow Jones Industrial Average. Obtained an overall accuracy of 86.7% in predicting the stock market fluctuations. Flor Miriam Plaza-del-Arco, M. Teresa Martín-Valdivia, L. Alfonso Ureña-López and Ruslan Mitkov [12] performed emotion recognition of Spanish tweets. They built a Spanish emotion lexicon from the “Affect in Tweets” dataset. They also incorporated certain lexical features for building the Naïve Bayes classification model. The Spanish lexical corpus improved the classification performance by 6.15%.

3 PROPOSED APPROACH
Profile of Mood States or POMS is a psychological instrument for analyzing a person’s emotional state. In its basic form, the six basic emotions viz. anger, depression, fear, joy, sadness and surprise. It defines 65 adjectives that are rated on a five-point scale by the particular person in consideration. Each of these adjectives individually contribute to one of the six emotional categories in the case of basic emotions. All of these ratings are combined to form a six-dimensional emotion-state representation. This method can be further extended to more dimensions for achieving a more accurate analysis.

3.1 Proposed System Architecture
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The proposed approach in Fig. (2) shows a generalized outline of the various steps that need to be carried out for building a multiclass classifier for emotion recognition. Firstly, the raw data from the social media site (i.e. Twitter) is obtained in real-time via the Twitter API. Then, certain pre-processing is done to convert the obtained data into suitable format. Following it are the feature selection and extraction steps whereby the discriminating features for emotion recognition are identified. A classification model is built using some emotion-labelled twitter training data owing to which the incoming new tweets are classified based on the emotion they depict. An emotion lexicon as well as certain NLP techniques will also be incorporated for a more in-depth analysis. After successful implementation of the formerly mentioned steps in fig. (2), the classification model can henceforth classify any new incoming tweets with respect to the emotions expressed semantically.

4 CONCLUSION
Emotions have a vital role in communicating the feelings of one person to another. As people nowadays use social media on a large scale to express their opinions, views and emotions on a particular topic, it can be considered as a rich source of emotion expression. Hence, such data can be qualitatively mined for emotion recognition. Another important aspect is that emotion recognition has various applications in detecting psychological disorders such as anxiety or depression in individuals, quantitatively detecting the public mood of a community and also predicting the stock market fluctuations, sales of various online and offline products, reception of a certain movie, etc. Taking into account all these factors, our paper proposes a model for emotion recognition on real-time streaming Twitter data that utilizes machine learning algorithm and an n-dimensional mood state representation combining Ekman’s and Plutchik’s emotions categories. It classifies the emotions with the help of multiclass classification and semantic analysis. The overall aim is to recognize and classify the emotions taken in to consideration as accurately as possible.

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