Emotion Recognition and Brain Mapping for Sentiment Analysis: A Review

Khodijah Hulliyah[#1], Normi Sham Awang Abu Bakar[#2], Amelia Ritahani Ismail[#2]

[#1] *Syarif Hidayatullah State Islamic University (UIN) Indonesia*
[1]khodijah.hulliyah@uinjkt.ac.id
[#2] *International Islamic University Malaysia (IIUM) Malaysia*
[2]nsham@iium.edu.my
[3]amelia@iium.edu.my

***Abstract*-- The rapid growth of the Internet has caused the increase in the amount of textual information available, such as in blogs, discussion forums and review sites on the web, where the texts surely have the emotion content. Emotion is one appearence of people behaviour and it is an important performance in human computer interaction (HCI). Human express the emotion in the form of facial expression, speech and writing text. Recently, researchers in computational linguistic (CL) areas are interested in the attention of emotion for Sentiment Analysis (SA). SA naturally observes the emotion conveyed by a text, and at the same time, distinguishing positive and negative valence.**

The wide areas of CL research, actually considerable for investigating the emotion dimension detection and searching the approaches and techniques in the term of emotion recognition (ER). There are two significant trends of research in the area, the emotion recognition based on state affective computing and the real time using brain signal machines. The two areas have the same aim for getting the improvement result in sentiment analysis with the mapping of emotion recognition provided. The exclusive work on emotion detection is comparatively rare and lacks empirical evaluation research. This paper provides the overview of past and recent research on emotion detection as well as some approaches and techniques used and shows the linked between both SA and ER.

Keywords: Emotion recognition, brain mapping, sentiment analysis, affective computing

I. INTRODUCTION

In the millennium era, information plays a pivotal role in human daily life. Language is one of the ways to transfer information as well as communicating views or messages that could be oral or written text. Written text is one good source for expressing ideas, emotions and feelings [1]. Furthermore, human emotion is a complex phenomenon which comes from the human brain while there is no explicit knowledge of its generation mechanism. Even though human feelings can be easily expressed in the form of writing, the researchers have been challanged to extract the emotion recognition from text. Sometimes the authors expresses emotion in writing is not the same as what they thinks. Therefore, many papers are always evolving in continuous research to get the results of emotional detection to be more accurate. As reported by Chopade article [2], the following are some of the most common application areas of the technique from emotional detection: 1) Sentiment Analysis, mainly focuses on information retrieval and knowledge discovery from text; 2) Computer Assisted Creativity; 3) Text to Speech generation; and 4) Improvement of HCI.

From past to recent, some emotion mapping for sentiment analysis research interacting with each other such as, the various approaches to emotion detection, developing emotion corpus, affective computing and sentiment analysis, brain signal machines to classify positive and negative emotion, and several methods for text based emotion recognition.

In this survey, we aim to review how different methods have been used to build emotion dimension dataset, to obtain the optimalyze of affective computing systems and perform reviews analysis. The rest of the paper is organized as follows: Section II is to discuss about past work done on the method and techniques of emotion detection for sentiment analysis and brain mapping. Section III elaborates the links between some research about that, and also the discussion of research gaps and future work. Finally Section IV concludes the review.

II. PAST RESEARCH WORK

Currently, the affective computing is a popular topic. Some computer science applications, indeed, need the emotion recognition. In fact, human computer interaction requires the features available to automatically detect emotion of users.[3]. Today, we get a lot of articles that show how to classify which emotion models, methods and approaches are best available to use.

1. Emotion Recognition from Text

Understanding human emotion is a very critical study. It is very challenging especially for researchers in the field of psychology.. [4], Ekman distinguished that there are two ways for determining the emotional model; (a) to describe elements that combine to form larger and more complex emotions and (b) to denote emotions that are presumed to have a biological basis. Therefore, we noted that there are some later articles doing research investigating and collecting emotional words as the emotional corpus.[5][6][7][8][9]

Later, the need for emotional word resources is being concerned by computational linguistic researchers as well, especially emotion detection from text topic. This study tackles the problem of emotion recognition from text focusing on the implicit emotional statements,[10] due to the flooding of information from internet.[11]. Furthermore, detecting and classifying emotions in the text requires reasonable efforts from researchers for human-computer interaction [2], they must examine and find methods, approaches and techniques that are capable of doing so.

A lot of work have been done on emotion model[4][12], emotion recognition and emotion classification methods. There are four text based emotion recognition methods as reported by Naresh [13][14][10]. They are: 1) Keyword spotting techniques, this method has several common the process of keyword marking from the original text to get categories of emotion detection; 2) Lexical affinity method, this way investigate emotion detection based on related keywords; 3) Learning based method, here are being used to map the problem different whereas it adopt the various theory of machine learning, such as SVM and Hidden Markov Model (HMM); and hybrid method, this is combining both keyword spotting and learning based method.

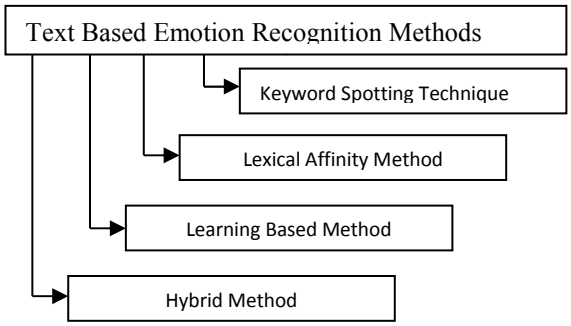

Figure 1. Several Methods of Emotion Recognition Based on Text [13]

Moreover, there are several research on the comparison of models and methods as well as integrated some of the key emotion theories in the various discipline tasks.[15]. In addition, they also discovered some limitation in these methods that are done by manual analysis approach, such as; Subjecticity terms [16]; ambiguity in keyword definitions; incapability of recognizing sentences without keywords; lack of linguistic information; and difficulties in detemining emotion

2. Affective Computing and Sentiment Analysis

The enermous amount flowing of information flow presented in the World Wide Web affects people's view in making decision process [17]. Likewise with the existence of social media, humans are free to write something with the emotions they are feeling.

Sentiment (SA) is the computational treatment of opinions, sentiments and subjectivity of text. Therefore, SA became a fascinating topic as well as a challenge for researchers [18]. Their paper issued an overview on the recent updates in SA algorithms and applications. Fifty-four of the recently published and cited articles were categorized and summarized.

The major reason work on SA is the huge volume of emotion data available on the web, so needed the automated method to extract the infomation and technique to classify the emotion or sentiment. [19]

According to Medhat et.al articles, we could look at the sentiment classification techniques in Fig.1

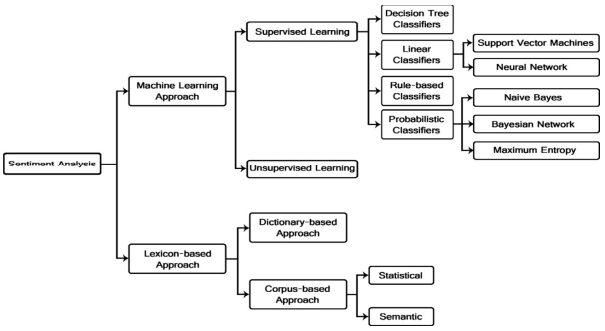

Figure 2. Sentiment Classification Techniques[18]

In brief, we built the summary of the architecture of SA based on Textual Processing from the author papers below this:

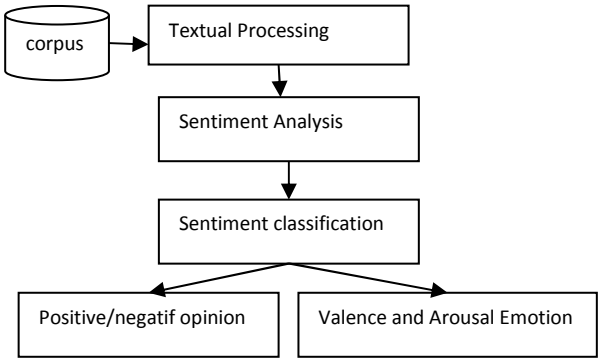

Figure 3. The Architecture of Sentiment Analysis

There are two kinds of SA approach: 1) Machine Learning Approach, to get the weight features of each words. Previously it should did pre processing first, and then sentiment analysis accuracies using Support Vector Machine (SVM)[20][19]; 2) Lexicon Based Approach, The Semantic Orienta- tion CALculator (SO-CAL) is one of applied to the polarity classification task which uses the lexicon based [21], the process of assigning a positive or negative label to

a text that captures the text's opinion towards its primary subjectmatter. The other ways of this approach is used corpus based.[22][23][18]

Cambria [24] proposes that the main task of affective computing (AC) and SA are emotion recognition and polarity detection. This research shows three main categories of approaches to AC and SA: 1) knowledge based techniques, as we know this way have the popular sources, such as SentiWordNet, WordNet Affect and do more research of developing corpus.[25][8]. 2) Statistical Model, usually uses SVM and deep learning techniques, eventhough this way also have the weakness, such as do not work well on smaller text[24]. 3) Hybrid Approach.

To date, Next-generation sentiment-mining systems need broader and deeper standard and knowledge bases, together with more brain inspired and psychologically motivated reasoning methods, to better understand natural language opinions and, hence, more efficiently bridge the gap between (unstructured) multimodal information and (structured) machine-processable data.

3. Brain Mapping and EEG

Researchers had few details of relationship between different emotional states and various EEG features[26]. This paper also systematically compares three kinds of existing EEG features for emotion classification.

Several authors propose three main approaches in the real-time of emotion classification in the past few decades [26] [27][28]. They are: 1) the analysis of facial expressions or speech; 2) the second approaches focuses on periphery physiological signals; and 3) this approaches focuses on brain signals captured from central nervous system such as electroencephalograph (EEG).

Many papers depict that brain signal is needed for analyzing and classifying the emotional humans changed to obtain the polarity detection, due to there is always the problem with redudancy data and increasing computational time [29].

On the other hand, to direct the EEG approach, is still have the limatations as well. The restrictions are; EEG is not static, EEG signals changes drastically, and there is always the problem of correlated data with EEG signals[29][30][31][15] According to Murphy et.al paper [32], to address the problem above, they used Common Spatial Pattern (CSP). The accuracy of classification can be improved by incorporating different feature extraction and selection technique. In this state, we could look at that there is the close link between emotion detection and EEG or other physiological signals.

III. DISCUSSION

1. Review Current Works

Many techniques, methods and approaches come up with to enhance certainty of emotion recognition and emotion classification using the kinds of method for sentiment analysis. Besides the statistical computational methods such as, take advantage of corpus resources, lexicon based and machine learning, this research investigates brain signal methods for finding the efficiency of emotion recognition mapping. The future work presents us an idea about comparing the rate of emotion classification between both approaches state emotion computational algorithm and the real time analysis using brain signal tools. This concept is as a bridge to overcome the limitations each other. Emotion dimensional state is needed by sentiment analysis, on the other side, brain mapping is required to be more convincing in the state of emotion recognition. Moreover, the area of SA research, sentiment classification improvement has been developing by doing with EEG signal and by improving emotion corpus.

Throughout the investigation in reviewing the results of many papers, we found several things that can be discussed. For instance, What is the most appropriate method of obtaining emotional detection?, What techniques can be used in evaluating the accuracy in polarity detection?, How close the relationship between emotion recognition and brain signal mapping for sentiment analysis?.

Moreover, as reported by Priyani, et.al [19], it is very beneficial for knowing the development of SA untul now. Their papers describe around 600 articles, CL and Affective computing is the third highest-ranked topic of interest among researchers. Other than that classification sentiment is in the third most-researched sequence based on subject category. It suggests that research in the field of computational linguistics, especially the detection of emotions, is beneficial in some areas and is still an interesting topic that will continue until now.

2. Future Work

According to review above, we have several hypotheses, such as: a) The measurement of emotion word scores using speech, written or reading text techniques still raise disambiguities or inaccuracies; b) The knowledge-based method of spotting keywords is the most crucial resource for most sentiment analysis algorithms; c) Emotion detection can be represented through neuro-physiological signals; and d) Brain signals provide better results from text resources in detecting emotions. We will compare the database of an emotion set of words with valence and arousal rating between using Self Assessing Manikin (SAM) method and brain signal tool to get the emotion classification based on texts.

The following is the conceptual framework (fig.4)

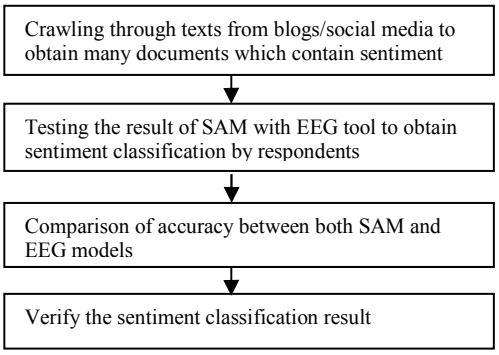

Figure 4. The conceptual Framework

The potential contribution of this work can be classified as including; 1) The production of the Sentiment_Neuro Physiological (SNP) Model data collection as a contribution to determining real-time emotional changes in people when they read the text sentiment and 2) A correlation between SNP and Self-Assessment Manikin (SAM) for Sentiment Analysis.

IV. CONCLUSION

Emotion detection has a promising future. Major approaches towards Emotion Extraction from text have been discussed in this paper. Futhermore, brain mapping based on the polarity of the valence (V) and arousal (A) model into consideration that will be used in this research to analyze the sentiment classification of text. Due to there is still limitation of brain signal tool as EEG is non stationary in nature and EEG signals changes drastically, then they need resource that could cope that problems. According several articles, resources of emotion dataset, recently, are dominated in English word, therefore, researching built support in other languages are still desperately needed. It is necessary while brain mapping works based on the emotional corpus.

This paper, a survey has been done of previous work related to emotion recognition and EEG signal tool for sentiment analysis reviews, so that new research area can be explored by looking into the advateges and disadvanteges of the current techniques and strategies.

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