

Towards using Multimodal Features of Social Networks for Improved Contextual Emotion Detection

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Abstract: Social networks are valuable source of information that could be used in classifying users' emotions. In this paper, we explore the importance of certain multimodal features of social networks, other than text, that can be used in enhancing emotion detection. We study the types of posts, the degree of interaction with contacts, and the influence of contact opinions and how they tend to affect the emotions of social network users. We conducted an online survey targeting Facebook users to know how they are affected by such features. The results of our study show that status messages are the most used feature to express the social network users' emotions, and the emotions of social network user are affected by posts and updates from friends, especially close friends. The number of likes expressed to social network users was found to positively affect their emotions. We will use such findings to prototype a system for enhanced emotion detection.

1 INTRODUCTION

Social networks have become an extremely valuable goldmine of context information that can be used very effectively in pervasive systems. One of the numerous pieces of high-level context information that can be elicited from social networks is human emotions. Unfortunately, much of the relevant scientific literature dealt with emotion detection from social networks as a typical text mining problem (Yassine and Hajj, 2010). However, the multimodal features of social networks including but not limited to the types of posts, the degree of interaction with specific contacts, the applications used, the influence of contact opinions and likes, are types of channels through which enhanced emotion detection may be achieved.

Emotion and mood are terminologies that identify the current status of person's cognition. An Emotion is defined in psychology as a short-term state of mind, which includes psychological arousal. It cannot be a physical state like pain or a behavioural state like aggression. For example, love, happiness, anger, and fear are considered kinds of emotions. Mood is also considered as a state of mind that includes a psychological arousal however it defers from emotion in its duration as it tends to last longer (Walter et al., 2006). With the widespread of

social network in our daily lives, their effect on our emotions and mood is yet to be investigated thoroughly. We will focus on the effect of social network on their users' emotions in our research.

Emotions can be manifested in social networks in situations, such as when a user is pleased for having a nice outdoor activity, feeling down by going through a bad day, even expressing feelings about the world economy. Users contribute to their social network through status updates, video posts, likes, and comments on certain topics. Group subscriptions can also carry much information through which user's emotion could be inferred. There are many social networks on the Internet. Facebook with close to one billion users and an average of 130 friends per users (Facebook, 2012), Twitter, Myspace, Google Plus, LinkedIn, and Flickr are examples of social networks.

In this paper, we realize the importance of emotion inference as one of the important contextual pieces of information in mobile pervasive systems. To this effect, we study the Facebook social network in specific and try to identify the contribution of various multimodal features, other than text, within the social network of a user and how those can hint about the emotion of its users. A very insightful review article about the future challenges and opportunities in the domain of pervasive computing by Conti, et al. (2012) indicates the need to

“understand and manage the dynamics of human behavior in order to make pervasive computing systems more usable and tractable.” We will present related work followed by the details of our study, our future work and conclusion in the next sections.

2 RELATED WORK

We will analyse some of the relevant related work that pertains to the study of emotion detection in social systems in this section. Kramer (2012) analysed the status updates of 400 million Facebook users in North America over time. The author showed that status updates provide cues to the emotional state of the user and can provide insights to the state of the groups updating status. He counted the relative rates of positive and negative emotion words used to identify culturally shared positive and negative events. He validated that the use of positive and negative words in status updates covaries with self-reported satisfaction with life.

In another study, Kramer (2012) aimed to research emotion contagion in social networks. Emotional contagion is the process by which people “catch” emotions from each other. He showed that when a user exhibits a certain emotion in his or her status, his or her friends are more likely to make similar emotion-oriented posts.

A study was conducted by Hancock et al. (2008) to investigate emotional communication in computer-mediated communication. The study examined negative emotion expression and contagion. The authors concluded that negative emotion was expressed and sensed by the communicating parties and that emotional contagion takes place in computer-mediated communication. All these studies show that social networks are environments where users tend to express their emotions. However, most of them considered social networks as a source of textual information only. They did not take into consideration the multimodal feature of social networks, such as likes, the degree of interaction between users such as relationships between users, events, gifts, and the preferences stored in the social networks users’ profiles.

3 STUDY OF EMOTIONAL EXPRESSION IN SOCIAL NETWORKS

To further study how the emotions of the users of

social networks are affected by the use of social networks, we decided to survey users in the quest for such kind of knowledge. The aim of this survey is to study the patterns in which the emotion of social networks users is affected by their daily interactions. The objective is to identify the most prominent used features in the social network and how that can affect emotions of the user so that we eventually can incorporate such features in emotional detection using social networks. The following are the characteristics of our survey:

- Paradigm: Quantitative
- Purpose: Analytical Research
- Outcome: Applied
- Logic: Deductive Research
- Process: Quantitative
- Methodology: Cross-Sectional Surveys

In this section, we will demonstrate our research hypotheses in details. Let the hypotheses be denoted by the letter H. The null hypothesis is that multimodal features of social networks have no effect on emotions. H1: Users of social networks express their emotions through different features of social networks. H2: Status messages are used more than any other feature to express emotions. H3: When the number of likes toward one of the social networks users increases, this positively affects the user’s emotions. H4: Emotions of users of social networks are affected according to the relationship between them and the person who made the post. (e.g. if a family member made a comment or a post this will affect him or her emotionally more than other posts.) H5: Receiving virtual gifts positively affects the emotions of the social networks users. H6: Accepting a social network event, such as birthday, wedding ...etc. will have an impact on the emotions of the users of social networks.

3.1 Sample

A total of 220 users of social networks contributed to this online survey. The sample consisted of international adults of different backgrounds and nationalities. The participants were from both genders with age range of (18-35). We chose Facebook as our social network as it is the most popular of the available social networks with the largest number of users, having close to one billion users (Facebook, 2012). The questionnaire was published on the Internet through an online survey using the surveymonkey website and posted to the researcher’s Facebook profile page; that contains more than 410 of friends and different Facebook pages and groups; to ensure high response rate. The

total survey duration was 10 days. We used close ended questions as the main source for this survey to investigate the effect of the social network on its users.

The survey questionnaire mapping matrix is illustrated in Table 1 which shows the purpose of question group, the number of questions related to each group, a short description of the purpose of that group, and the relationship between the question and our hypotheses.

Table 1: Survey Questionnaire Mapping Matrix.

Purpose of the question	Description	Question number	Hypothesis
Exclusion question	Excludes respondents with limited usage of their Facebook accounts	1	H1
Tendency to express emotions through Facebook features	Illustrate if the users tend to express their emotions through various features of Facebook and being affected by posts made by friends	2,3	H1
Effect of likes	Explains how the increase of the number of likes to a user's post may affect his or her emotions	4	H3
Most used features and emotion expression	Capture the most frequently used features by Facebook users and their tendency to express emotions through them	5-8	H2,H5,H6
Posts that affect the users emotions	Investigate, which posts affects the users' emotions the most, e.g. posts from close friends, family members, work colleagues ...etc.	9,10	H4

The following section will reveal the results and details of our survey. We will illustrate the patterns of social network users' behaviour.

3.2 Study Results

When asked about their daily usage of Facebook,

90% of the surveyed sample answered that they use it on a daily basis. The graph in Figure 1 shows that 7% of the sample used Facebook at least once weekly, 2% of the sample used Facebook at least once monthly and only 1% does not use it. This reflects how extensively people are keen on using social networks and how integrated it is in their daily lives.

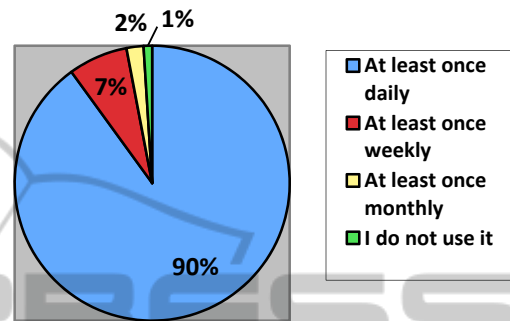


Figure 1: H1: How often do online users use Facebook?

Users on Facebook post their status updates and receive comments and likes about the posts. "Like" is an action in Facebook where users can click Like button that indicates their liking to the posts, the number of likes to the posts are aggregated and shown. Users also post photos, links, videos, and commentary conversations, and likes are received for those multimodal features as well. During these interactions within the social networks, users tend to be emotionally affected by posts, comments, and likes made by friends and other users of social networks. The graph in Figure 2 shows the high tendency of users to express their emotions through Facebook, and it also shows that friends' posts can affect the emotions of the social networks users. Users of social networks read many updates from their friends, which carry emotional implications and these updates affect their emotions.

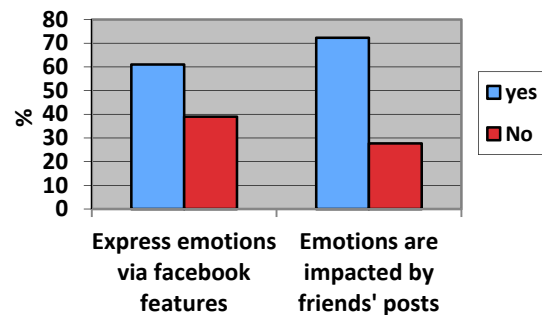


Figure 2: H1: Expressing emotions through Facebook.

The survey reflected that status updates, comments, and likes are the most used features by the social networks sample. After which users tend to use private messaging, photos, events, and notes prospectively. Users of social networks use status updates, comments, and by liking their friends posts the most to express their emotions. Figure 3 shows a graphical representation of the number of responses that we received. In this survey question, users were allowed to select multiple answers, so that is why the percentages do not add to one hundred.

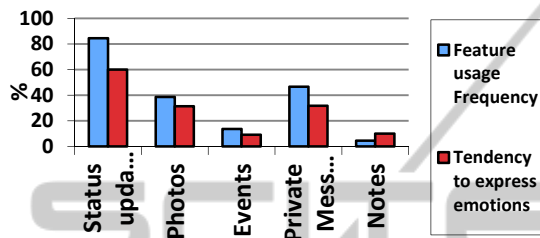


Figure 3: H2: Facebook features usage frequency Vs tendency to express emotions through them.

We investigated the effect of increase in the number of likes received for one of the user's posts on the emotions of the social network users. As shown in Figure 4, 81% of the sample showed that the increase of the number of likes on their posts affects their emotions positively. Only 19% reported that the increase in the number of likes on their posts does not affect their emotions.

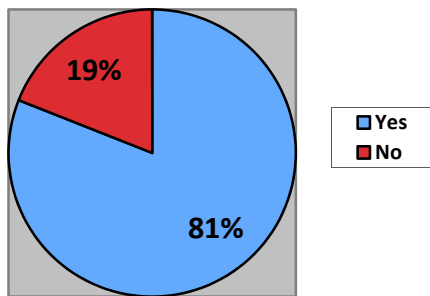


Figure 4: H3: The effect of an increase in the number of "likes" upon the emotions of social network user.

Facebook recognizes the relationships between friends within the same social network. For example, a friend can be a close friend, a family member or general friend. We aimed at identifying the category that has the most effect on the users of social networks emotionally. Users could select more than one answer for this question. Figure 5 shows that majority of responses out of our sample tend to be affected more by posts, comments, and likes from

close friends.

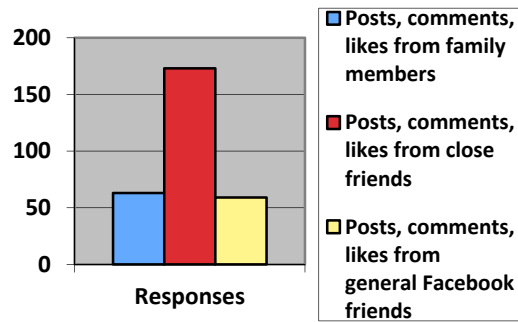


Figure 5: H4: How emotions are affected by different types of social contacts.

The following figure shows how receiving a Facebook gift from a friend within a social network can affect the emotions of the user. 41% of the sample expressed that their emotions will be affected positively if they receive a Facebook gift. 59% of the sample users showed that receiving a gift does not affect their emotions. It also shows that 47% of the sample's emotions are affected positively if they are invited to an event, such as birthdays or weddings and 53% of the sample will not be affected by such invitations. In the next section, we will explain how we will use the study results to automatically guess the social network users' emotions.

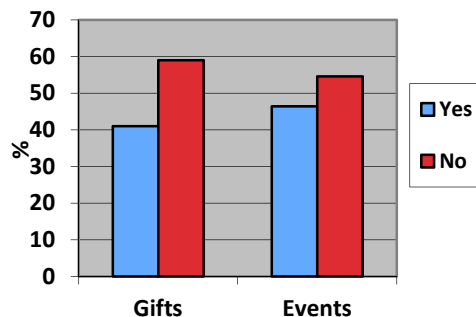


Figure 6: H5 and H6: The impact of receiving a gift or being invited to an event on emotions.

4 FUTURE WORK

We will explore the utilization of our study findings to achieve more accurate emotion classification. We will assign weights to status messages of the social network users user based on the comments, degree of connection between them and their friends and the number of likes for each post. We will run set of experiments with various weights and compare their

results to the real emotions of the users to see which weight variation is closer to their real emotions. Based on the results of these experiments we will select our weighting criteria. These weighting criteria will be used to enhance the accuracy of eliciting the emotion of the social networks users.

5 CONCLUSIONS

In our study, we investigated the way Facebook users utilize Facebook multimodal features, such as comments, likes, and relationships between contacts to express emotions. The results of our survey indicate that not only do users express emotions on Facebook, but their emotions are also affected by the type of interaction happening. Social network users tend to express their emotions through status updates and comments more than other features. They are affected by written exchange between users in the form of status updates, comments, and also the likes of their friends on their activities. The number of likes to their posts tends to affect their emotions positively. In specific, social network users are affected more by emotions exhibited in their close friends' posts. These results match our hypotheses H1 through H4. However, the results invalidated hypotheses H5 and H6 as social networks users were not impacted by the gifts that they receive from their friends nor the events that they were invited to. From these results, we have a better understanding on how social network features and the information they encompass can be used to automatically elicit the emotions of their user.

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