Music Recommendation System Based on User's Sentiment

Radhika N[1]

[1]PG Scholar, NSS College of Engineering, Palakkad, Kerala, India

Abstract: ***Social media is a place where users present themselves and share all type of information, ideas, and experiences with world. In recent years sentiment analysis has been explored by several internet services to recommend contents accordance with human emotions, which expressed through social network. Many user's on social network write sentence in variety of languages. This paper presents language independent sentiment analysis in music recommendation system. This system suggests music to user depending upon the current emotional state of that person. Where the current emotional state of a person is calculated by measuring adjusted sentiment intensity value, which is an association of sentiment intensity value with a correction factor. This correction factor is based on user profile information and used to adjust final sentiment intensity value. Traditional classifiers are language specific and require much work to be applied to different languages. Proposed system uses a supervised sentiment classification approach for language independent sentiment intensity calculation. We train Naive bays classifier on our data and evaluate it on over 1000 posts in 3 languages, English, Malayalam, and Hindi. The supervised sentiment classifier with a correction factor can improve the performance of a proposed language independent music recommendation system.***

Keywords: Social Network, Sentiment Analysis, Correction Factor, Recommendation

1. Introduction

The internet has changed our lives. Nowadays it is common for people to express their sentiment and opinion through social networks and microblogs. Social media allows us to have the world in our hands. Twitter is one of the biggest microblogging services on the internet [8]. Microblogs are the short text messages that people use to share all kinds of information with world. On Twitter these microblogs are called "Tweets" and over 400 million of them are posted every day. In this context studies about sentiment intensity have started to emerge.

Sentiment analysis is a technique of natural language processing and text analysis, which can be applied to many recommendation systems. Knowledge of sentiment intensity of a sentence can helps to know more about a person who express herself or himself about an event, product or content However its use in recommendation system remains a challenge, because people express their feelings in different ways, which makes it is difficult to create reliable recommendations based on sentiment analysis[2].

Here sentiment analysis is starting to be explored in music recommendation system to suggest a specific song depending on the current emotional state of person, since the song is totally related to the current emotion and feelings of the person. The current emotional state of the person is calculated by collecting user's post on social network.
People use social network at certain times of a day and knowing their behaviours and habits may be useful for several applications [8], [9]. Therefore it is important to record all these data in logs. By implementation of logs, it is possible to develop a recommendation system for a customised period of time. For example a person usually reads financial news from 8a.m to 9a.m on Monday and Thursday and tends to read entertainment news on Sunday.

There has been a large amount of research to find ways to automatically extract sentiment from text data. Most researches are conducted only on tweets of one language. However Twitter is an internationally popular social network service and large part of the tweets are in variety of languages. Therefore analysing tweets in only one language covers only a part of available content.

A classification approach is not restricted to analysing only one language and would able to collect much more sentiment information from tweets in multiple languages. In this paper, we examine language independent sentiment classification approach. We train a classifier to label the sentiment polarity of tweets, for this stage requires raw tweets of that language for training classifier.

We train classifier on tweets of 3 different languages: English, Malayalam, and Hindi. For the purpose we collect thousands of human- annotated tweets in these 3 languages and assume that any one tweet only contains one sentiment at a time. To personalise this recommendation system a correct factor is used, this correction factor completely depend on user's profile information.

This paper extent contribution to the work [1], which proposes a personal language independent music recommendation system using corpus based sentiment analysis with a correction factor based on user's profile information.

2. Related Works

2.1 Sentiment Analysis

There has been a large amount of research to find ways to automatically extract sentiment from text. Sentiment analysis can be performed by using three approaches as shown in Fig 1, the lexicon based approach using word dictionary, the corpus based approach using machine learning and a hybrid

based method, which combines both approaches.

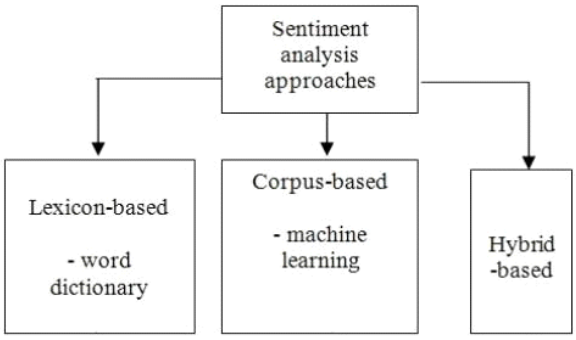

Figure 1: Different approaches for performing sentiment analysis

Lexicon based sentiment analysis technique [1] is governed by the use of a dictionary consisting pre-tagged lexicons. The input text is converted to tokens by the Tokenizer. Every new token encountered is then matched for lexicon in the dictionary. If there is a positive match, the total scores of the text incremented. Otherwise the score is decremented or the word is tagged as negative. For example Sentiment (F) represent the total sentiment score of sentence F, is calculated by using the below equation.

Sentiment Score(F) = ∑ Dictionary.Value(W)

Where dictionary.value is the sentiment value defined in the dictionary of each word Wi in the sentence F. But this classifier is language specific and requires much work to be applied to a different language. Lexicon based sentiment analysis has other limitations: Its performance in terms of time complexity and accuracy degrades drastically with the growth of the size of word dictionary that is, the number of words.

Machine learning based sentiment analysis [7] is one of the most prominent techniques due to its adaptability and accuracy. This corpus based sentiment analysis is a supervised learning method. It comprises of five stages: Data collection, Pre-processing, Training data, Classification, Plotting results. In data collection stage the required data to be analysed is crawled from various sources like Blogs, social networks (Twitter, MySpace, etc...) depending upon the area of application [11]. Then on second pre-processing stage the collected data is cleaned and made ready for feeding it into the classifier. Training data is the hand-tagged collection of data is prepared by most commonly used crowd-sourcing method. This data is the fuel for the classifier for learning purpose. Classification stage is the most important stage in this technique. Depending upon the requirement of application SVM or Naïve bayes is deployed for analysis. At the last stage the result are plotted based on the type of representation selected. The main advantage of this technique is language independent and it's less time complexity.

Naive bayes classifier [10] is a simple probabilistic classifier based on applying bayes theorem with strong independence assumptions between features. Given a class variable and a dependent feature vector through, Bayes theorem state the following relationship:

P(A/B) = P(B/A) * P(A) / P(B)

2.2 Recommendation System

There are three recommendation system models [2], content-based recommendation system, collaborative recommendation system, and hybrid based recommendation model. The content based approach [7] works with the association between the description of an item and the user's profile, which the suggest items based on the user's preferences. Content based system examine properties of items recommended, where similarity of items determined by measuring similarity of their properties.

The collaborative based approach [6] analyses the user behaviour and preferences and explores similar preferences between people. Collaborative filtering system worked by collecting user feedback in the form of rating for item in a given domain. Then exploiting similarity in rating behaviour of several users for determines how to recommend an item. The hybrid approach combines both methods.

A recommendation system is allocated on a server containing a database with user's preferences or history. The advantages of using the server allocation are that they do not overload the memory of the user's device with data, since the client-side application is of low complexity. There is a data transmission flow between the client and server, but the current data network is not as restricted as it used to be.

In the recommendation systems, the sentiment analysis began to be explored to suggest more updated contents and based on the person's mood and feelings.

Recommendation systems in specific areas such as in multimedia need to suggest contents based on the person's current mood, emotion and feeling because the person chooses a particular film or song depending on their current mood and feeling.

The user feedback in any recommendation system [12], [14] is an important tool to be considered. Studies which focus on digital TV or music recommendations make suggestions according to user feedback to be more effective. Users do not often like to write manual feedback. Therefore it is important to use an automatic technique to collect user feedback. Sentiment analysis is one of the ways of collecting user's satisfaction feedback automatically.

The user's profile is another important factor that must be included in a recommendation system, as collected by a questionnaire or rating. There are many studies pointed that user profile details influence the sentiment metric, ie the sentiment intensity may vary according to user profile information.

This recommendation system calculates the sentiment intensity of sentences extracted from real social networks as

opposed to extracting sentences from a specific trusted network.

Lexicon based sentiment analysis with the correction factor [1] accurate the final sentiment intensity value, where the correction factor is calculated from user profile information. But this approach is language specific, because this sentiment analysis technique is based on word dictionary.

The proposed systems extend this work by using a language independent corpus based sentiment analysis with the correction factor, which will improve the performance of existing recommendation model.

3. Methodology

This section covers the details and methodology of the proposed language independent music recommendation system based on final sentiment intensity value. The system architecture is shown in Fig 2.

The recommendation system has a user's profile database which contains the user's profile parameters such as age, gender, education level, music preference based on his/her emotional state and the social network user name of the person who use this system at the first time. Initially the system captures every sentence posted by a person on social network, in which the time and date is recorded in a log and sent to the database.

Then perform Naive baye's classification on collected user's data, to find sentiment intensity of the sentences posted by the user. Then enhance the sentiment intensity by adding a correction factor, this correction factor is calculated by using profile information collected in first stage such as age, education level and gender. And finally the system selects the music according to the final sentiment intensity and sent it to the user application.

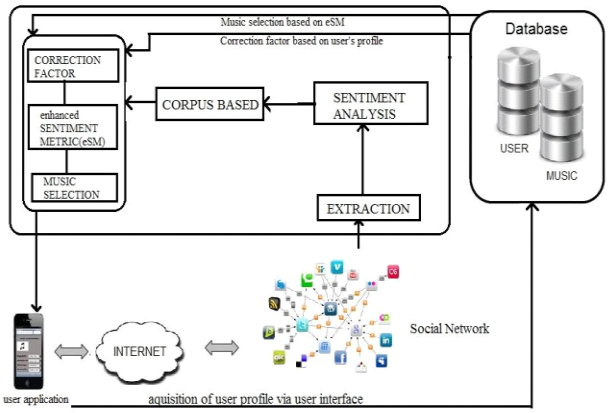

Figure 2: Architecture of a proposed music recommendation system based on sentiment intensity

3.1 Databases

1) User's Database: This recommendation system has two types of databases: User Profile database contain the user's musical preference, and the profile parameter's as age, gender, education level and the social network username of the user. These profile information collected by designing a user interface which shown in Fig 3.

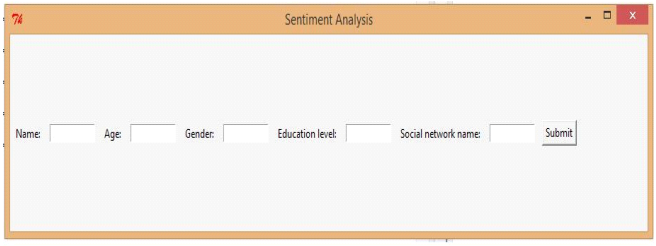

Figure 3: User interface to collect user profile information

The initial characteristics extracted from Fig. 3 helped to know what characteristics of a person could affect the final sentiment value. These information are used to calculate correction factor.

2) Music Database: A number of songs extracted from music portal and categorized in emotions and sentiment intensity by specialists in music [5]. These songs are stored as file streams in MPEG-1 Layer 3 audio coding scheme known as MP3 in the database to be used for recommendation system.

The musical categories used in this recommendation system are based on happy, sad, angry, and calm emotions shown in Fig.4.

These records containing the name of the song, style, singer, sentiment intensity and emotions are stored in the database. The majority of the songs have 3.0 MB as maximum size and the average length is in range of 2 to 3 minutes.

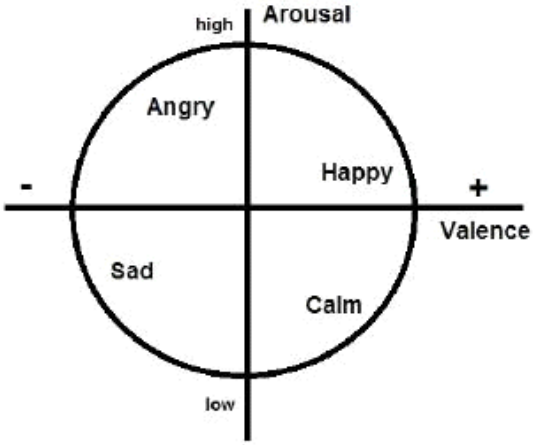

Figure 4: Emotions used to categorize songs

3.2 Correction Factor

The information stored in user profile database was used to calculate the correction factor [1]. This correction factor will adjust the initial sentiment values, as shown in Fig 5.

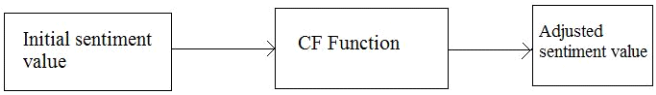

Figure 5: Sentiment correction factor (CF) function to adjust initial sentiment value

The final sentiment intensity value of a sentence F is given by the below equation. This value was obtained from the subjective test results, which represent sentiment intensity value given by the assessors.

FSM(F) = SM*C*e(a1*A1+a2*A2+...+an*An +g1*M+g2*F +e1*G+e2*nG)

Where FSM(F) represent final sentiment intensity and SM(F) represent initial sentiment intensity, C represent scale constant. a1, a2, …, an represent are binary factors related to age ranges, if one of them is equal to one, the others are zeros. A1, A2, …, An are the weight factors of each age range. Here considers four ranges g1 and g2 are binary factors related to the gender, if one of them is equal to one, the other is zero, M and F are the weight factors of gender, man or woman, respectively, e1 and e2 are binary factors related to educational level (higher education or not), G e nG are the weight factors of educational level, higher education or not, respectively.

3.3 Language independent sentiment analysis

This system use twitter as the online social network platform and naive bays classier for sentiment classification. Then modify the classifier with an extension that retrain the Classifier to classify English, Malayalam and Hindi tweets posted on twitter. Now the sentiment classifier was become language independent. Finally the system recommends a song to the user according to his/her current emotional state.

4. Conclusion

In this paper we present a language independent music recommendation system based on user's sentiments extracted from social network such as twitter. The sentiment intensity value of tweets is calculated by using a language independent corpus based sentiment analysis with the correction factor. This correction factor will personalise the recommender system, since this correction factor is evaluated from user profile information. The language independent sentiment analysis with the correction factor improves the performance of music recommendation system.

References

[1] Renata L. Rosa, Demostenes Z. Rodriguez, and Grace Bressan, "Music Recommendation System Based on User's Sentiments Extracted from Social Networks," In Proceedings of the IEEE Transaction on Consumer Electronics , PP 359-367, Auguest 2015

[2] Y. Shi, M. A. Larson, and A. Hanjalic, "Towards understanding the challenges facing effective trust-aware recommendation", in proceedings on Recommender Systems and Social Web,Barcelona, Spain, pp. 40-43, September 2010

[3] S. Koelstra, C. Muhl, M. Soleymani, J. Lee, A. Yazdani, T. Ebrahimi, T. Pun, A. Nijholt, and I. Patras, "DEAP: a database for emotion analysis using physiological signals" In Proceedings of the IEEE Transaction on Affective Computing, volume 3,pp.18-31, Jan 2012

[4] K. Yoon, J. Lee, and M.-U. Kim, "Music recommendation system using emotion triggering low-level features," in Proceedings of IEEE Transaction consumer Electronics, Volume 58, pp. 612-618. May 2012

[5] C.M Chen, M.F. Tsai, J.y. Liu and Y.H. Yang, " Using emotional context from article for contextual music recommendation," in proceedings on ACM International Conference on Multimedia, New York, USA, pp. 649-652, Oct 2013

[6] G. Crespo, R. C. Palacios, J. M. G. Berbís, and F. G. Sánchez, "SOLAR: social link advanced recommendation system", Future Generation Computer Systems, Volume 26, pp.374-380, Mar 2010

[7] Y. B. Fernandez, J. P. Arias, A. G. Solla, M. R. Cabrer, and M. L. Nores, "Providing entertainment by content-based filtering and semantic reasoning in intelligent recommender systems,", IEEE Transaction on Consumer Electronics, Volume 54, pp. 727-735, May 2008

[8] F. A. Nielsen, , "A new ANEW: evaluation of a word list for sentiment analysis in microblogs," in proceedings on Workshop on Making Sense of Microposts:Big Things come in small Packages, pp. 93-98, May 2011

[9] Q. Ye, R. Law, and B. Gu, "The impact of online user reviews on hotel room sales," International journel of Hospitality management,Vol 28, pp. 180-182, july 2009

[10] R. Feldman, "Techniques and applications for sentiment analysis," ACM Communications, vol 56, pp. 82-89, April 2013

[11] Nadia Felix F. Da silva, Luiz F S. Coletta, Eduardo " A Survey and Comparative Study of Tweet Sentiment Analysis via Semi-Supervised Learning", ACM Computing Surveys,(CSUR), Volume 49, July 2016

[12] W. Zhang, G. Ding, L. Chen, C. Li, and C. Zhang, "Generating virtual ratings from Chinese reviews to augment online recommendations," ACM Transaction Intellectual Systems and Technologies Jan 2013

[13] G. Paltoglou, and M. Thelwall, "Twitter, MySpace, Digg: unsupervised sentiment analysis in social media," ACM Transaction on Intellectual Systems and Technologies, Vol 3, pp.1-19, Sept 2012

[14] S. E. Shepstone, Z.-H Tan, and S.H Jensen, "Audio-based age and gender identification to enhance the recommendation of TV content,", IEEE Transaction on Consumer Electronics, Vol 59, pp. 721-729,Auguest 2013

[15] A. C. Lampe, N. Ellison, and C. Steinfield, "A familiar Face(book): profile elements as signals in an online social network," in proceedings of Conference on Human Factors in Computing Systems, pp. 435-444, May 2007