



Research on Sentiment Analysis in Network Public Opinion – A Case Study of Song Plagiarism

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Abstract. In the Internet age, the online music platform is not only a platform for people to listen to music, but also a platform for comments, exchanges, and sentiments. In addition to reflecting users' opinions, song online review can also be used as an important basis for sentiment analysis. At the same time, it can also be used as an important reference indicator for the recommendation system. This paper takes the song "Out of the Mountain" in NetEase Cloud Music as an example, and uses the LSTM neural network model to perform sentiment analysis on the song network comment data. Because of its official release and popular social media for a period of time, a "plagiarism" scandal broke out. Therefore, two extreme emotions appeared before and after his comment. This increases the complexity of the research object, and at the same time has certain reference significance and value for the analysis of emotional changes caused by the impact of emergencies.

Keywords: Song Online Review · LSTM · Word2vec · Sentiment Analysis

1 Introduction

With the rapid development of artificial intelligence technology, natural language processing has also become one of the important research directions. Natural language processing is the effective communication between humans and computers. There are mainly application directions such as machine translation, public opinion monitoring, sentiment analysis, speech recognition, text classification and text mining. Among them, sentiment analysis technology is widely used in various fields. For example, in the field of e-commerce, sentiment analysis can mine effective information from product reviews, so as to make targeted improvements and improve service quality.

In the online world, products generally use ratings and reviews as user evaluation criteria. Songs are a kind of entertainment products, but they have their particularities. Music users pay more attention to emotional experience, song originality, and music innovation. Nowadays, listening to songs in mobile apps has become the mainstream way of listening to songs. In music apps, users can rate and comment on songs, which

has also become a yardstick for evaluating songs. However, to evaluate songs solely from the score, there is a single evaluation angle, and malicious evaluation cannot be avoided. Therefore, in addition to the score as a measurement standard, the review data can also be used as an important basis for sentiment analysis, and at the same time, it can also be used as a recommendation system. An important indicator. [1].

This article selects the song “Out of the Mountain” in the “NetEase Cloud Music APP” as the research object to conduct emotional analysis of online song reviews. The reason why he was chosen as the research object was that after he was officially released and became popular on social media for a period of time, the “plagiarism” scandal broke out. Therefore, two extreme emotions appeared in his comments. This increases the diversity of research objects, and at the same time has certain reference significance and value for emotional changes caused by the impact of emergencies.

2 Related Technology Overview

This research uses the general process of natural language processing, using Word2Vec, RNN model, LSTM model and other related theories.

2.1 Natural Language Processing

Natural language processing refers to the technology that uses the natural language used by humans to communicate with machines to communicate with each other. Through artificial processing of natural language, the computer can read and understand it [2]. The research on natural language processing began with the exploration of machine translation by humans. Although natural language processing involves multi-dimensional operations such as speech, grammar, semantics, and pragmatics, in simple terms, the basic task of natural language processing is to segment the processed corpus based on the ontology dictionary, word frequency statistics, contextual semantic analysis, etc. The unit is the smallest part of speech and is rich in semantic lexical items. [3].

The general steps of natural language processing are obtaining original text, cleaning, word segmentation, standardization, feature extraction, and modeling training. This research will use the same process to perform sentiment analysis of online song evaluation data.

2.2 Word2Vec

Word2Vec is a way for computers to understand human language. Computers cannot understand text but can only understand numbers, so all text input must be input in the form of numbers or vectors. A word vector is a mapping from text to vector, and the relationship between text and vector can be learned using neural networks [4]. Word2Vec word vector has two methods. CBOV uses word context as input, and then predicts the word itself; Skip-gram uses a word as input, and then predicts the context of the word. Skip-gram is suitable for training on large corpus, and CBOV is suitable for training. For training on small corpus. In Word2Ve training, when input, the word or sentence is converted into a matrix of numbers. After a series of operations of the neural network,

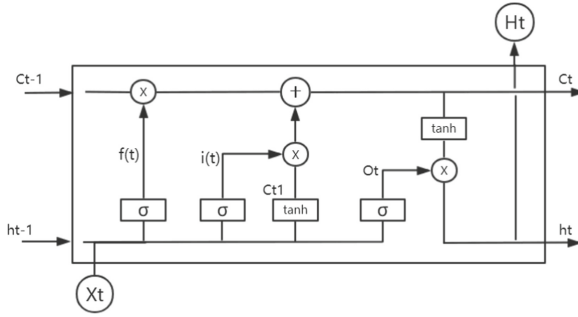


Fig. 1. LSTM neural network model

the word vector matrix before compression is output for full use, and the output word vector corresponds to what is needed word. However, Word2Vec only considers the partial information of words, and does not consider the connection outside the partial window of words at all, so there is no way to distinguish the semantics of polysemous words. [4].

2.3 LSTM Neural Network Model

LSTM neural network is a neural network model based on the RNN recurrent neural network. The LSTM model has a neural network with long and short-term memory, which can selectively retain and forget data [5]. Compared with the RNN recurrent neural network, the LSTM neural network has a control parameter C , which can control the retention and forgetting of the feature vector. The gate is a method to allow information to be selected through. The neural network layer and multiplication operation are controlled by the sigmoid function, and the gate can be used for feature selection and abandonment. [6][7].

As shown in Fig. 1, X_t is the current input data, and h_{t-1} is all the hidden information at the previous moment. The current σ function weight parameter determines the retention and deletion of the information, and $f(t)$ and the control parameter at the previous moment are obtained. The C_{t-1} calculation determines what information value to discard. In the next stage, the current control parameter C is updated, $I(t)$ is the information to be retained, C_{t1} is the control parameter formed by new data, and the C_t value is updated not only through the retained information but also through the forgotten information. Finally, the new control parameter is used to generate output. After the data X_t and h_{t-1} are combined, the current result is obtained through the gate unit, and the current result is applied to the control parameter C , and the control parameter C_t is applied to the current output, that is, it is selectively retained Valuable information output h_t . [8][9].

3 Application of Sentiment Analysis in Song Online Comment Data

3.1 Acquisition of Network Song Comment Data

This paper adopts the crawler method to crawl the user comment data of the song “Out of the Mountain” in “NetEase Cloud Music”. Mainly crawl the user name, age, gender,

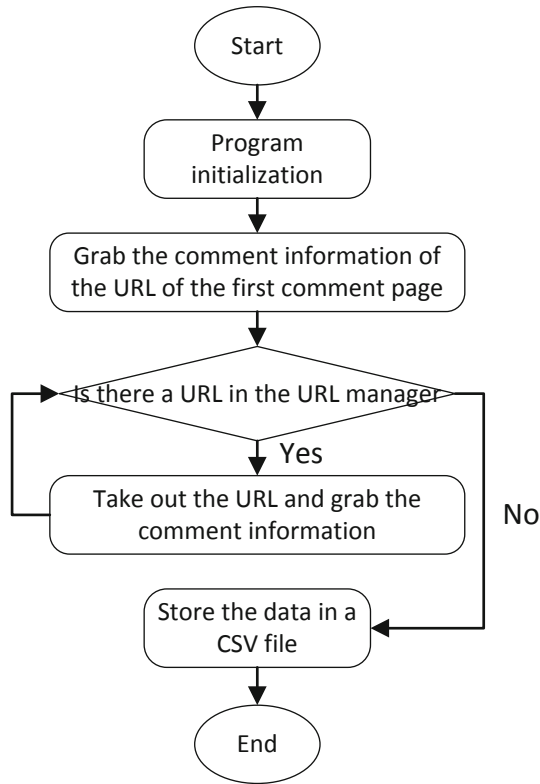


Fig. 2. Flow chart of NetEase Cloud Music

comments, number of likes, comment time and other characteristics in the comment page. Since the song “Out of the Mountain” was exposed to plagiarism after a period of time after its release, 1,019 pieces of comment data when the song was first released and 1,111 pieces of the most recent comment data after it was exposed to plagiarism were crawled, a total of 2,130 pieces. The crawling process is shown in Fig. 2.

3.2 Preprocessing of Song Online Comment Data

Before model training, it is necessary to perform artificial emotion labeling on 2130 comment data for model training. Because the amount of comment data is not large, only the comment data is classified into two emotions, namely positive emotion and negative emotion. As shown in Fig. 3, the comment data is labeled with artificial emotion according to this format. In column C3, ‘0’ represents positive emotion and ‘1’ represents negative emotion.

The application program reads the comment data that has been emotionally marked, and uses jieba word segmentation to segment the comment data. The comments before and after the word segmentation are shown in Fig. 4 and Fig. 5.

C1	C2	C3	
1	0	No problem	0
2	1	Woo-woo, guard the best two-dimensional, woo-woo	0
3	2	What did he say? Deleted?	0
4	3	It is recommended to marry Li Yuanjie in place and open a tailor's shop~	1
5	4	The words in the play are really well written.	0
6	5	Everyone knows that accompaniment is sUper love, but how do business disputes have anything to do with pla	0
7	6	Even if the immortals come, the fourth floor will always be advertised.	1
8	7	Hahahaha	0
9	8	I'm not standing at the moral high point, but just standing at the moral level. You think it's the commanding he	0
10	9	The three views are touching.	1
11	10	You can't live for 6 years.	1

Fig. 3. Sentiment labeling of comment data

```
txt=data['comment']
txt
0 My flower porridge is starving to death. It takes 11 days to send a new song even if I jump from here!
1 NaN
2 It sounds good. Your uncle will always be your uncle.[simile]
3 It's a pity that Taoyuan is nowhere to be found.
4 The painting style of "drinking drunk" sings Jay Chou's style.
5 Pleasant to hear
6 It's nice to hear flower porridge for lyrics and flower porridge for music. Praise me!
7 Come, come, come late
8 Don't ask anything else, Mr. porridge , the previous 500 million yuan has not arrived [bared his teeth)
9 You have different opinions...
10 This song is not very "porridge" , isn't it
```

Fig. 4. Comment data

```
In [26]: import jieba
txt=str(txt)
list = jieba.lcut(txt)
txt = " ".join(list)
txt

Out[26]: '0 My flower porridge is starving to death It takes 11 days to send a new
song even if I jump from here!
NaN
It sounds good Your uncle will always be your uncle.
4 It's a pity that Taoyuan is nowhere to be found.
The painting style of "drinking drunk" sings Jay Chou's style.
Pleasant to hear
6 It's nice to hear flower porridge for lyrics and flower porridge for music. Praise me!
7 Come, come, come late
8 Don't ask anything else, Mr. porridge , the previous 500 million yuan has not arrived [bared his teeth)
9 You have different opinions...
10 This song is not very "porridge" , isn't it'
```

Fig. 5. Comment data after word segmentation

3.3 Construction of LSTM Model of Song Network Comment Data

This study chooses to use the Keras framework to build the LSTM model. Keras is a simple and modular neural network framework developed at the bottom of Tensorflow. Using Keras to build a network structure is easier than Tensorflow. After preprocessing, the 2130 pieces of “Out of the Mountain” song review data were divided into training set and test set, and 1972 pieces of data in the training set and 158 pieces of data in the test set were obtained. The training set is used as the input of the LSTM neural network model to train the model, using sigmoid as the activation function, and the sigmoid layer outputs a value between 0 and 1, describing how much of each part can pass. 0 means “No amount is allowed to pass”, 1 means “Allow any amount to pass”. When the input changes, its output changes very little, between 0 and 1. The training steps of the model are shown in Fig. 6.

Firstly, the Sequential class was used to instantiate an empty sequential model and define its input type. The first layer is the Embedding layer. The input matrix in the

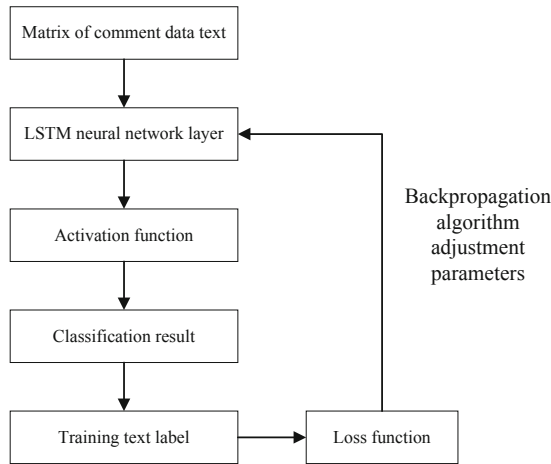


Fig. 6. Flow chart of training neural network model

Layer (type)	Output Shape	Param #
embedding_1 (Embedding)	(None, 236, 300)	15000000
bidirectional_1 (Bidirection	(None, 236, 64)	85248
lstm_2 (LSTM)	(None, 16)	5184
dense_1 (Dense)	(None, 1)	17

Fig. 7. Structure of the model

Embedding layer is batch_size (the number of samples) is 236. The Embedding interface provided by Keras avoids cumbersome The sparse matrix operation. The next layer is the BidirectionalLSTM layer. There are 32 units in this layer that will return a sequence at each step, and then import a single-item LSTM layer. This layer will not return sequences but only return the final result. Finally, a standard fully connected (Dense) layer is added, and a number between 0 and 1 is output from the sigmoid activation function of the fully connected layer. According to this value, it is judged whether the input text belongs to a positive emotion or a negative emotion., Negative 0 represents a negative comment, and 1 represents a positive comment. The model calculates the emotional label corresponding to the input data through the sigmoid activation function, and then uses the softmax function as the loss function to determine the degree of inconsistency between the emotional label of the output data and the emotional label of the input. The structure of the established model is shown in Fig. 7.

Through the construction and prediction of the LSTM model of the review data, it is found that about 95% of the sentiment of the first 1019 pieces of data of the song is “0” (positive sentiment), and only 5% of the sentiment is “1” (negative sentiment). Then, 1111 data “1” (negative emotional) comments rose to 80%, indicating that the user or fan’s emotional inclination for the song has changed dramatically after being

```
Epoch 1/5
2021-04-20 14:35:53.501332: I tensorflow/core/platform/cpu_feature_guard.cc:141] Your CPU
1663/1663 [=====] - 8s 5ms/step - loss: 0.6730 - acc: 0.5785
Epoch 2/5
1663/1663 [=====] - 7s 4ms/step - loss: 0.6209 - acc: 0.6093
Epoch 3/5
1663/1663 [=====] - 7s 4ms/step - loss: 0.6135 - acc: 0.6320
Epoch 4/5
1663/1663 [=====] - 7s 4ms/step - loss: 0.6128 - acc: 0.6599
Epoch 5/5
1663/1663 [=====] - 7s 4ms/step - loss: 0.6124 - acc: 0.6993
训练模型保存在7class_char_lstm.h5
正在加载 TEST 的数据...
source shape = (158, 3)
一共加载了 158 个数据
158/158 [=====] - 0s 2ms/step
Test score: 0.80792236328125
Test accuracy: 0.56202531456947327
```

Fig. 8. Predicted result

plagiarized. After building and training the model, it was found that the loss value of the model remained unchanged after 5 iterations after it was about 0.62.

3.4 Evaluation and Analysis of the Model

In the established model, input 158 pieces of test data for model prediction, and the final result is shown in Fig. 8. From the prediction results, we can see that the accuracy of the model is only 0.56.

It can be seen from the prediction results that the accuracy rate in the test set is low. The analysis is mainly caused by two reasons: one reason is that the training data set is too small and the number of iterations is small, which leads to the low accuracy of the model prediction result; the second is the data It’s music comment data, and the song was exposed to plagiarism. Many users posted their opinions in the comment area, and some even quarreled. Most of them were filled with mocking words, such as: “You are really good”, “You 9 Years of compulsory educational affairs are really not in vain” and so on. These sentences are literally understood as positive emotions, but negative emotions are actually a mockery of others, and the model cannot recognize the connotation of such sentences. To improve the accuracy of the model, it is necessary to increase the training data set, further increase the data volume of the data set, and increase the number of iterations at the same time.

4 Conclusion

This paper takes the song “Out of the Mountain” in NetEase Cloud Music as an example, and uses the LSTM neural network model to perform sentiment analysis on the song network comment data. Mainly carry out data acquisition, word segmentation, cleaning, standardization and other related processing. LSTM neural network is used to model and predict the processed comment data. The modeling result shows that the comment data has a certain predictive effect on the user’s emotion prediction, but because the subjectivity of artificially adding emotional tags, the small amount of data, and the diversity of Chinese vocabulary meanings, there is still room for improvement in the accuracy of the model.

References

1. Zhong Jiawa, Liu Wei, Wang Sili, Yang Heng. Summary of Text Emotion Analysis Methods and Applications [J]. *Data Analysis and Knowledge Discovery*, 2021,5 (06): 1-13.
2. Wang Yingjie, Zhu Jiuqi, Wang Zumin, Bai Fengbo, Gong Jian. Application of Natural Language Processing in Text Emotion Analysis [J]. *Computer Applications*, 2022,42 (04): 1011-1020.
3. Xinni Chen. Comparative Analysis of the Performance of Deep Neural Network Models Based on Natural Language Processing. *Proceedings of 2nd International Conference on Education Technology, Economic Management and Social Sciences (ETEMSS 2021)*. Ed. BCP, 2021, 103–107.
4. Qin Jingqiao, Wang Tong, Wang Yuzhen. Based on Word2vec_BiLSTM Emotional Analysis of Dining Comments [J]. *Journal of Zaozhuang University*, 2022,39 (02): 37-44.
5. Wan Hongxin, Peng Xinyue. Construction of Complex Network Text Emotion Analysis Model Based on LSTM [J]. *Information and Computer (theoretical Edition)*, 2021,33 (14): 65-67.
6. Liang Yiming, Shen Ying, Zhao Yongyi. Research on Emotional Analysis of Film Criticism Based on LSTM [J]. *World of digital communication*, 2021 (02): 27–28 + 81.
7. Xing Wang, Shouhua Zhang, and Ivan Smetannikov. Fiction Popularity Prediction Based on Emotion Analysis. *Proceedings of 2020 International Conference on Control, Robotics and Intelligent System (CCRIIS 2020)*. Ed. ACM, 2020, 177–183.
8. Chunmei Zhang, Mingqing Zhao, and Gang Dong. Emotional Research on Mobile Phone E-Commerce Reviews on LSTM Model. *Proceedings of the 10th International Conference on Computer Engineering and Networks (CENet2020)*. Ed., 2020, 203–212.
9. Yuyao Cheng, et al. Sentiment Analysis of Movie Review Based on LSTM. *Proceedings of 2019 the 9th International Workshop on Computer Science and Engineering (WCSE 2019)*. Ed., 2019, 275–282.

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