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Emotion Recognition from Text using LSTM algorithm

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Abstract— The growth of social networking sites lead to increase in number of users and the amount of time spent by the users on these sites. In this era of internet, human expresses their emotions, sentiments and feelings via text, comments or tweets. People share their thoughts, feelings, experiences and opinions according to their observation and understanding. Emotion is an appearance of human behavior and plays an important role in human computer interaction. To extract the emotion behind this textual data we have proposed a model, emotion recognition from text. Our method detects emotion from a text-input by using deep learning algorithm Long Short Term Memory (LSTM). Emotions such as anger, love, surprise, joy, sadness and fear are classified through this model and the accuracy of each classifier is calculated.

Keywords— LSTM, Emotion Recognition.

I. INTRODUCTION

Today, Internet has become a center stage of our lives. People all over the world are using different social networking sites, blogs and many more informal texting sites to express their emotions, feeling and opinions. Analyzing and classifying this data on the basis of emotions is an advanced form of a sentiment analysis and quite difficult task.

There are many theories proposed by researchers to understand what is emotion and types of emotions.

Paul Ekman, American Psychologist is considered as pioneer in the study of emotions, he defined fear, disgust, anger, surprise, happiness and sadness as basic emotions in 1993. Robert Plutchik proposed the famous “wheel of emotions” which consisted of the eight basic bipolar emotions viz., joy vs sadness, trust vs disgust, anger vs fear, and surprise vs anticipation. Parrot, another researcher defined primary emotions as love, joy, surprise, anger, sadness and fear in his tree structure of 100 emotions in 2001. Lövheim proposed eight basic emotions as anger, interest, distress, surprise, fear, joy, shame and disgust.

For our project we have considered six emotions as Anger, Love, Surprise, Joy, Sadness and Fear and we have tried to classify the text into these six different classes.

In this paper, we try to solve the problem of emotions recognition from text. In our model we have used mix of two different approaches. First is deep learning classification algorithm based approach and other one is Natural language Processing approach for grammatical analysis and other textual features like Parts Of Speech, lemmatizing and tokenizing. For the experiments we consider the data which is in English language and is collected from Twitter.

II. RELATED WORK

S.Shaheen, W.El-Hajj, H.Hajj, and S.Elbassuoni, has created model based on KNN classifier which uses automatically generated rules for emotion detection. If the terms and their relation to the meaning of the sentence are found, they can be easily generalized and considered as emotion recognition rules (ERRs)[1]. The emotions considered in this study are happiness, sadness, disgust, anger, surprise and fear. S. N. Shivhare and S. K. Saritha, proposed model that is based on keyword searching technique which also uses the concept of ontology which makes this model more efficient than other methods in recognizing emotions from text input[2]. This has been created to overcome following limitations: Ambiguity in Keyword Definitions, Incapability of Recognizing Sentences without Keywords and Lack of Linguistic Information.

Chetan R. Chopade surveyed all emotion detection methods viz.,keyword-based, Lexical affinity method, learning based, and hybrid based approach[3]. F. Calefato, F. Lanubile and N. Novielli,has developed java based "EmoTxt: A toolkit for emotion recognition from text," which supports emotion classifiers from manually annotated training data[4]. It identifies emotions in an input corpus provided as a CSV file, with one text per line with unique identifier. This gives output as a CSV file containing the text id and the predicted label for each item of the input collection. E. Batbaatar, M. Li and K. H. Ryu created a Semantic-Emotion Neural Network for Emotion Recognition From text, based on the combined network which consists of CNN based emotion encoder and BiLSTM based semantic encoder called SENN. They conducted the ten datasets and then analyzed using the proposed SENN model. The other baseline models including machine learning and deep learning models. Experiments on emotionally related datasets show that this

method can achieve better performances compared to baseline methods[5]. This proposed framework is general enough to be applied to more scenarios.

S.L.Ramírez-Ávila, R. Oramas-Bustillos, M.L. Barron-Estrada, R.Zatarain-Cabada describe the development of system to generate a corpus of textual opinions in Spanish, labeled with learning-centered emotions. Here, the corpus generated with the ERAS system contains 851 textual opinions. The system remains available for more participants to express their opinions on educational resources[6]. This model will help Intelligent Tutoring Systems to detect emotions through text and make the teaching process more efficient for students, adjusting the content to the particular needs of each of them. MahiraKirmani, MudasirMohd, Nida Manzoor Hakak and Mohsin Mohd has surveyed prior works done in the field of emotion analysis through text and they came to conclusion that text emotion analysis faces some challenges because emotions and the ways to express are subjective[7].

Zichao Yang, Diyi Yang Chris Dyer, Xiaodong He, Alex Smola, Eduard Hovy has proposed a hierarchical attention network (HAN) for document classification, A model with two levels, word and sentence level of attention mechanism to visualized the document in such a way that it highlights and aggregates important words in sentences[8]. Priyanka H. S. and Ramya B. V. proposed a way to find polarity of movie reviews by using logistic regression. They performed feature extraction and classification using machine learning approach and their model achieved accuracy upto 88%[9]. Adarsh S R proposed a way for emotion recognition based on word clustering which helps in reducing dimensions of feature space and shows improvements in results[10].

Romana Rahman, Tajul Islam, Md. Humayan Ahmed has created a method for Emotion detection from text and emoticon, based on keyword analysis, keyword negation analysis, and by finding proverbs, emoticon and exclamatory word from sentences. Their method achieved upto 80% accuracy[11].Sudhanshu Prakash Tiwari, M. Vijaya Raju, Gurbakash Phonsa and Deepak Kumar Deepu has proposed a hybrid approach of emotion recognition which is a combination of both machine learning and keyword based approach. And they concluded that hybrid approach of emotion recognition gives better results than model which is based only on learning based or keyword based[12].

III.METHODOLOGY

Long Short Term Memory is a special kind of Recurrent Neural Network (RNN) designed by Hochreiter and Schmidhuber. LSTM is used to solve problem of long-term dependencies of RNN in which the RNN cannot predict the word stored in the long term memory but can give more accurate predictions from the recent information.

LSTM has three gates such as input, output and forget gate. They are composed of a sigmoid neural net layer and a point-wise multiplication operation.

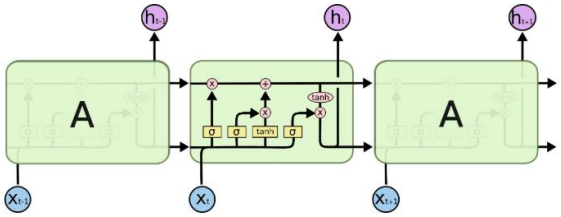

Figure 1. LSTM model structure.

We have implemented this project in Spyder IDE which comes along with the anaconda installation for coding purpose. For this experiment we divided the work into 5 steps as follows:

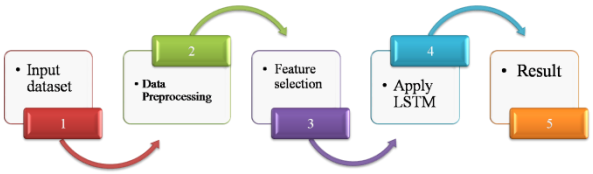

Figure 2: Implementation process flow

A. *Input Dataset*

We can get text based data from movie reviews, product reviews from Amazon, Ebay, Nykaa, Zomato,etc. But, in our project we are using labeled text dataset. This dataset has total 416,809 tweets, labeled as different human sentiments.

B. *Data preprocessing*

We need to remove all special characters, punctuation, plural forms, short forms and stop words like prepositions from dataset and make this data noise free. Also we need to breakdown Sentences into small parts. We use Natural Language Processing to do this preprocessing which includes different tasks as follows:

- Making all letters lowercase
- Removing Punctuation, Symbols
- Lemmatization: In this process we convert all the variant forms of the word like plural forms, past tense into its root form. Also we delete the repetition of letters in a word.
  E.g. boys will be converted into boy.
- Stemming: here, we remove affixes from word. E.g. writing will be converted into write.
- Finding antonyms and synonyms
- Finding Stop words: In this step we remove words like is, the, an, for, to, in from sentence.
- Tokenizing Text: In this step we split sentence into small parts to make preprocessing easy. E.g. 'I prefer tea over coffee.' will get converted into ['I', 'prefer', 'tea', 'over', 'coffee', '.']
- Speech Tagging: By using NLTK we can classify words from sentences as verbs, nouns, adjectives, adverb, etc.

C. Feature Selection

i. TF-IDF:

TFIDF stands for term frequency–inverse document frequency which is used to find out how important a word is to a document is. It is used to sort data into categories, extract keywords, automated text analysis, and scoring words in Natural Language Processing (NLP) and Information retrieval.

Term frequency: It is a count to find out how many times word appears in a document.

$$TF(term) = \frac{no\_of\_times\_term\_appea}{total\_no\_of\_terms\_i} \quad (1)$$

The inverse document frequency: This is used to find out how frequent or rare a word is in the given document

$$IDF(term) = \frac{total\_no\_}{no\_of\_doc\_wit} \quad (2)$$

TF-IDF can be calculated by multiplying two metrics:

$$TFIDF = TF(term) \times . \quad (3)$$

ii. Count Vectors:

Machine learning deals with numbers but we are using text based data. So we need to convert that text into numbers we can do this task by using TFIDF and count vector function together.

D. Training Our Models

In this step we apply deep learning algorithm to our model like LSTM. While performing the experiment we have observed the accuracy, total loss and time taken by different algorithms to perform multiple iterations by each algorithm.

E. Testing

The last step is testing in which we can test this model to check if it gives accurate results in reality by giving some random text input.

IV.RESULTS AND DISCUSSION

After training the models using LSTM we get output as follows which shows the iterations and time taken by model to perform each iteration, Also accuracy and loss at each iteration.

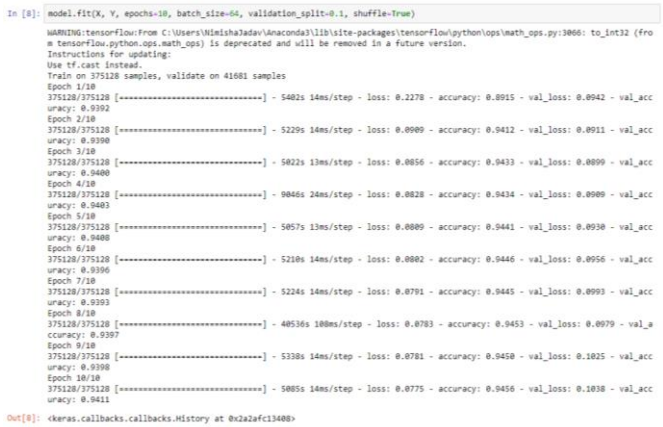

Figure 3. Iterations.

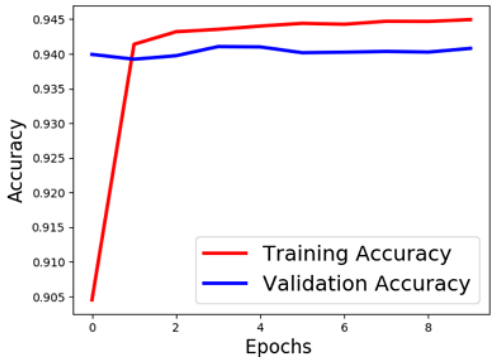

Figure 4. Accuracy curve of LSTM

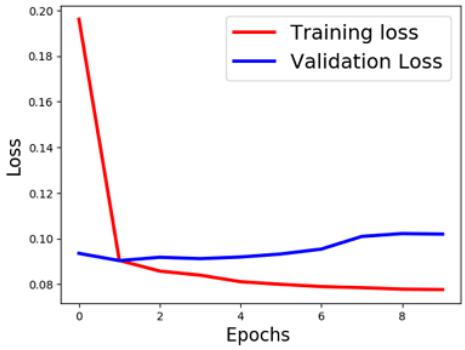

Figure 5. Loss curve of LSTM

These learning curves show how accuracy and loss varies from 1st iteration to Nth iteration.Accuracy is a measure of how accurate our model prediction is compared to true data and it is in the % format. Loss is a sum of error made in training or validating data.

After training we got final output as shown in following figures:

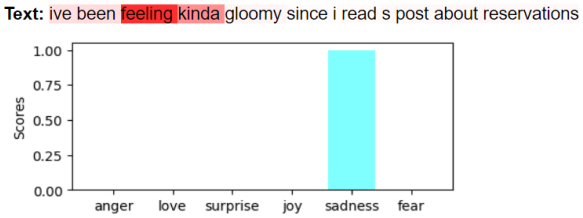

Figure 6. Extracting emotions from sentence a

Figure 7. Extracting emotions from sentence b

V. CONCLUSION AND FUTURE SCOPE

Today, sentiment analysis or emotion mining is considered as important field in machine learning to have better human-computer interaction. In this project we tried to show the way of classifying tweets into 6 different

emotions Using Long short term memory (LSTM) algorithm. Our model has achieved 94.56% accuracy after using LSTM algorithm.

Experiments have proved that process of extracting Human emotion is dependent on the context of word and the process is subjective because of concept like irony and sarcasm.

One can further improve results by trying to extract more features from the tweets. Also one can try using LSTM to extract emotion from audio files. In future, this method can be developed to find emotion like skepticism, hope, anxiety, excitement.

REFERENCES

[1] Amit Palve, Rohini D.Sonawane, Amol D. Potgantwar, "Sentiment Analysis of Twitter Streaming Data for Recommendation using, Apache Spark," *International Journal of Scientific Research in Network Security and Communication*, Vol.5, Issue.3, pp.99-103, 2017

[2] Gagandeep Kaur, Kamaldeep Kaur, "Sentiment Detection from Punjabi Text using Support Vector Machine," *International Journal of Scientific Research in Computer Science and Engineering*, Vol.5, Issue.6, pp.39-46, 2017

[3] S. Shaheen, W. El-Hajj, H. Hajj, and S. Elbassuoni, "Emotion Recognition from Text Based on Automatically Generated Rules," *2014 IEEE International Conference on Data Mining Workshop*, 2014.

[4] K. Saritha Khethawat, S. Shiv, "Emotion detection from text,".

[5] C. Chetan, "Text based emotion recognition:A survey," *International Journal of Science and Research(IJSR)*, 2015.

[6] F. Calefato, F. Lanubile, and N. Novielli, "EmoTxt: A toolkit for emotion recognition from text," *2017 Seventh International Conference on Affective Computing and Intelligent Interaction Workshops and Demos (ACIIW)*, 2017.

[7] E. Batbaatar, M. Li, and K. H. Ryu, "Semantic-Emotion Neural Network for Emotion Recognition From Text," *IEEE Access*, vol. 7, pp. 111866–111878, 2019.

[8] R. Oramas-Bustillos, M. L. Barron-Estrada, R. Zatarain-Cabada, and S. L. Ramirez-Avila, "A Corpus for Sentiment Analysis and Emotion Recognition for a Learning Environment," *2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT)*, 2018.

[9] K. Mahira, M. Mudasir, H.Nnida, M.Mohsin, "Emotion analysis:A survey,", *2017 International Conference on Computer, Communications and Electronics (Comptelix) Manipal University Jaipur, Malaviya National Institute of Technology Jaipur & IRISWORLD, July 01-02*, 2017

[10] Z. Yang, D. Yang, C. Dyer, X. He, A. Smola, and E. Hovy, "Hierarchical Attention Networks for Document Classification," *Proceedings of the 2016 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*, 2016.

[11] Dr. Ashok Kumar R, Priyanka H S, Ramya B V, "Classification model to determine the polarity of moviereview using logistic regression," *2019 International Research Journal of Computer Science (IRJCS) ISSN: 2393-9842, Issue 06, Volume 6*,2019

[12] Adarsh S R. (2019). "Enhancement Of Text Based Emotion Recognition Performances Using Word Clusters." *International Journal of Research - Granthaalayah*, 7(1), 238-250. https://doi.org/10.5281/zenodo.2550669.

[13] Md. Humayan Ahmed, Romana Rahman, Tajul Islam,"Detecting emotion from text and emoticon,"2017 *London Journal of Research in Computer Science and Technology, Volume 17, Issue 3, Compilation 1.0*,2017.

[14] P. Gurbakash, D. Deepak, T. Sudhanshu, M. VijayaRaju, "A novel approach for detecting emotionin text," *Indian Journal of Science and Technology,Vol 9(29)*, 2016.

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