Emotion Intensity Detection

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Emotion Intensity Detection

***Abstract*—Emotion detection is one of the major tasks of Sentiment analysis. In this paper, we aim to determine the intensity of emotion. Different statistical as well as deep learning models are proposed in this paper. Emotion Intensity in tweets [1] dataset is used. Comparison of different models is done based on Pearson's correlation and Spearman's rank correlation. Further, we also give insight into our future work on emotion intensity detection.**

I. Introduction

People express how they feel through emotions. Emotion Intensity determines the degree of an emotion. Sentiment analysis plays a major role in identifying emotions and its intensity. Lexicons determines the vocabulary of a language, person or a subject and thereby, can be use to describe the emotion's extent. Word2Vec is a tool that takes a text corpus as input and produces the word vectors as output.

Regression models like Linear Regression and SVR are statistical models that models linear relationship between the input variables and the output variable. Here, the input variable refers to the features of the text and the output variable refers to the emotion intensity. In this paper, we have used both these models to obtain a linear model for the tweet texts whose features are derived through lexicons.

Deep Learning models like RNN, LSTM, Bi-directional LSTM, and 1d-Convolutional layer network have been used in many sentiment classification and regression problems. For our model, we need to determine the range of emotion intensity between 0 and 1. Thus we have built a regression model using these deep learning techniques which uses the embeddings generated by Word2Vec model.

II. Problem Definition

Given a tweet and an emotion X, determine the intensity or degree of emotion X felt by the speaker – a real-valued score between 0 and 1. The maximum possible score 1 stands for feeling the maximum amount of emotion X . The minimum possible score 0 stands for feeling the least amount of emotion X.

III. Proposed Solutions

Emotion Intensity Detection is a sentiment analysis task. The proposed methodology consists of text cleaning, pre-processing, generation of embeddings or word vector and statistical and deep learning models to detect emotion intensity.

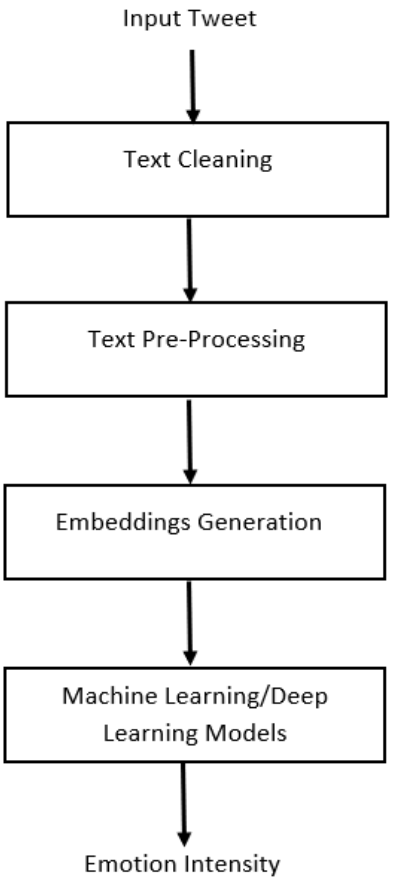

Fig. 1. Proposed Methodology

A. Text Cleaning

It involves removal of noise from texts. It involves converting text to lower case characters, removal of numeric characters, URLs, user-handles and special characters. Hashtags are separated from text because they carry special meaning of the tweets. The words are tokenized. Stop-words are the most commonly occurring words that do not convey much information regarding the emotion intensity and hence, is removed. Lemmatization with parts of speech help to convert words back to its original root words which helps in the process of analysis giving same meaning to words with same root words rather than assigning separate meaning to the root word and obtained word.

B. Text pre-processing

The obtained tokenized word list of each tweet is converted to a matrix. The words in the list are padded with maximum sentence length and tokenized. Further, tweets have gold score emotion intensity less than 0.5 is also obtained.

C. Embeddings Generation

Embeddings are feature vectors of words which helps to represent words in a mathematical format. In this paper, we use two different methods to generate embeddings.

1) Lexicons: Lexicons defines the vocabulary of a language. The NRC Emotion Lexicon is a list of English words and their associations with eight basic emotions (anger, fear, anticipation, trust, surprise, sadness, joy, and disgust) and two sentiments (negative and positive). The annotations were manually done by crowdsourcing and is used to obtain lexicon for each word. For our work, we obtain lexicon for each word in the tweet and calculate average of the entire tweet. This serves as our feature vector.

2) Word2Vec: Google's pre-trained word2vec model includes word vectors for a vocabulary of 3 million words and phrases that they trained on roughly 100 billion words from a Google News dataset. The vector length is 300 features. For our work, we use pre-trained weights from Google's word2vec model, instead of building a vocabulary from a small corpus. The weights in word2vec is used as pre-trained weights while training the model.

D. Model Generation

Various statistical and deep learning models can be used to find emotion intensities. Determining emotion intensities is a regression task and not a classification task. The range of intensity varies from 0 to 1.

1) Linear Regression: Linear Regression is used to model relationship between input variables and output variable. For our work, we have built a simple linear regression model. The input variable is the average lexicon of each word in the tweet and the output variable is the emotion intensity of the tweet

2) SVM Regression: SVR is used to find an appropriate line or hyperplane in higher dimensions to fit the data. We have standardized the input variables before fitting the data. We gave taken hyperparameter value C equal to 1.0 and set epsilon to 0.2. Since the training data has only 1 row for training, we reshaped it to (-1,1).

3) LSTM: They are Long Short-Term Model which are a type of recurrent neural network capable of learning order dependence in sequence prediction problems. For our work, we have used 'relu' activation function for our regression task. The loss function is 'mean-squared-error'. We train the model for 5 epochs.

4) Bi-Directional LSTM: It is a sequence processing model that consists of two LSTMs: one taking the input in a forward direction, and the other in a backwards direction. It provides a better prediction accuracy. For our work, we have used 'relu' activation function for our regression task. The loss function is 'mean-squared-error'. We train the model for 5 epochs.

5) 1D-CNN: Convolutional Neural Networks helps to find spatial patterns, work for pattern-finding in sequences of words. In our model, the first layer is the convolutional layer with 'relu' activation function and 32 filters. Then, we have added a max pooling layer followed by a global max pooling layer. The model then contains a dense layer. The loss function used is 'mean-squared-error'.

IV. Evaluation Metric

The evaluation of model is done by correlating the relation between the predicted y value and the gold score of the emotion intensity. Following are the methods used for finding correlation:

A. Pearson Correlation coefficient

It measures the linear relationship between two datasets. It varies between -1 and +1 with 0 implying no correlation. Correlations of -1 or +1 imply an exact linear relationship. Positive correlations imply that as x increases, so does y. Negative correlations imply that as x increases, y decreases.

B. Spearman's Rank Correlation coefficient

The Spearman correlation between two variables is equal to the Pearson correlation between the rank values of those two variables; while Pearson's correlation assesses linear relationships, Spearman's correlation assesses monotonic relationships (whether linear or not).

V. Analysis and Interpretation

Different models and feature vectors are evaluated for different emotions.

Evaluation Metric				
Model	PearsonC	SpearmanRC	PearsonC0.5	SpearmanR0.5
Lexicon+Lin Reg	1.00	1.00	1.00	0.99
Lexicon + SVM Reg	0.18	0.42	-0.78	-0.49
Word2Vec+LSTM	0.915	0.936	0.491	0.276
Word2Vec + Bi-LSTM	0.13	0.15	-0.18	-0.18
Word2Vec + 1D-CNN	0.18	0.23	-0.25	-0.19

TABLE I. Scores for Emotion Intensity of Anger

Evaluation Metric				
Model	PearsonC	SpearmanRC	PearsonC0.5	SpearmanR0.5
Lexicon+Lin Reg	1.00	1.00	0.99	0.99
Lexicon + SVM Reg	0.32	0.21	0.29	0.27
Word2Vec+LSTM	0.03	0.01	0.015	0.15
Word2Vec + Bi-LSTM	-0.014	-0.035	0.05	0.18
Word2Vec + 1D-CNN	0.11	0.10	-0.08	-0.05

TABLE II. Scores for Emotion Intensity of Fear

Evaluation Metric				
Model	PearsonC	SpearmanRC	PearsonC0.5	SpearmanR0.5
Lexicon+Lin Reg	1.00	1.00	1.00	1.00
Lexicon + SVM Reg	0.83	0.86	0.70	0.82
Word2Vec+LSTM	0.05	0.07	0.03	0.00
Word2Vec + Bi-LSTM	0.04	0.05	0.011	0.04
Word2Vec + 1D-CNN	0.13	0.12	0.36	0.36

TABLE III. SCORES FOR EMOTION INTENSITY OF JOY

Evaluation Metric				
Model	PearsonC	SpearmanRC	PearsonC0.5	SpearmanR0.5
Lexicon+Lin Reg	0.99	1.00	1.00	1.00
Lexicon + SVM Reg	0.89	0.92	0.70	0.83
Word2Vec+LSTM	-0.14	-0.13	-0.02	0.276 -0.02
Word2Vec + Bi-LSTM	0.13	0.15	-0.18	-0.18
Word2Vec + 1D-CNN	0.11	0.10	-0.08	-0.04

TABLE IV. SCORES FOR EMOTION INTENSITY OF SADNESS

VI. CONCLUSIONS AND FUTURE WORK

Linear Regression seems to give very high correlation between the predicted value and gold scores. Future work includes using of BERT model.

REFERENCES

[1] Saif M. Mohammad and Felipe Bravo-Marquez, "Emotion Intensities in Tweets," in *Proceedings of the 6th Joint Conference on Lexical and Computational Semantics, August 3-4, 2017,Association for Computational Linguistics*