Affect Analysis in Tweets

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1. Outline

In this project, we present a system to predict the affect of a tweet and its intensity. The affect analysis constitutes of two parts: classification and intensity estimation of emotions: anger, sadness, joy and fear; and the VAD: valence, arousal, and dominance analysis. Valence measures how pleasant an emotion is. For instance, anger is an unpleasant emotion and has a high negative valence whereas joy is a pleasant emotion and has a high positive valence. Arousal measures intensity of an emotion. For instance, both anger and boredom are unpleasant emotions but boredom has a lower arousal value as compared to anger. Dominance represents the controlling and dominant nature of the emotion. For instance while both fear and anger are unpleasant emotions, but anger is a dominant emotion, while fear is a submissive emotion. Figure 1 is a illustration for the valence-arousal space for emotions.

The state of the art emotion detection systems only categorize the data without measuring the emotion intensity. However, there is vast difference in feelings such as annoyance and fury, even though the two fall under the same anger category. Analyzing the emotion intensity and VAD scores would help us better understand complicated emotions conveyed in text.

This problem is a part of the SemEval 2018 Task 1, “Affect in Tweets”.

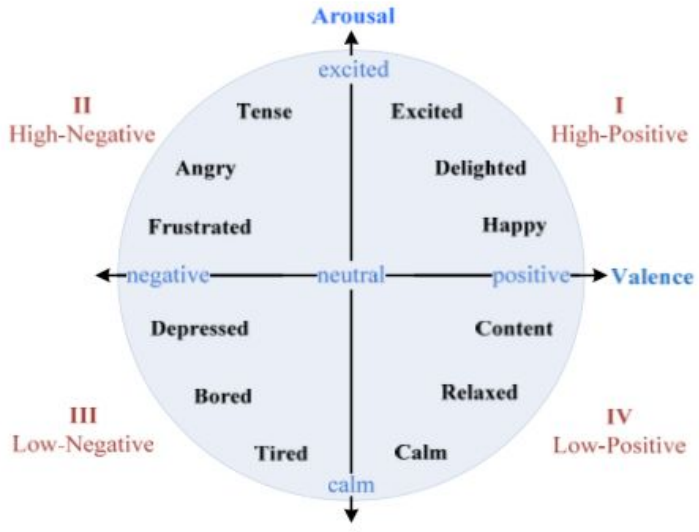

Figure 1. Valence Arousal Coordinates Illustration

2. Literature Review

Paper [2], describes a benchmark regression system *AffectiveTweets Package*[3], which automatically determines emotion intensity of a tweet. The package provides a collection of filters for extracting features from tweets for sentiment classification and other related tasks. The paper also shows the extent to which various features help in determining emotion intensity. We intend to use this package to generate feature vectors for the baseline implementation. We will use these features vectors in addition to our own feature representation of the tweet.

Paper [5] presents a weighted graph model to automatically determine the valence-arousal ratings of affective words. It performs experiments on English and Chinese affective lexicons and shows that its method yields a smaller error rate on valence-arousal prediction than the linear regression, kernel method, and pagerank algorithm. However, this model only does valence-arousal predictions at the word-level and not the sentence- or document-levels. Although, the valence-arousal score for a word can be useful for this project, we will need features which include information about the context of the word to better predict the intensity at the sentence(in this case, a tweet) level.

Paper [6] uses the valence-arousal-dominance(VAD) metrics in the software engineering domain. It uses data of 700,000 Jira issue reports containing over 2,000,000 comments to identify the symptoms of productivity loss in software engineering. This data was more structured as compared to the twitter data and focussed on identifying the links between issue characteristics like issue type, priority, resolution time with VAD.

Paper [9] describes an open-source emotion detection classifier for text. This package contains a trained classifier and tools for training personalized text emotion classifiers.

Paper [10] describes feature selection methods in n-gram model for emotion detection in text. We will learn these methods and potentially apply them in our model.

3. Approach

1. Feature Representation: We will use the provided *AffectiveTweets Package*[3] as a baseline for generating the feature representation of a tweet. We plan to explore the relationship between the 4 different emotions(anger, fear, joy, sadness) and VAD coordinates to generate our own feature representation of the tweet. We also plan to use the *ANEW dataset*[8] (details in next section) to learn meaningful features from a tweet with respect to valence, arousal and dominance. We will use this dataset to find the affect information for all the words in a tweet, aggregate this information and find the affect for overall tweet.

2. Experimenting with models: We plan to experiment with Naive Bayes, Hidden Markov Model and Deep Learning Models to build the regressor. First, we will use the bag of words approach with the information from *ANEW dataset*[8] as weights to build a weighted Naive Bayes Model. Then we plan to improve generalization by incorporating sequence of words using Hidden Markov Model. Finally, we plan to use the Recursive Neural Net(RNN) model. We will attempt to improve the accuracy of our model by experimenting with different types of tokenization techniques and sequence of words/feature representations. We will report the performance analysis of all implemented models.

4. Datasets

- SemEval 2018 Task 1 dataset: We will use the training, dev and test datasets for English tweets provided by SemEval 2018 for this project. The emotion intensity detection dataset contains tweet ID, tweet text and the emotion of the tweet along with its intensity score. The dataset with the intensity scores for valence for each tweet is also provided. Training and development data for Arousal and Dominance scores, for English tweets will be released mid-October. The test data is expected to be released in January and hence we will split the training data into train and test set for the purpose of this project. https://competitions.codalab.org/competitions/17333#learn_the_details-datasets
- SemEval 2017 Task "Shared Task on Emotion Intensity (EmoInt)" dataset: We may also choose to validate our results using the test data provided for SemEval 2017 Shared Task on Emotion Intensity (EmoInt), which had the same training data as the 2018 task for emotion intensity prediction. https://competitions.codalab.org/competitions/16380#learn_the_details-dataset
- We will use the Affective Norms for English Words(ANEW) dataset[8] which is a dataset that has affective valence, arousal, and dominance ratings for around 14000 English words. We will use this dataset to help with feature extraction for detecting VAD intensity of a tweet.

5. Scope

In this project, we will experiment with multiple models and choices of features to predict the class and intensity of emotions, as well as the VAD scores for each given tweet. Each tweet will be classified into one of the four categories(anger, fear, joy and sadness), and will receive an intensity score between 0 and 1. Each tweet will also receive its valence, arousal, and dominance scores in range of 0 and 1. 0 means lowest possible emotion intensity/valence/arousal/ dominance level, and 1 means highest possible emotion intensity/valence/arousal/dominance level.

The dataset provided will be split into training, validation and test datasets, and the system will be evaluated by calculating the Pearson Correlation Coefficient with the Gold ratings/labels provided by the challenge organizers. The dataset for 2018 task is similar to the 2017 challenge and thus the accuracy for emotion detection can be compared against the best systems from 2017 results.

6. Pre-existing Softwares to be used

1. Language for implementation: Python
2. *AffectiveTweets*[3] package for basic feature representation of a tweet.
3. Useful information on word relations from : WordNet/NLTK
4. Machine Learning functions and utilities in Python from: sklearn, tensorflow(for RNN/Deep Learning etc.), numpy, matplotlib etc.

References

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