An Approach for Modeling Affect Intensity in Tweets

Aarsh Patel & Lynn Samson

November 18, 2017

1 Outline

Affect intensity modeling is a general problem of considerable interest in numerous fields, including neuroscience, psychology, computer vision, and computational linguistics, among others. In this project, we focus on affect intensity modeling for natural text, particularly tweet data. We will be working in the specific framework imposed by a SemEval 2018 task, in which we are provided with a tweet and an affect category (such as anger, joy, or fear), and the task is to output a real value between 0 and 1, indicating the intensity of that affect felt by the author of the tweet. This is different from the task of sentiment analysis or affect detection, which is a classification problem where the task is to predict what affect is expressed by a particular piece of text, such as a tweet. Hence, sentiment analysis or affect detection can be seen as a potential preliminary component to affect intensity modeling in a natural language pipeline. As was previously mentioned, affect intensity modeling has a wide variety of applications in both industrial and research settings where it is important to gain insight into the sentiment of the population of interest.

2 Literature Review

Kolchyna et al. discusses a variety of approaches for Twitter sentiment analysis. The paper mentions both lexicon-based and machine learning methods, with experimental results showing that machine learning methods perform better. However, an ensemble method in which the lexicon-based score was used as a feature in the machine learning method proved to produce the best classification results. Although this paper deals with the 3-class sentiment detection problem (positive, negative, neutral), the methods used can be extended to work in the multi-class case, which is required for the affect detection problem. In turn, the affect detection problem could serve as an inspiration for our problem of modeling affect intensity, which mostly differs only by the fact that it is a regression problem rather than a classification problem.

Nagarsekar et al. addresses this issue of moving beyond binary or ternary sentiment detection to multi-class sentiment detection for Ekman's six basic emotions. In doing so, they extend the machine learning methods such as those discussed in Kolchyna et al. to do multi-class classification. In particular, they identified Multinomial Naive Bayes and SVM as two diverse algorithms and ran the algorithms on three distinct datasets. The results seemed to show that while Multinomial Naive Bayes has the best performance across all datasets, SVM remains more stable with respect to datasets with an unequal distribution of tweets.

Akhtar et al. propose a Multi-Layer Perceptron (MLP) for financial sentiment analysis. They develop various deep learning models based on Convolutional Neural Networks (CNNs), Long Short Term Memory Networks (LSTMs), and Gated Recurrent Neural Networks (GRUs). An ensemble is created between these Deep Learning models and a classical supervised model based on Support Vector Regression (SVR). The deep learning models are trained on top of distributed word representations, while the SVR is trained on a diverse set of features such as tf-idf and sentiment lexicons. These models perform remarkably well to identify sentiment of financial text and will serve as an inspiration for the type of models we will be building for predicting affect intensity.

Kim et al. demonstrate how a Convolutional Neural Network (CNN), trained on top of pre-trained word vectors, could be used for sentence classification. The CNN model, with little hyperparameter tuning, achieves good classification performance across a range of text classification tasks, such as Sentiment Analysis. Again, this will serve as an inspiration for the type of models we will be building for predicting affect intensity.

3 Approach

We plan to use classical supervised machine learning algorithms, as well as deep learning architectures to model affect intensity in tweets. Our first plan of action is to establish a baseline supervised regression model based on SVR or Random Forests. We intend to use a basic set of features extracted from the tweets, which would include tf-idf, n-grams, pos-tags, sentiment lexicons and more. However, we eventually intend to use deep learning to automatically learn good feature representations for tweets, rather than manually defining these features. We tend to improve our system by using deep learning architectures such as CNNs and RNNs (LSTM and GRU). Our hope is that the deep learning based methods will outperform the classical supervised algorithms. Finally, we plan to combine all our models to form an ensemble model.

The datasets only include train and development. We will use the development dataset to tune the hyperparameters of ours models (number of hidden layers, number of neurons, regularization parameters, etc.) using k-fold cross validation. We will split the train dataset in order to account for the lack of a test dataset.

4 Possible Datasets

1. We are planning to use the *word2vec* dataset trained on Google News as a distributional representation for words. There are roughly around 3 millions words in the vocabulary and each word is represented as a 300-dimensional vector.

2. The *NRC Affect Intensity Lexicon* dataset by Saif M. Mohammad is a list of English words and their associations with four basic emotions (anger, sadness, fear, joy). Each word in the dataset is associated with an emotion and the intensity (real valued number between 0 and 1) expressed by that emotion. These lexicons will provide us with some features for our supervised learning algorithms.

3. We are also using the dataset (English version) provided by the SemEval task organizers. The dataset consists of training and development data. The training data includes tweets and the affect category (anger, fear, joy, sadness) represented by those tweets. It also has gold standard annotations representing the intensity expressed by the category, which is a real valued number between 0 and 1. Since there is no test dataset, we plan to split the training data accordingly in order to build a sample test dataset.

5 Scope

Our project is based on the SemEval 2018 Task, "Affect in Tweets". It's often useful to know the degree to which an affect category is expressed in text. Automatically detecting emotion intensities in tweets is especially beneficial in applications such as tracking brand and product perception, support for issues and policies, etc.

Thus, the main scope of the project is to build a system that can accurately predict affect intensity for a given tweet and affect. The models that we build will primarily consist of classical supervised regression models, as well as deep learning models. We believe that we have the proper data and sufficient number of examples to learn a good model.

6 Pre-existing Software Systems which can be used

1. Implementation of code: Python

2. NLP Software: NLTK (for processing text)

3. Machine Learning Libraries: sklearn, gensim

4. Deep Learning Libraries: Keras/Tensorflow

References

[1] Keith Cortis, André Freitas, Tobias Daudert, Manuela Huerlimann, Manel Zarrouk, Siegfried Handschuh, and Brian Davis. Semeval-2017 task 5: Fine-grained sentiment analysis on financial microblogs and news. In *Proceedings of the 11th International Workshop on Semantic Evaluation (SemEval-2017)*, pages 519–535, 2017.

[2] Yoon Kim. Convolutional neural networks for sentence classification. *arXiv preprint arXiv:1408.5882*, 2014.

[3] Olga Kolchyna, Tharsis TP Souza, Philip Treleaven, and Tomaso Aste. Twitter sentiment analysis: Lexicon method, machine learning method and their combination. *arXiv preprint arXiv:1507.00955*, 2015.

[4] Uma Nagarsekar, Aditi Mhapsekar, Priyanka Kulkarni, and Dhananjay R Kalbande. Emotion detection from the sms of the internet. In *Intelligent Computational Systems (RAICS), 2013 IEEE Recent Advances in*, pages 316–321. IEEE, 2013.