An Expert System Technique for Sentiment Analysis of Opinions

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Abstract:

To help the users and the product owners it is quite necessary to extract aspects from the online reviews, their sentiment polarities, and associations between them. There is a great deal of work done in the field of sentiment analysis. Lexical and learning-based systems can be combined to separate the assessments from online opinions and reviews. In learning-based techniques, the Gaussian mixture model can be used for getting probabilistic results for polarities against aspects and naïve baize classifiers for the problem of spam comments which produced better and competitive results against previous techniques.

Keywords – Opinions, mining, reviews, sentiments, web, social data

1. INTRODUCTION

Nowadays, an extensive number of sentiment related reports are placed on the different forums on the internet. Mostly individuals post item surveys, state their political perspectives, and share their emotions. The capacity to concentrate assumptions from such sources can give precious data about individuals' perspectives on different points. The feeling found inside the remarks, input or investigates give valuable pointers to a wide range of purpose.

Sentiment is basically an opinion, thought, belief or attitude regarding any situation or occasion. To judge these ideas, scrutiny is required which is mainly describes as opinion mining. Ideas scrutiny is done to harvest and classify instinctive information in provided material by using analysis techniques on text, processing of natural language and rules of the language. Additionally, the objective of sentiment analysis is to induce the thinking of orator or writer towards specific subjects and to check the positivity and negativity of the reviewer related to that article. Generally, the attitude of the reviewer is based on assessment or judgment and state of mind in which the reviewer may be at the time of writing or reading.

The main problem that is going to be considered is to distinguish between negative and positive feedbacks, filtering spam comments and avoiding the problem of ellipsis. The main approaches used earlier were the method-based on the lexicon approach and machine learning approach that is also called a statistical approach. The orientation of the file or article can be calculated by the lexicon-based approach by measuring the semantic orientation of terminologies and phrases in the file. To proceed further in this method manually or automatically dictionaries of words are generated. Mostly adjectives are used as pointers for the orientation of content that is usually text and this orientation is done semantically. The statistical approach that classifies text majorly comprise on building machine classifiers that are trained on distinct data set of text or phrases that may be speech labeled or no. Unigrams and bigrams are

features that are used usually for training of dataset. These classifiers that are based on supervised learning methods present more knowledge about sentiments than simple unsupervised classifiers.

A method for aspect-based sentiment analysis is proposed in this paper to get knowledge about ideas somehow for the identification of spam comments. In this technique, firstly identification of aspect will be done, and then sentiments will be measured at a concept level. The technique that is proposed for the analysis of sentiments is the combination of the lexicon-based approach and machine learning.

2. RELATED WORK

Zhang, et al. (2017) gave an introduction of sentiment analysis. They discussed sentence sentiment, aspect sentiment and sentence classification methods of sentiment analysis. They also did a comparative study of supervised and lexicon-based an approach. Additionally, they elaborate on the different learning models like the topic model, corpus -based approach and dictionary-based approach.

Cambria, et.al. (2012) In this paper they introduced the concept of SenticNet 2 to overcome the gap between the world-level ordinary language and concepts or ideas transferred by them. Web plays a vital role in providing information about sentiments and opinions of people so in that case SenticNet 2 is a paradigm that helps us to extract, interpret and process this information using AI and Web Semantic techniques.

Pontiki, Maria, et al. (2014) have given SemEval-2014 TASK4 concept which aimed at aspect-based sentiment analysis. The 4 tasks include term extraction of aspect, Aspect term polarity, category detection and category polarity of aspect. These tasks assist to determine aspects of entities targeted and sentiments of each aspect.

Soujanya Poria, Erik Cambria, et.al(2014) gave a knowledge-based technology semantic computing for opinion mining and sentiments analysis, which is predicted at the ensemble Computing application of common sense and emotions' psychology to conclude the

conceptual and information of sentiments related to pure way of communication. For appropriate detecting of opinions transferred by the natural language, a naive approach of concept-level sentiment analysis is used.

Yanghui Rao, Jingsheng Lei, et.al(2014) In this article, three pruning techniques and an algorithm proposed which is efficient enough to build the emotional dictionary on the world level. This dictionary is used at the social level to detect emotions. Except words spell checker, topic-level dictionary also constructed by topic modeling in which every subject matter belongs to the collective sensations.

A. Moreo, et.al (2012) Contribution of this paper analyzer was "A lexicon-based comments oriented news sentiment(LCN-SA)" which has the potential to work with (a) detection of opinions of target users (b)tendency of users to express their opinions in language that may either natural of non standard (c) the design of language modularization with low-cost adaptability. The system has obtained promising results in experimental validation.

Penalver-Martinez, Isidro, et al (2014) in this study paper an avant-garde stance obtaining method is to procure with the long-established pure articulation manage Operandi including the belief of judgment Operandi. The primary intention of purposed Operandi is 1) to enhance hallmark garrison slant mining along using relationship at hallmark anthology elevation. 2) To dispense a contemporary vector investigation predominantly establish resemble for point of view survey. This system changed into carried out and punctuality tested rigid very propitious columniation when juxtaposing with other typical tactics.

Zahi Hong Dang et al. (2014) gave a oversee logic in idiom leading the methods to better identify sentiments from a training document with category label. The term weight is to measure the weight of terms for training documents using VSM (Vector Space Model). Now a day's very useful data/reviews about some products can be getting through tweets, facebook, and YouTube, etc. Useful text is fetched through term weighting scheme which contains two main factors, 1st is ITD (Important Term Document) which is further specified by two definitions on the bases of frequency and the

2nd one is ITS (Important Term Sentiments). To make Sentiment analysis more reliable ITS is learned through 7 statistical functions. They experimentally proved that their method is relatively providing outperforming results.

Mike Thelwall et al. (2011) presented a SentiStrength algorithm that performs better than any machine learning algorithm. Reviews from social networks are human coded data which is usually used by authors to quote as examples in books. Extracting sentiments from such human-made text is done through machine learning algorithms and they give better results but they are domain-specific. Some patterns are identified from the text or some classifiers are set against some type of text but there are chances of no accurate indicators so this SentiStrength algorithm is based on the Lexical approach. The two most common tasks of sentiment analysis, the 1st one is subjectivity and the other is polarity. The subject is selected from the text and checked how much it is positive or negative.

Soujanya Poria et al. (2016) proposed a method for aspect extraction in opinion mining. They introduced a seven-layer neural network alongside with some linguistic patterns to help tagging words either they are aspect based or not. The main tasks of aspect-based opinion mining is identifying opinion target and extracting the aspect.

Abinash Tripathy et al. (2016) cast-off the N-GRAM technique for the classification of comments and reviews on social sites. Clustering is very important to give a result quantitatively. They used algorithms of unsupervised machine learning like naïve Bayes(NB), support vector machine(SVM), maximum entropy(ME), for the prediction of comments stochastic gradient descent(SGD). N-GRAM near is used on these algorithms to obtain further accuracy.

Johannes v Lochter et al.(2016) solved the short term comments, abbreviations, emoticons, idioms, and symbols by using an ensemble technique. Three techniques automatically combine classification methods and text processing techniques. To extract meaningful words and phrases they used state of art techniques of semantics and context detection along with text expansion technique.

Soujhanya pyuria et al.(2016) presented a methodology for multimodal sentiment analysis which works on demonstrating a model for audio, video and textual modalities by extracting sentiments from web videos. Comparative experiments with the YouTube data set achieved nearly 80% of accuracy.

Weiyuan Li et al. (2014) Contributed a system based on the arithmetic rule to detect and identify emotions in microblog stanchion. Using a Chinees microblog of posts, a corpus-based on emotion is build. The results show the promising performance of the overall system.

Atefeh Heydari et al. (2015) This paper discussed spam review, their detecting techniques and strengths and weaknesses of these techniques. The technique proposed for the detection of review spam is "finding duplicates" It is discussed that to know whether the review is spam or not, data is categorized in three types i.e, Data-about-data, the content of reviews, and product information.

The biggest gap is the natural language data available to the machine and the concept level sentiments it extracted from those opinions and reviews. Aspect based Analysis of reviews is quite difficult understanding exactly what is written understanding the same perspective and semantic is basically the challenge of our research area. Distinguishing between negative and positive feedbacks, filtering spam comments and avoiding the problem of ellipsis and anaphora is also an issue. There are different techniques for opinion mining and each has its drawbacks some failed in fining sentiment word with domain-specific orientation, unsupervised learning techniques don't tell about people's interests and similarly supervised learning techniques fail on biased data.

The Objective of our research is to propose a methodology for scrutiny of opinions, introduce an effective technique for aspect sub-structure perspective mining and enhance anti-spam mechanism that is effective in categorizing the spam apparatus and eliminate the ellipsis and anaphora.

Research question in our research are the following:

1. How to detect spam comments?
2. Which method will be used to fetch semantics of reviews?
3. Which technique will be used to classify the spam reviews?
4. How the ellipsis & anaphora will be categorized and solved?

3. Problem statement

It states that a methodology should be proposed for an expert system for viewpoint Analysis of opinions. A technique should be proposed to implement aspect-based opinion mining. Proposed a solution for resolving Semantics and perspective of spam reviews and spam filtration problems in comments and reviews.

4. Proposed solution

The work in this field that others are worked or still working on of viewpoint scrutiny is divided into different categories based on their viewpoints some just involved the appliances training Operandi for the training and codification of datasets, lexicon-based approaches that involve the calculation of polarities of sentiments and the rule-based approach that identifies the opinion words and classifies it on the base of negative and positive words but we are going to use the combination of appliances training method and lexicon root near for aspect based scrutiny analysis and somehow for the identification of spam comments.

Lexicon and Learning-based model is used for identifying the aspects from the given comments of the users.

A Bayesian Gaussian concoction mock-up is repeatedly enlarged to good enough a vector of mysterious framework (symbolize in Bold) or statistical of quotidian dispensation. In a statistical stratification (i.e. one fashion a vector with N indiscriminate kaleidoscopic) one may craftsmanship a vector of framework (as many consternations of gesticulation or reinforcement inside a resemblance) applying a Gaussian concoction method preparatory dispensation on the vector of gauge particular by
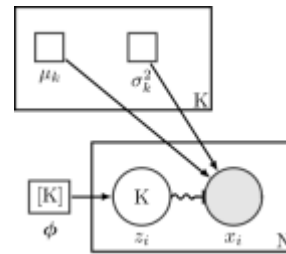

Figure 1: Bayesian Gussian mock-up

4.1 Lexicon and Learning-Based Approach

The main advantage of this combination of techniques is that it identifies the aspects and measures the sentiments at a concept level and less sensitive to changes that occur in the topic domain. At the very beginner level, we remove the garbage values from the test that effect the further processing of our data any pictures, emoticons, etc. Then aspects and views are extracted from the opinions to create the datasets for machine learning algorithm computations. Aspects are nouns and noun phrases and views are adjectives. How the Aspects and views are extracted from the opinion sentence
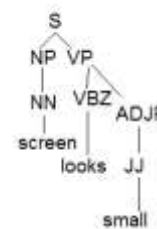
Now after identifying the aspects and the views from the opinions we assign them polarities that are positive, negative. Theses polarities are decided on the basis of semantic score we get from the SemanticWordNet dictionary which contains score against each adjective and returns +1 if it is positive and -1 if it is negative we store that information against each dataset regarding specific attribute (aspect).

Then we use a gaussian mixture model which is probabilistic model which calculate the probability of each dataset against its attribute and calculate probabilities and depending upon the highest probability we assign the dataset to respective class

$$p(\mathbf{x}|\lambda) = \sum_{i=1}^{M} w_i \, g(\mathbf{x}|\mu_i, \Sigma_i),$$

For identifying the spam comments, we train kNN classifiers for all the possible words that are irrelevant to the category and mostly spam words and then test aspect elements through the classifier if 50% of the aspects extracted from comments are marked as spam then that opinion is considered as spam.

1. **Data Sets**

We have used the data set of laptops and restaurants to get reviews and opinions of different authors about the associations and polarity. The Data set is obtained from Kaggle.com. Followings are the attributes of the laptop's data set:

1. Company Name
2. Model
3. Price
4. Editor's choice (stars)
5. Comment

Followings are the attributes of restaurant data set:

1. Name
2. Review
3. Likeness
4. Stars

Sample Data set of Restaurant Reviews

Restaurant Name	Review	Liked	Recommended	Stars
Broadway	Wow… Loved this place.	1	yes	5
Fri Chicks	Crust is not good.	0	no	1
Burger King	Not tasty and the texture was just nasty.	0	no	1
Mc Donald	Stopped by during the late May bank holiday off Rick Steve's recommendation and loved it.	1	yes	4
California Burger	The selection on the menu was great and so were the prices.	1	yes	4
Coke and Bull	Now I am getting angry and I want my damn pho.	0	no	2
Five Stars	Honestly, it didn't taste THAT fresh.)	0	no	1
Simply Sufi	The potatoes were like rubber and you could tell they had been made up ahead of time being kept under a warmer.	0	no	1
Monal	The fries were great too.	1	yes	5
Arcadian	A great touch.	1	yes	5
Gloria Jeans	The Service was very prompt.	1	yes	5
Pizza hut	Would not go back.	0	no	1
Dominos Pizza	The cashier had no care what so ever on what I had to say it still ended up being way overpriced.	0	no	2

Sample Data Sets of Laptop Review

Company Name	Model	Price	Editor's Choice	Comment
Toshiba	Satellite c850-x0110	Rs. 42,500	4	Typically great Razer design, at its best in the alternate Mercury White color scheme. Excellent performance, especially considering the small size. One of the only gaming laptops with a very thin screen bezel.
Dell	Inspiron 6400	Rs. 29,990	4	Hefty weight and dimensions. Poor gaming performance. Some minor design quirks.
Apple	MacBook Air	Rs. 137,592	3	The design feels dated, with a thick bezel around a low -resolution screen. Windows laptops in the same price range offer newer components, higher-res screens and lighter, slimmer bodies.

6. Results and Discussion

These are the reverberations that are already implemented by RNTN and CNN. As the interaction and location of words matter a lot for sentiment analysis so the bag of words model is not adequate. For example, if we observe the negative opinions of people, actually that are not the negative words rather expressed in negation of positive words. A very suitable model for this task is the recursive neural tensor network (RNTN) [15], which has exposed excellent performance in the analysis of sentiments. However, our data does not take fine-grain annotation of the parse tree at each node. Thus,

RTNT is not satisfied with these inputs. Instead of RNTN, we adopt a convolutional neural network (CNN) from [15], which needs sentiments at sentence level only. In Table 1 results are reported in case of laptops. Using these results, our system performed superior performance and graded in the 6th and 10th positions out of 28 submitted systems. In this case, the usage of Word Space is effective almost 2 points in measure of A1 when we noticed the gain if 4th position. Table 2 depicts the results in the case of restaurants. Here, the usage of Word Space does not show improvement in the concluding performance.

Table1: Aspect Term Extraction Results- Laptop.[15]

System (Rank)	S	N	A1
UNITORs-C (10/28)	.7741	.5764	.6608
UNITORs-U (6/28)	.7575	.6162	.6795
Best-System-U (2/28)	.8479	.6651	.7455
Best-System-C (1/28)	.8251	.6712	.7403

Table2: Aspect Term Extraction corollary - Restaurants.[15]

System (Rank)	S	N	A1
UNITORs-C (5/29)	.8244	.7786	.8009
UNITORs-U (6/29)	.8131	.7865	.7996
Best-System-U (1/29)	.8535	.8271	.8401
Best-System-C (2/29)	.8624	.8183	.8398

Table 3 results shows that proposed combination of kernel permits to achieve 8th rank with the system in the restaurant that will be unconstrained. If we notice the difference with the restaurant constrained setting that demonstrates the involvement of the Word Space attained from the TripAdvisor Corpus. Unfortunately, as shown in Table 4, it is not true for the laptop domain. The usage of Opinosis corpus lets the performance drop of the unconstrained setting

Table3: Aspect Term Polarity Results- Restaurants.[15]

System(position)	Accuracy
UNITOR-U (8/32)	.7777
UNITOR-C (12/32)	.7248
Prime-apparatus -U (5/32)	.7787
Prime-apparatus -C (1/32)	.8095

Table 4: Aspect Term Polarity Results- Laptop.[15]

apparatus (position)	Consistency
UNITOR-U (17/36)	.5675
UNITOR-C (10/36)	.6299
Prime-apparatus-U (5/36)	.7777
Prime-apparatus -C (1/36)	.7048

Our proposed model presents the following proposed technique.

7. Conclusions

The conclusion of this paper is the proposed model of deep learning to analyze the aspects of sentiments and opinions and to demonstrate comparable or overall best performance providing the finest results in each subtask. We proposed a novel approach to relate sentiments and opinions, based on some aspect, with the constituency tree that is parsed. Promising results and performance has achieved in unseen domains by using this model.

8. Future recommendation

In the future, the performance of transfer learning can be evaluated and test the proposed model by using a larger dataset. We can also explore more sophisticated models for predicting the aspects of opinions and sentiments using the adaptive threshold.

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