Introduction to Sentiment Analysis

Andrew Moore, Paul Rayson

March 2, 2018

School of Computing and Communications, Lancaster University.

Table of contents

Setup

Setup

1. Git clone:
   `https://github.com/apmoore1/SentiLexTutorial.git`
2. Within that directory run the following command:
   pip3 install -r requirements.txt
3. Followed by this command:
   python3 -m nltk.downloader stopwords

Sentiment Analysis Literature

What is Sentiment analysis?

is the field of study that analyzes people's opinions, sentiments, appraisals, attitudes, and emotions towards entities and their attributes expressed within text

[9]

Different levels of sentiment

1. Document
2. Sentence
3. Aspect

Coarse

$\downarrow$

Fine

Document sentiment analysis

Objective

To find the sentiment of a document.

Assumption

That the document is only discussing one entity

Datasets

1. Movie Reviews [21, 19, 12], hotel reviews [29], Amazon reviews [1, 6] and restaurant reviews (Yelp)[1].
2. Lots of labelled data out there '*in the wild*' and many more datasets that I have missed.

[1] https://www.yelp.co.uk/dataset_challenge

Document Example

User Reviews

★★★★★★★★★★ **please made your own decision**

8 June 2017 | by (egypt) – See all my reviews

stephen sommers two mummy movies are classic to me they are from best action adventure movies ever saw when this reboot announce i get so excited and worried in same time because the challenge was big but thank god the movie is great the story is unique the acting from all cast is great and sofia boutella performance was brilliant best mummy ever to me tom cruise very good like every time he do action movie the best thing in this movie is horror their are some good horror scenes this movie get bad review from critics like jack reacher movie that movie was good to me and entertainment please made your own decision and don't listening to any one including me don't let any body play in your head you are not a kid

37 of 67 people found this review helpful. Was this review helpful to you? Yes No [2]

[2] This came from IDMB website http://www.imdb.com/

Document papers to read

1. Original paper for document and sentiment analysis in general [21]
2. Unsupervised method [28]
3. Great evaluation across multiple datasets [18]
4. New Neural Network (NN) approach [31]

Sentence sentiment analysis

Objective

1. To find the sentiment of the sentence.

Datasets

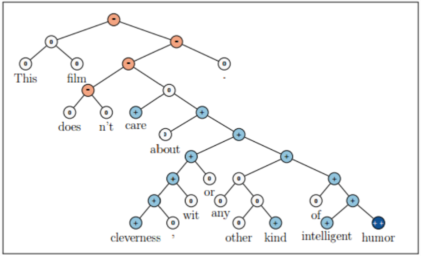
1. Movie review sentences [20]

Papers

1. One of the original papers [14], used a joint model of sentence and document.
2. Comparisons of different sentence level sentiment classifiers over different datasets [22]
3. Recusive Neural Network approach RNN [25]

Sentence Examples

[3]



[25]

[3] This came from rotten tomatoes website `https://www.rottentomatoes.com`

Subjectivity within sentences

Objective

1. To determine if the sentence is subjective or objective.

Examples

1. At several different levels, it's a fascinating tale. Subjective sentence.
2. Bell Industries Inc. increased its quarterly to 10 cents from seven cents a share. Objective sentence. [4]

Datasets

1. MPQA corpus [2]
2. Rotten tomatoes dataset [19]

[4] Both of these sentences are taken from [11]

Subjectivity and uses of subjectivity papers to read

1. Original papers [11] and [23]
2. Uses subjectivity to show that it is a good summary for document level sentiment analysis [19]

Twitter Sentiment

Objective

Given a Tweet predict the sentiment within it.

Datasets

1. SemEval Twitter Dataset [15]

Metric evaluation

$$F_{\text{pos}} = \frac{2(p_{\text{pos}} + r_{\text{pos}})}{p_{\text{pos}} * r_{\text{pos}}} \tag{1}$$

$$F = \frac{(F_{\text{pos}} + F_{\text{neg}})}{2} \tag{2}$$

Twitter sentiment papers

1. Original paper [17] automatically created a training set of Pos, Neg and Objective.
2. Ensemble approach to Twitter sentiment analysis [4]
3. Word embedding approach [26]

Sentiment lexicons

Objective

To create a list of words/phrases that are representative/associated with a sentiment class.

Approaches

1. Manual - create a sentiment lexicon from scratch by using annotators [10].
2. Thesaurus - expand a known set of sentiment words using relations within a thesaurus e.g. synonym relations [7]
3. Corpus - created by exploiting co-occurrences within a corpus [8]

Other papers

Hamilton et al. [5] used a word embedding approach to find sentiment words that are domain dependent.

Example of corpus lexicon creation

Pros:

- The sound is natural.
- Music is easy to find.
- Can enjoy creating my favorite play-lists.

Cons:

- The remote controller does not have an LCD display.
- The body gets scratched and fingerprinted easily.
- The battery drains quickly when using the backlight.

[8]

Aspect

Aspect sentiment has 7 different properties [3, 9]:

1. Aspect identification.
2. Sentiment of aspect.
3. Aspect groupings.
4. Opinion holder.
5. Time extraction.
6. Sentiment reasoning.
7. Sentiment qualifier.

Aspect Sentiment

Objective

Given text identify the sentiment of a specific aspect.

Approaches

1. Co-occurrences/window frame/pattern/dependencies [16]
2. Machine learning [24, 30]

Papers

1. Original paper [16]
2. Deep learning [24]
3. Deep learning with attention [30]

Reproducibility

Within our area there is a lack of sharing of code. At the moment we are very good at:

1. Sharing papers
2. Sharing datasets

Unfortunately we are not doing the same with code and this has been noticed [13]

Sentiment Workshops

Sentiment analysis workshops

1. SemEval [5]
2. WASSA [6]
3. ESA [7]
4. PEOPLES [8]

[5] http://alt.qcri.org/semeval2017/

[6] http://optima.jrc.it/wassa2017/

[7] http://gsi.dit.upm.es/esa2016/

[8] https://peoples2016.github.io/

Questions?

Andrew Moore	@apmoore94
Paul Rayson	@perayson

Tasks

Task 1: Online sentiment demos

Aim (spend 20 minutes on this, then we'll compare notes)

Try out existing web demos to see how they rate your test sentences and how their scores vary. Test them with a variety of capitalisation, repeated letters and exclamation marks for emphasis, plus emoticons. [27]

Systems

1. Potts Stanford (7-9 different sentiment lexicons): `http://sentiment.christopherpotts.net/textscores/`
2. SentiStrength: `http://sentistrength.wlv.ac.uk/`
3. NLTK 2.0.4: `http://text-processing.com/demo/sentiment/`
4. TheySay: `http://apidemo.theysay.io/`
5. Daniel Soper: `http://www.danielsoper.com/sentimentanalysis/`
6. LIWC: `http://liwc.wpengine.com/`

Task 2: Creating your own sentiment lexicon

We are going to create a sentiment lexicon using word embeddings and a few seed words [5].

Go to the Git repository that we cloned at the start in the command line and run the following command:
ipython3 notebook

References I

[1] J. Blitzer, M. Dredze, and F. Pereira.
Biographies, bollywood, boom-boxes and blenders: Domain adaptation for sentiment classification.
In *Proceedings of the 45th Annual Meeting of the Association of Computational Linguistics*, pages 440–447. Association for Computational Linguistics, 2007.

[2] L. Deng and J. Wiebe.
Mpqa 3.0: An entity/event-level sentiment corpus.
In *Proceedings of the 2015 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies*, pages 1323–1328. Association for Computational Linguistics, 2015.

[3] X. Ding, B. Liu, and P. S. Yu.
A holistic lexicon-based approach to opinion mining.
In *Proceedings of the 2008 international conference on web search and data mining*, pages 231–240. ACM, 2008.

[4] M. Hagen, M. Potthast, M. Büchner, and B. Stein.
Webis: An ensemble for twitter sentiment detection.
In *Proceedings of the 9th International Workshop on Semantic Evaluation (SemEval 2015)*, pages 582–589. Association for Computational Linguistics, 2015.

[5] L. W. Hamilton, K. Clark, J. Leskovec, and D. Jurafsky.
Inducing domain-specific sentiment lexicons from unlabeled corpora.
In *Proceedings of the 2016 Conference on Empirical Methods in Natural Language Processing*, pages 595–605. Association for Computational Linguistics, 2016.

[6] R. He and J. McAuley.
Ups and downs: Modeling the visual evolution of fashion trends with one-class collaborative filtering.
In *Proceedings of the 25th International Conference on World Wide Web*, pages 507–517. International World Wide Web Conferences Steering Committee, 2016.

References II

[7] M. Hu and B. Liu.
Mining and summarizing customer reviews.
In *Proceedings of the tenth ACM SIGKDD international conference on Knowledge discovery and data mining*, pages 168–177. ACM, 2004.

[8] N. Kaji and M. Kitsuregawa.
Building lexicon for sentiment analysis from massive collection of html documents.
In *Proceedings of the 2007 Joint Conference on Empirical Methods in Natural Language Processing and Computational Natural Language Learning (EMNLP-CoNLL)*, 2007.

[9] B. Liu.
Sentiment analysis: Mining opinions, sentiments, and emotions.
Cambridge University Press, 2015.

[10] T. Loughran and B. McDonald.
When is a liability not a liability? textual analysis, dictionaries, and 10-ks.
The Journal of Finance, 66(1):35–65, 2011.

[11] J. M. Wiebe, R. F. Bruce, and T. P. O'Hara.
Development and use of a gold-standard data set for subjectivity classifications.
In *Proceedings of the 37th Annual Meeting of the Association for Computational Linguistics*, 1999.

[12] L. A. Maas, E. R. Daly, T. P. Pham, D. Huang, Y. A. Ng, and C. Potts.
Learning word vectors for sentiment analysis.
In *Proceedings of the 49th Annual Meeting of the Association for Computational Linguistics: Human Language Technologies*, pages 142–150. Association for Computational Linguistics, 2011.

[13] E. Marrese-Taylor and Y. Matsuo.
Replication issues in syntax-based aspect extraction for opinion mining.
In *Proceedings of the Student Research Workshop at the 15th Conference of the European Chapter of the Association for Computational Linguistics*, pages 23–32. Association for Computational Linguistics, 2017.

References III

[14] R. McDonald, K. Hannan, T. Neylon, M. Wells, and J. Reynar.
Structured models for fine-to-coarse sentiment analysis.
In *Proceedings of the 45th Annual Meeting of the Association of Computational Linguistics*, pages 432–439. Association for Computational Linguistics, 2007.

[15] P. Nakov, S. Rosenthal, Z. Kozareva, V. Stoyanov, A. Ritter, and T. Wilson.
Semeval-2013 task 2: Sentiment analysis in twitter.
In *Second Joint Conference on Lexical and Computational Semantics (*SEM), Volume 2: Proceedings of the Seventh International Workshop on Semantic Evaluation (SemEval 2013)*, pages 312–320. Association for Computational Linguistics, 2013.

[16] T. Nasukawa and J. Yi.
Sentiment analysis: Capturing favorability using natural language processing.
In *Proceedings of the 2nd international conference on Knowledge capture*, pages 70–77. ACM, 2003.

[17] A. Pak and P. Paroubek.
Twitter as a corpus for sentiment analysis and opinion mining.
In *LREc*, volume 10, 2010.

[18] G. Paltoglou and M. Thelwall.
A study of information retrieval weighting schemes for sentiment analysis.
In *Proceedings of the 48th Annual Meeting of the Association for Computational Linguistics*, pages 1386–1395. Association for Computational Linguistics, 2010.

[19] B. Pang and L. Lee.
A sentimental education: Sentiment analysis using subjectivity summarization based on minimum cuts.
In *Proceedings of the 42nd Annual Meeting of the Association for Computational Linguistics (ACL-04)*, 2004.

[20] B. Pang and L. Lee.
Seeing stars: Exploiting class relationships for sentiment categorization with respect to rating scales.
In *Proceedings of the 43rd Annual Meeting of the Association for Computational Linguistics (ACL'05)*, pages 115–124. Association for Computational Linguistics, 2005.

References IV

[21] B. Pang, L. Lee, and S. Vaithyanathan.
Proceedings of the 2002 Conference on Empirical Methods in Natural Language Processing (EMNLP 2002), chapter Thumbs up? Sentiment Classification using Machine Learning Techniques.
2002.

[22] F. N. Ribeiro, M. Araújo, P. Gonçalves, M. A. Gonçalves, and F. Benevenuto.
Sentibench-a benchmark comparison of state-of-the-practice sentiment analysis methods.
EPJ Data Science, 5(1):1–29, 2016.

[23] E. Riloff, J. Wiebe, and T. Wilson.
Proceedings of the Seventh Conference on Natural Language Learning at HLT-NAACL 2003, chapter Learning subjective nouns using extraction pattern bootstrapping.
2003.

[24] S. Ruder, P. Ghaffari, and G. J. Breslin.
A hierarchical model of reviews for aspect-based sentiment analysis.
In *Proceedings of the 2016 Conference on Empirical Methods in Natural Language Processing*, pages 999–1005. Association for Computational Linguistics, 2016.

[25] R. Socher, A. Perelygin, J. Wu, J. Chuang, D. C. Manning, A. Ng, and C. Potts.
Recursive deep models for semantic compositionality over a sentiment treebank.
In *Proceedings of the 2013 Conference on Empirical Methods in Natural Language Processing*, pages 1631–1642. Association for Computational Linguistics, 2013.

[26] D. Tang, F. Wei, N. Yang, M. Zhou, T. Liu, and B. Qin.
Learning sentiment-specific word embedding for twitter sentiment classification.
In *Proceedings of the 52nd Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pages 1555–1565. Association for Computational Linguistics, 2014.

[27] P. Teh, P. Rayson, I. Pak, S. Piao, and S. Yeng.
Reversing the polarity with emoticons, pages 453–458.
Lecture Notes in Computer Science. Springer, 6 2016.

References V

[28] P. Turney.
Thumbs up or thumbs down? semantic orientation applied to unsupervised classification of reviews.
In *Proceedings of the 40th Annual Meeting of the Association for Computational Linguistics*, 2002.

[29] H. Wang, Y. Lu, and C. Zhai.
Latent aspect rating analysis on review text data: a rating regression approach.
In *Proceedings of the 16th ACM SIGKDD international conference on Knowledge discovery and data mining*, pages 783–792. ACM, 2010.

[30] Y. Wang, M. Huang, x. zhu, and L. Zhao.
Attention-based lstm for aspect-level sentiment classification.
In *Proceedings of the 2016 Conference on Empirical Methods in Natural Language Processing*, pages 606–615. Association for Computational Linguistics, 2016.

[31] J. Xu, D. Chen, X. Qiu, and X. Huang.
Cached long short-term memory neural networks for document-level sentiment classification.
In *Proceedings of the 2016 Conference on Empirical Methods in Natural Language Processing*, pages 1660–1669. Association for Computational Linguistics, 2016.