

01 – Opinion mining, sentiment analysis

IA161 Advanced Techniques of Natural Language Processing

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Opinion mining, sentiment analysis

Example 1:

So *boring*. I *enjoyed the first book* but *this one* really *didn't work* for me. The *story, characters, and relationships* all fell *flat*.

Example 2:

Lair of Dreams like everything else Miss Bray writes is *mind-boggling*. It's *big*. It's *insanely atmospheric* and it's *creeptastic*.¹

this book: boring
first book: enjoyed
this book: did not work
story: flat
characters: flat
relationships: flat

Lair of Dreams: mind-boggling
LoD: big
LoD: insanely atmospheric
LoD: creepstastic

¹both examples from goodreads.com

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2 Applications of opinion mining

3 Problem definition

4 Methods

Opinion mining, sentiment analysis

Opinion mining / sentiment analysis:

*Given a set of **subjective** texts that express opinions about a certain **object**, the purpose is to extract those **attributes** (features) of the object that have been commented on in the given texts and to **determine** whether these texts are positive, negative or neutral. [Dinu and Iuga, 2012]*

Automatic opinion mining: why?

- many subjective texts exist
- mostly because of social media
 - ▶ people express their opinions in texts
 - ▶ one's opinions influence others' opinions
 - ▶ aggregation of opinions
- also, there are review sites that influence customer behavior
- emotions make part of a decision process (see [Minsky, 2007])

“Opinions” are key influencers of our behaviors. [Liu, 2012]



Přidat fotky

Přehled recenzí



Pokoje · 2,2 ★★★★★

Někteří hosté uvedli, že koupelny jsou malé a že by mohly být čistější. · Z pokojů byl pěkný výhled.

Lokalita · 4,2 ★★★★★

Blízko zastávky veřejné dopravy. · Poblíž jsou obchody, pamětihodnosti, restaurace a bary. · Snadno dostupné autem

Služby a vybavení · 4,2 ★★★★★

Hostům se líbil přátelský a profesionální personál. · Hostům se líbila sauna a fitness centrum. · Hostům se líbila správa a recepce, ale někteří uvedli, že úklid by mohl být lepší.

MALL.CZ

MAL

★★★★★
4295

CENA A TERMÍN DODÁNÍ

KOMUNIKACE ESHOPU

OBSAH ZÁSILKY

ZKUŠENOST S VRÁCENÍM

ZKUŠENOST S REKLAMACÍ

Platba: On-line platby (

Platba kartou (Euro Ca



na MALLCZ už nikdy! Jednou jsem to zkusil a teď už se nikdy nevrátím. DRUČUJI!!!!

★ (ověřený zákazník)

olená

★ (ověřený zákazník)

naného zboží došlo něco zcela jiného, čemuž jsem zjistil, že zboží vůbec nemají a tudíž

Opinion mining: related applications

- document sentiment classification:
This document contains a lot of negative statements.
- sentence subjectivity classification:
This sentence is objective.
- aspect-based opinion summarization/aggregation:
Most customers of your company think that the communication is not good.
- mining comparative opinions:
Many people think that iPhone is better than SG.
- utility or helpfulness of reviews:
This review is useless.
- cross-lingual opinion mining

Problem definition

What is an opinion?

- an evaluating proposition: *Linux is great.*
- a comparative proposition: *Linux is better than Windows.*

*An opinion is simply a **positive or negative** sentiment, view, attitude, emotion, or appraisal about an **entity** or an **aspect of the entity** from an **opinion holder**. [Liu, 2012]*

entity *e* is a product, person, event, organization, or topic: iPhone, Madonna, Microsoft ...

aspect *a* (feature) is a component of *e* or attribute of *e*: battery, price, appearance, communication skills ...

Problem definition

opinion = $(e_j, a_{jk}, so_{ijkl}, h_i, t_l)$, where

- e_j is a target entity.
named entity recognition
- a_{jk} is an aspect/feature of the entity e_j .
information extraction
- so_{ijkl} is the sentiment value of the opinion from the opinion holder h_i on feature a_{jk} of entity e_j at time t_l .
sentiment identification
- h_i is an opinion holder.
information extraction
- t_l is the time when the opinion is expressed.
information extraction

not just **one** problem

anaphora resolution + synonym matching

Problem granularity

Generally, find structure in **unstructured** data (text)

- document level opinion mining: *The document is negative.*
- sentence level: *The sentence is negative.*
- object/entity and feature/aspect level: *iPhone is expensive.*

Classification task:

- 2-classes: positive/negative
- 3-classes: positive/negative/neutral
- 5-classes ...

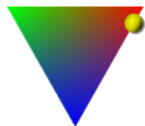
A hard problem (sometimes)

- opinion mining in tweets is relatively easy (short texts, hashtags) usually 3-classes classification for each tweet
- opinion mining in reviews is harder but still the form contains aspects and the reviewer has to mark the review positive/negative usually 2-classes classification for each aspect (e.g. high price)
- opinion mining in discussions, comments, blogs is very hard

sentiment lexicon

evaluative words: nice, cool, shit, bad. . .

SentiWordNet [Baccianella et al., 2010]



Positive: 0 Objective: 0.125 Negative: 0.875

blue = filled with melancholy and despondency

A hard problem (sometimes) II

evaluative word	aspect	sentiment
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thin	phone	good
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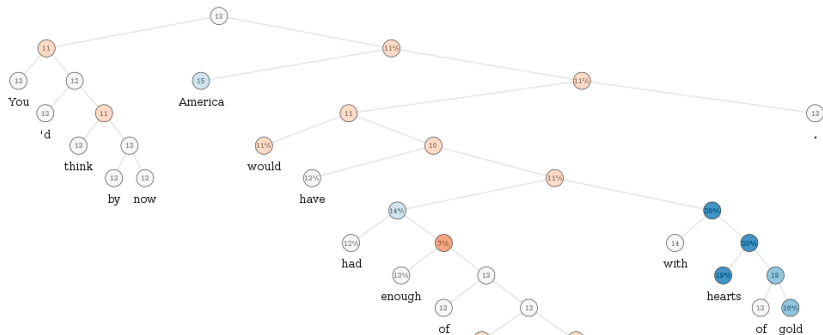
thin	steak	bad
------	-------	-----

high	value	good
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high	price	bad
------	-------	-----

flat	story	bad
------	-------	-----

flat	phone	good
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Sentiment analysis methods: supervised machine learning

- 1 get example data with labels
- 2 extract features from the data, i.e. convert the documents to feature vectors
- 3 train the parameters (choose an algorithm: SVM, Naive Bayes, Neural Networks ...)
- 4 test the model

Sentiment analysis methods: supervised machine learning

[Dinu and Iuga, 2012] report best results on Naive-Bayes with tokens as features and bigrams as features

[Liu, 2012] reports best results with SVM on balanced (English) data

currently (after 2014), neural networks are the most used technique

Note: use of word embeddings is questionable, since context vectors do not distinguish polarity (e.g. *good* and *bad* occur in similar contexts and thus have similar vectors).

Sentiment analysis methods: state-of-the-art results

- on political tweets, [Maynard and Funk, 2012]: **78% precision** and **47% recall**
- on document level (movie reviews)[Richa Sharma and Jain, 2014]: **63% accuracy** and **70% recall**
- sentiment embeddings [Tang et al., 2016]: outperform word2vec by about 6 percentage points,
F1 of Twitter Sentiment Classification on SemEval Datasets:
pos/neg class: **86.6%**
pos/neg/neu class: **67.5%**
hybrid ranking model (neural net catching context and sentiment) + text features (word n-grams, character n-grams, ...)
- a survey on using deep learning for sentiment analysis: [Zhang et al., 2018]

References I



Baccianella, S., Esuli, A., and Sebastiani, F. (2010).

Sentiwordnet 3.0: An enhanced lexical resource for sentiment analysis and opinion mining.

In Chair), N. C. C., Choukri, K., Maegaard, B., Mariani, J., Odijk, J., Piperidis, S., Rosner, M., and Tapias, D., editors, *Proceedings of the Seventh International Conference on Language Resources and Evaluation (LREC'10)*, Valletta, Malta. European Language Resources Association (ELRA).



Dinu, L. P. and Iuga, I. (2012).

The Naive Bayes classifier in opinion mining: In search of the best feature set.

In Gelbukh, A., editor, *Computational Linguistics and Intelligent Text Processing*, volume 7181 of *Lecture Notes in Computer Science*, pages 556–567. Springer Berlin Heidelberg.

References II



Liu, B. (2012).

Sentiment analysis and opinion mining.

Synthesis Lectures on Human Language Technologies, 5(1):1–167.



Maynard, D. and Funk, A. (2012).

Automatic detection of political opinions in tweets.

In García-Castro, R., Fensel, D., and Antoniou, G., editors, *The Semantic Web: ESWC 2011 Workshops*, volume 7117 of *Lecture Notes in Computer Science*, pages 88–99. Springer Berlin Heidelberg.






Minsky, M. (2007).

The Emotion Machine: Commonsense Thinking, Artificial Intelligence, and the Future of the Human Mind.

SIMON & SCHUSTER.

References III

-  Richa Sharma, S. N. and Jain, R. (2014).
Opinion mining of movie reviews at document level.
International Journal of Information Theory, 3(3):13–21.
-  Tang, D., Wei, F., Qin, B., Yang, N., Liu, T., and Zhou, M. (2016).
Sentiment embeddings with applications to sentiment analysis.
IEEE Transactions on Knowledge and Data Engineering,
28(2):496–509.
-  Zhang, L. J., Wang, S., and Liu, B. (2018).
Deep learning for sentiment analysis: A survey.
Wiley Interdiscip. Rev. Data Min. Knowl. Discov., 8.