Sentiment Analysis

Jelke Bloem & Giovanni Colavizza

Text Mining
Amsterdam University College

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Announcements

- Tuesday 02/05: Project update 1
- Tuesday 02/05: Project working session **cancelled**
- Friday 05/05: Liberation day (no lab)
- Monday 15/05: Project update 2
- Monday 15/05: Reading assignment - Bias in word embeddings

BERT reading assignment: Questions

- How well does it work on highly complex human-like tasks, such as common sense of language, slang, and situational jokes?

- If I understood correctly the CLS token represents the whole 'sentence' (text input). However, the text input, the sentence, can be a long text. It doesn't have to be a sentence as in a linguistic sentence. So, can the CLS token represents a whole paper of a few pages?

- Are there any other use cases of BERT that aren't described here? Or does this generally cover everything?

- Does BERT work better on languages that read in a different direction than English?

- Is it possible to not be able to use BERT for certain language tasks?
  - Sequence length limitation (512 tokens by default)
  - Generating text (in sequence)
  - Predicting negative descriptors: A sheepdog is not ... [1]

[1]What BERT is not: Lessons from a new suite of psycholinguistic diagnostics for language models https://arxiv.org/abs/1907.13528v1

BERT reading assignment: Questions

- Could BERT be made more efficient with more pre-training?
- Could BERT be used without fine-tuning?
- Has GPT-3 changed its fundamental architecture from the GPT discussed in the paper, and if not, how did it manage to outperform BERT as a chatbot (which includes questions and answers, something at which the paper considers it limited)?
- We see that OpenAI's (Chat)GPT model has inherent biases in deployment because of the data it was trained on. Does the same go for BERT? Assuming it does, how would such a model be used in deployment when we can't pinpoint at what stage the biases were infused into the model due to its black box structure?
- Knowing that machine learning models tend to exhibit bias, how does BERT compare to other language models in this regard?
- Models can be highly performant and give good fake results. How can we create more truthful models or even check for it?

BERT reading assignment: Questions

- The authors did not really discuss the prospects of future research using BERT, so what could be potential implications of such embedded architectures?
- How possible is it to install/download these kinds of models on your own computer and run them yourself, since the code and pre-trained models are public? Could you show us how to go about this?
  - Training only feasible for small datasets or by renting powerful AWS instances. Pre-training BERT would cost about $4000
  - Fine-tuning BERT-base: GPU with 12GB of RAM
  - Inference possible on any system, just slower
  - Some accessible code in my colleague Jelle Zuidema's course: https://clclab.github.io/ANCM/05_extra_lab_ICCN-EyeTracking.html

Sentiment Analysis

★ ★ ★ ★ ★ 6 maanden geleden

This is really a top notch sea and honestly my favorite sea out of all of them. I learned that the water gets saltier the further east you go in the sea which makes people more buoyant when swimming. If I could give it 10 stars, I totally would!

Sentiment Analysis

This review is from: **Black Dragon T-Shirt 100% Cotton Short Sleeve Shirt Pre-Shrunk (Apparel)**

This is, without a doubt, the best black shirt with an angry monochrome dragon perched on two natural pillars on a cliff that I have ever seen. I know that when I get married, this is the undershirt I'll wear. The amount of awesome displayed on your chest canvas while wearing this shirt, obviously a shirt given to man by Zeus himself, is currently impossible to calculate using our current mathematical constructs. We actually need to devise a new form of mathematics which we should call Wurm Theory in order to parse the data.

Demo

https://text2data.com/Demo

Definition

- Sentiment Analysis: The study of **opinions, attitudes and emotions** towards an entity expressed in a text
  - Persons, objects, events, topics
- Text classification of subjective information
- A one-dimensional scale of opinions is often assumed
  - like/dislike
  - for/against
  - positive/negative
  - five stars - one star
- Negative and positive polarity
  - Negative polarity item

Tasks

- Sentiment Classification
  - Classify the opinions expressed in a text or document into categories or on a scale
- Subjectivity Classification
  - Detect to what extent a text contains opinions, evaluations, emotions, beliefs etc.
- Opinion Summarization
  - Summarize the opinions generated by describing a specific entity
- Opinion Retrieval
  - Retrieve documents that express an opinion about an entity of interest
- Emotion Detection
- Sarcasm/Irony Detection
- Opinion Spam Detection
  - Messages/reviews that aim to distort the public perception of an entity

Opinions on entities?

1. I bought an iPhone a few days ago.
   - a fact, not an opinion
2. It was such a nice phone.
   - positive opinion
   - on the phone as a whole
   - from the author of the review
3. The touch screen was really cool.
   - positive opinion
   - on a component of the phone
   - from the author of the review
4. The voice quality was clear too.
   - positive opinion
   - on a characteristic of the phone
   - from the author of the review

Opinions on entities?[2]

5. Although the battery life was not long, that is ok for me.
   - negative opinion?
   - on a characteristic of the phone
   - from the author of the review

6. However, my mother was mad with me as I did not tell her before I bought it.
   - negative emotion/opinion
   - towards the author of the review
   - from the mother of the author of the review

7. She also thought the phone was too expensive, and wanted me to return it to the shop.
   - negative opinion
   - on a characteristic of the phone
   - from the mother of the author of the review

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[2]Example from Liu (2010) Sentiment Analysis and Subjectivity. In Indurkhya & Damerau (eds.) Handbook of Natural Language Processing, CRC Press: Chapter 26.

Entities

- Entity of interest can be a product, person, event, organization or topic
- Entities can have components (battery, screen)
- Entities can have attributes (size, weight, price)
- Or just 'object features'

Opinions

- A view, attitude, emotion, or appraisal on a feature from an opinion holder
- **polarity**: positive, negative or neutral orientation
- **emotion**: subjective feelings and thoughts. Many categorization schemes exist, e.g. VADC, Valence - Arousal - Dominance - Concreteness
- **opinion holder**: a person or organization. Often the author of a post, or sometimes another party that is mentioned (e.g. in a news article)

Unit of analysis

Sentiment of...

- A community
- A specific other person
- The user/author
- Expressed in a document, e.g. a song
- Clause, sentence or paragraph
- Entity or object feature

Applications

- Movies: is this review positive or negative?
- Product: what do people on Twitter think about the new iThingy?
- Advertising: show an ad of our product to people who expressed positive sentiment on a similar product
- Politics: how much do people like this political party currently?
- Economics: is the Twitter stock going to go up or down?
- Users: what other users share similar feelings towards an entity of interest?
- Public sentiment: how is consumer confidence?
- Customer support: is this customer happy or unhappy?
- ...

Characteristics

Sentiment analysis is a type of text classification, but...

- Relatively few categories
- Categories not independent, but e.g. ordinal
- Often not connected to particular domains, topics or users
- Opinions are expressed in complex ways
  - Lexical content may not be enough
- Ordering effects
- Use of rhetorical devices such as sarcasm and irony
- Information often left implicit
- Different sentiments expressed within a text or even sentence
- Relevance of smileys/emoji

Characteristics

- Negation is complicated
- What is the scope?

*I do **not** call this film a comedy movie and it's bad*

- Scope ambiguity

I wasn't watching all the time

= I was watching none of the time, or I was watching some of the time?

- Long distance negation

*I really like horror movies, but I do **not** feel the same about this one*

Methods

- Supervised classification
    - e.g. (binarized) Multinomial Naive Bayes
    - Many datasets available, e.g. movie review polarity datasets, Amazon reviews
    - Plenty of self-annotated data
- Use of lexical resources
    - SentiWordNet
    - WordNet synsets with sentiment scores: positivity, negativity and objectivity
    - Whissell's Dictionary of Affective Language
    - About 9000 words rated in terms of their Pleasantness, Activation, and Imagery (concreteness)

Methods

- Use of lexical resources
  - Regular WordNet (Hu & Liu, 2004)
  - Begin with known adjectives: "great", "excellent", "awful" etc
  - For unknown adjectives, measure distance to seed adjectives
  - Use k-nearest neighbour style classification to decide
- Hu & Liu, 2004 developed their own polarity lexicon using this method (2006 positive and 4783 negative words)

Methods

- Supervised classification

Useful features:

- Terms and their (weighted) frequency
- Part-of-speech tags
- Opinion words and phrases ("what a trainwreck!")
- Negation
- Emoticons/emoji
- Syntactic dependencies

Evaluation issues

- Low inter-rater reliability, hard to get a ground truth
- STS-Gold dataset: Full agreement only on 2/3rd of tweets (for negative/positive/neutral)
- Krippendorff's alpha of 0.765 for tweet-level annotation
- 0.416 for entity-level annotation per tweet

Sentiment is subjective and can be reader-dependent