Sentiment Analysis

Jelke Bloem & Giovanni Colavizza

Text Mining
Amsterdam University College

May 2, 2022

Announcements

- Monday 09/05: Project update 1
- Wednesday 11/05: Reading assignment - Bias in word embeddings

BERT reading assignment: Questions

- What is "finetune all the parameters end-to-end"?
- Why was BERT only applied to classification tasks and not to translation tasks?
  - BERT only adopts the encoder, not the decoder
  - 'catastrophic forgetting' due to too complex fine tuning procedure? [1]
- 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 ... [2]
- I felt like predicting and training differed. Do we have the mask when predicting?
- How is BERT able to handle different inputs for different downstream NLP tasks without a 'mismatch' between the pre-training and fine-tuning stages?
  - Make sure that enough data without a mask token is seen

[1] https://aclanthology.org/2021.eacl-main.241.pdf

[2] 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

- Concerning the [CLS] token's final hidden state which is claimed to be used as the "aggregate sequence representation for classification tasks" (p.4): how does this token represent any sequence aggregation or in short, what exactly does it incorporate?
  - Contains probability that sentence is a 2nd sentence, from sentence prediction task
- I'm curious if they received any criticism from the community after the publication of the paper, as I found it interesting that the architecture of BERT and OpenAI GPT is actually very similar
- Are there ways to prove the importance of (hyper)parameters mathematically or logically (even for simpler models)?
- What are the things we look for when trying to find a dataset to test our model?
- How does GLUE work?
  - Collection of many 'simpler' language understanding tasks such as semantic similarity, question answering, linguistic acceptability, inference etc.

BERT reading assignment: Questions

- I don't really understand why the paper in which bidirectionality was achieved through combining left and right models (ELMO) did not reach anywhere close to BERT.
- Connection between BERT and Transformers?
  - Uses the encoder part of the transformer model, trained on two tasks:
  - Masked language modeling (predict hidden words)
  - Next sentence prediction (predict whether two sentences follow)
- Why are the segment embeddings important in the input architecture?
  - First or second sentence
- If the dataset contains a significant percentage of its content from a specific region, would it be more susceptible to bias?
- Could BERT be made more efficient with more pre-training?
- Could BERT be used without pre-training?
- State-of-the-art in other languages?
- How can we make better language models than BERT?

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?[3]

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

[3]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