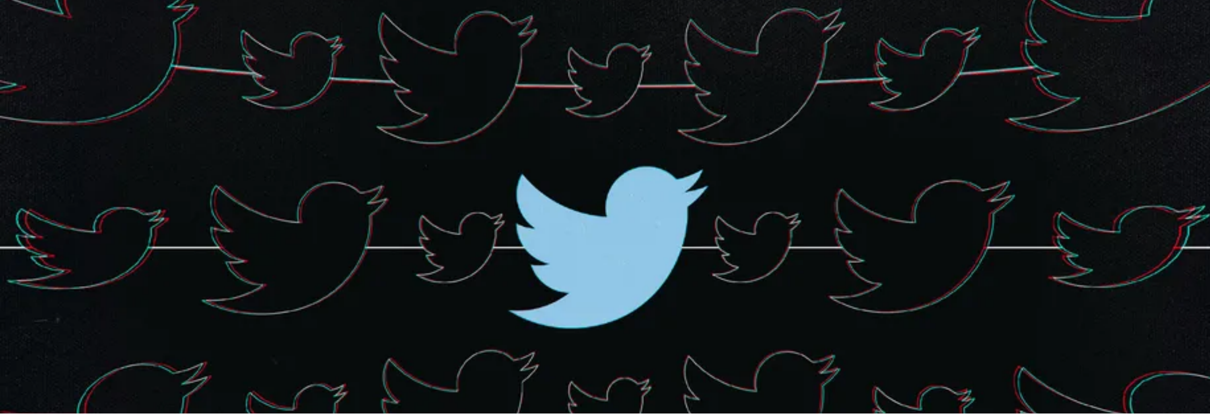

Topic-specific sentiment analysis for tweets by German MPs

Statistical consulting

Asmik Nalmpatian & Lisa Wimmer | July 12th, 2021

REFERENCES

1 INTRODUCTION & PROJECT OUTLINE

1 INTRODUCTION

- Social media: constant stream of publicly available **text data**
- **Twitter** established as a medium for political discourse and constant source of information
- Frequently resurfacing **research questions:**
  - Which **topics** are being addressed?
  - What kind of **sentiment** is expressed about these topics?

1 PROJECT OUTLINE

- **Primary goal:** analysis of public sentiment in a topic-aware manner for posts scraped from Twitter by German Members of Parliament (MPs)

  → Explore how **topic-specific sentiment analysis** can be implemented with (1) standard ML techniques and (2) more complex DL models.

- **Secondary goal:** make analysis of social media texts in a political context more easily accessible to researchers

  → Provide teaching material on both approaches, composed as a coherent online course

2 GENERAL THEORETICAL CONTEXT

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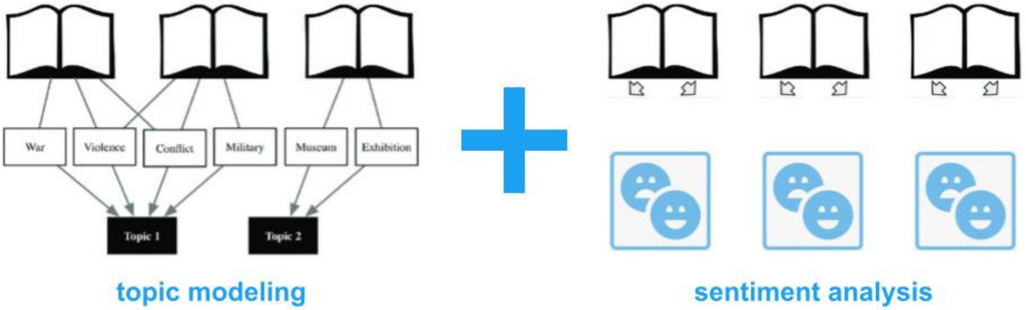

Figure: Adopted and modified from Min and Park (2016)

→ Topic-specific sentiment analysis

2 TOPIC MODELING: IDEA

- **Goal**: discover latent semantic structures in a corpus & group documents into topical clusters with characteristic topic-word distributions
  - Exploratory tool $\rightarrow$ unsupervised learning task
  - Means of dimensionality reduction
- For each document $d \in \{1, 2, \ldots, D\}$, assign a topic label $k \in \{1, 2, \ldots, K\}$
  - K: key **hyperparameter**
  - Interpretability up to human practitioner

2 TOPIC MODELING: TAXONOMY

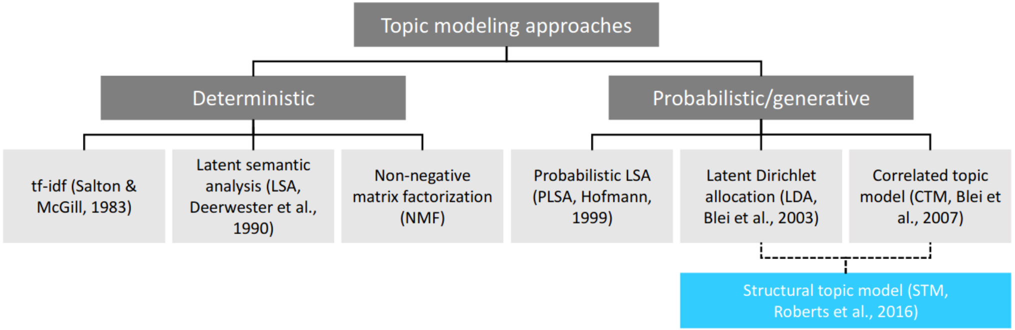

Figure: Source: own representation, published on https://lisa-wm.github.io/nlp-twitter-r-bert/

2 TOPIC MODELING: GENERATIVE APPROACHES

Idea: reverse-engineer the imaginative process of document generation with hierarchical Bayesian mixture models

1. For each document $d \in \{1, 2, \dots, D\}$, draw a vector of topic proportions from some assumed distribution
2. For each word position $n \in \{1, 2, \dots, N_d\}$, $N_d \in \mathbb{N}$,
    1. draw a topic assignment from the distribution associated with the document-specific topic proportions
    2. draw a word from the distribution associated with the topic

2 TOPIC MODELING: GENERATIVE APPROACHES

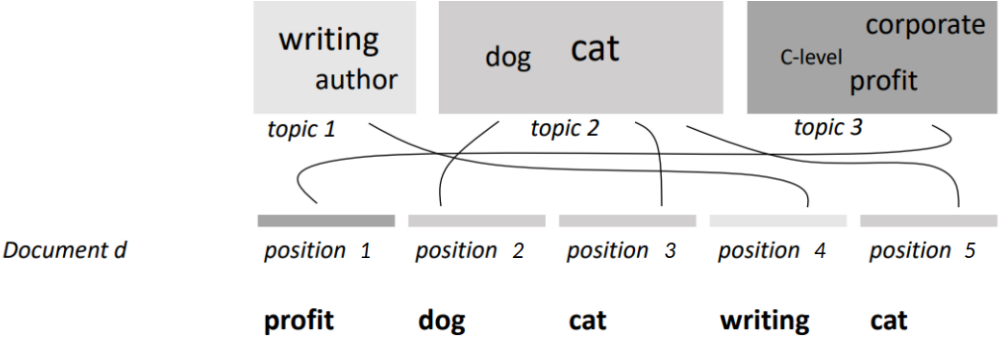

Figure: Source: own representation, published on https://lisa-wm.github.io/nlp-twitter-r-bert/

2 SENTIMENT ANALYSIS

- **Goal**: assign sentiment labels to documents - in our case, out of $\{$positive, negative$\}$, formalized as $y \in \mathcal{Y} = \{0, 1\}$
- Standard **classification** task
- Find $f : \mathcal{X} \rightarrow \mathbb{R}^g$, $\mathcal{X} \subseteq \mathbb{R}^p$ for $p \in \mathbb{N}$
- Methods considered:
  - Standard ML: random forests & regularized logistic regression
  - BERT: fine-tuning to sentiment analysis

2 TOPIC-SPECIFIC SENTIMENT ANALYSIS

Idea: combine topic modeling & sentiment analysis

- Subsequent modeling mostly due to the complexity of joint models

- Standard ML:

    - Build clusters of tweets based on topic modeling
    - Use clusters to generate topic-specific word embeddings

- BERT:

    - Aspect-based sentiment analysis (ABSA)
    - Aspect extraction & aspect sentiment classification

3 ANALYSIS

4 KNOWLEDGE TRANSFER

5 DISCUSSION

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