

Public Opinions on COVID-19 Vaccines from Social Media: A Machine Learning Study



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Understanding public opinion from social media

- Declining response rates and high costs associated with traditional surveys
- Abundant and freely-available social media data
- Data from sites like Twitter are rich, but also noisy and complex
- Machine learning research offers tools for natural language processing (NLP)



We analyze tweets about COVID-19 vaccines by...

- **Identifying** the themes of tweets
- **Classifying** tweets into the identified categories
- **Visualizing** major subtopics within categories
- **Tracking** changes in conversation about vaccines



Human-labeled data: Tweets about COVID-19 vaccines (~6,000 tweets)

- 7 human-defined topics: Getting vaccinated & gratefulness (32.2%), Politics & production (29.1%), Research (11.7%), Side Effects (8.4%), Skepticism (5.8%), Others (8.6%), Noise (4.3%)

Classification model

- Bidirectional Encoder Representations from Transformers (BERT) model
- Models pre-trained on large corpus of Twitter data related to COVID-19 (Nguyen et al. 2020, Müller et al. 2020)
- Fine-tuned BERT model on context-specific classification task

Model application: CoVaxxy Dataset (sample of ~800,000 tweets)

- English-language tweets sampled from CoVaxxy dataset, collected from January 2021 to August 2021
- Classified into 7 topics by fine-tuned BERT model

Results



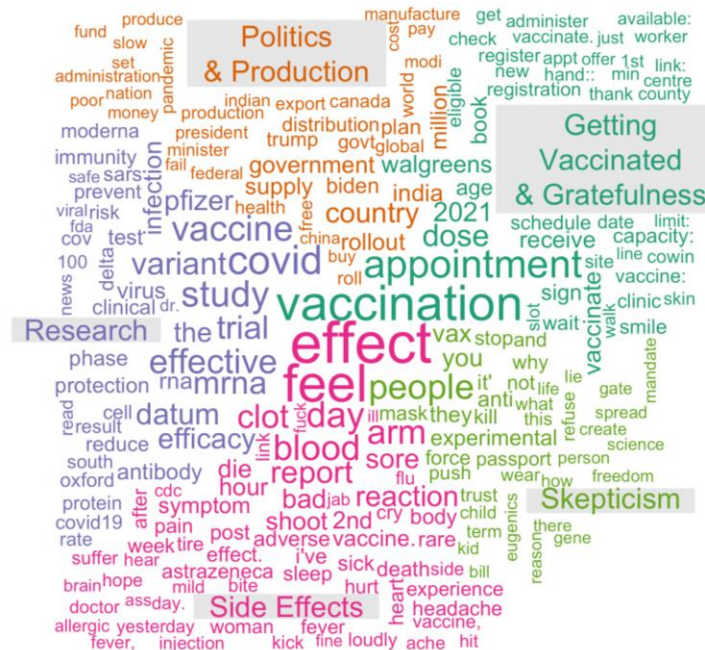
Robust Model Performance

- Minimal supervision required

Model Name	Accuracy	Macro-F1	Runtime
Naïve Bayes	0.662	0.540	
Support Vector Machines	0.696	0.568	
BERTweet-COVID19 (Nguyen et al. 2020)	0.763	0.674	1:33:04
COVID-Twitter-BERT (Müller et al. 2020)	0.788	0.716	8:35:30

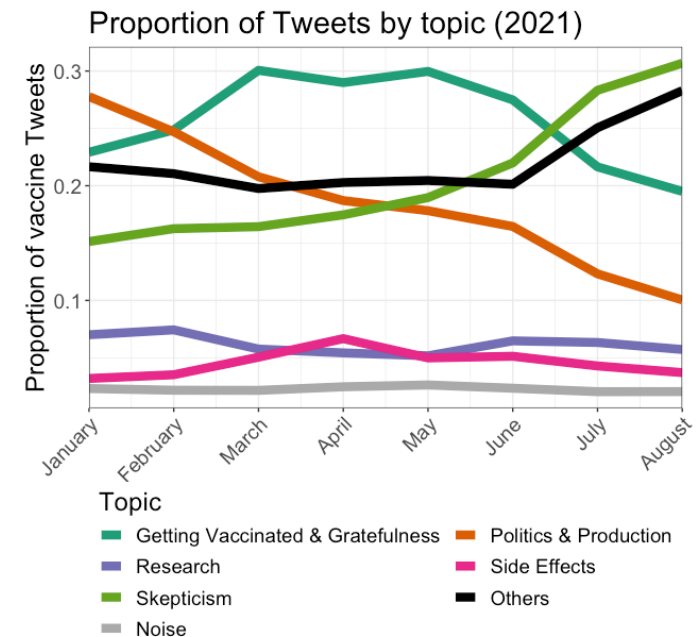
Word Frequency Results

- Frequent words consistent with labeler expectations



Changes in conversation over time

- May be utilized to examine changes in conversation over time



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