

Ethically Developing an African American Tweet detection algorithm to inform culturally sensitive Twitter based social support intervention for dementia caregivers

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Background and Aims

The prevalence of dementia is higher for African Americans than Whites.¹ Although deep learning and other statistical techniques have been widely applied to infer demographic information on Twitter, those demographic detection algorithms tend to be unavailable to open science communities and/or require access to account details that could compromise individuals' privacy.² The purpose of this study is to develop an ethically acceptable lexicon-based African American Tweet detection algorithm to inform culturally sensitive Twitter based social support intervention for African American dementia caregivers.

Methods

- For our Tweet corpora, we extracted 3,291,101 Tweets using hashtags associated with African American-related discourse (#BlackTwitter, #BlackLivesMatter, #StayWoke) and 1,382,441 Tweets from a control set (general or no hashtags) from September 1, 2019 to December 31, 2019 using the Twitter API.
- For our literature corpora, we extracted 14,692 poems and prose writings by African American authors and 66,083 items authored by others as a control, including poems, plays, short stories, novels and essays, using a cloud-based machine learning platform (Amazon SageMaker) via ProQuest TDM Studio.
- Lastly, we combined statistics from log likelihood and Fisher's exact tests as well as feature analysis of a batch-trained Naive Bayes classifier to select lexicons of terms most strongly associated with the target or control Tweets.

Results

- A total of 803,495 Tweets (24.41%) associated with African American-related discourse and 369,348 Tweets (26.71%) in the control group were identified as unique and non-bot generated Tweets.³
- Size of the lexicon: African American lexicon contains 1,735 unigrams and control contains 2,267 unigrams.

Table 1. Statistics of log likelihood, Fisher's exact tests, and feature analysis of a batch-trained Naive Bayes classifier on sample terms in African American lexicon

term	aa_freq	all_freq	log_ratio	log_p	fisher_ratio	fisher_p	bayes_nll	doc_freq	log_inv_freq
black	28873	52819	1.85	0.00	2.89	0.00	-6.22	29880	1.71
white	22301	51368	1.47	0.00	1.84	0.00	-6.50	31968	1.64
old	20267	63743	1.08	0.00	1.12	0.00	-6.69	40211	1.41
woman	18606	40940	1.54	0.00	2.00	0.00	-6.59	24799	1.90
hair	7693	23581	1.11	0.00	1.16	0.00	-7.37	18011	2.22
hell	3786	10955	1.17	0.00	1.26	0.00	-7.88	8891	2.92
hurt	2756	7413	1.26	0.00	1.42	0.00	-8.11	6175	3.29
Jesus	1687	4298	1.33	0.00	1.55	0.00	-8.45	2973	4.02
Harlem	1586	1778	3.03	0.00	19.77	0.00	-8.33	1116	5.00

Discussion

- A lexicon composed of unigrams was more effective at differentiating Tweets from held-out test samples of the two groups. Ongoing experiments involving classifiers using more sophisticated language models, specifically Bidirectional Encoder Representations from Transformers (BERT), have a strong likelihood of significantly altering the findings above.
- **Ethical Consideration:** Identifying existing African American communities and discourse patterns on social media platforms like Twitter is the first basic step towards understanding a community and culture necessary to develop culturally sensitive interventions (e.g., terms, norms, culturally sensitive expressions).
- As a limitation, it is important to consider the ethical issues regarding the use of Twitter data in mental health surveillance. Researchers must be aware of the unresolved distrust towards scientists and health professionals among African Americans in the U.S. due to historical factors (Tuskegee experiment)



Conclusion

With ethical concerns in mind, our first version of a lexicon-based African American Tweet detection algorithm developed using literature and Tweet texts can be used both effectively and ethically to inform culturally sensitive Twitter-based social support interventions for African American dementia caregivers and future studies are needed to refine this algorithm.

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