

Vaccine attitudes detected in tweets by AI model

July 12 2022



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People's attitudes towards vaccines can now be detected from their social media posts by an intelligent AI model, developed by researchers at the University of Warwick.

The AI-based model can analyze a social media post and establish its author's stance towards vaccines, by being "trained" to recognize that

stance from a small number of example tweets.

As a simple example, if a post contains mentions of mistrust in healthcare institutions, a fear of needles, or something related to a known conspiracy theory, the model can recognize that the person who wrote it likely feels negatively towards vaccinations.

The research is to be presented today (July 12) at the 2022 Annual Conference of the North American Chapter of the Association for Computational Linguistics. It is led by Professor Yulan He of the University's Department of Computer Science.

Professor He and her colleagues at the University of Warwick have used a dataset of 1.9 million tweets in English, posted from February to April 2021, to develop the Vaccine Attitude Detection (VADet) Model.

VADet first analyzed the stream of tweets concerning COVID-19 vaccines, learning an ever-increasing variety of elements and contexts pertinent to the ongoing vaccination debate. Then, the model gradually narrowed down its analyses by looking at patterns characterizing user's concerns and attitudes.

VADet looks for statistical patterns in words relating to different topics or stance. It is built on a large-scale language model pre-trained on a large amount of text from English books and Wikipedia and has already gained some linguistic knowledge. It was then trained using vaccine-related tweets so that it understands what topics have been discussed in those tweets.

A small number of those tweets were then manually labeled by the researchers with information on the user's stance towards topics discussed in vaccine-related tweets. VADet can leverage such a small amount of labeled tweets to distinguish semantic information relating to

stance and topic from the remaining unlabeled tweets.

The AI model then arranged the tweets into clusters of similar aspects, forming geometric patterns that visually demonstrate how certain viewpoints on vaccinations (pro-vaccination, anti-vaccination, or neutral) can be linked with specific detectable characteristics or references in a social media post.

The model could potentially be used to provide insights into why people are negative about vaccination, information that government and health organizations can use to design better targeted messages to reassure the [general public](#) about vaccination.

Professor Yulan He from Warwick's Department of Computer Science and AI Acceleration Fellow at The Alan Turing Institute commented that "the COVID pandemic intensifies the use of social media. People express their attitudes towards matters relating to public health, including COVID-19 vaccinations. We have shown that it's possible to monitor social media traffic, detect vaccine attitudes and segment tweets into clusters discussing similar aspects. Such real-time monitoring of public attitudes could help healthcare organizations and [government agencies](#) address [vaccine hesitancy](#) and combat misinformation regarding vaccines in a timely manner."

The key to the breakthrough lies in the specially developed algorithm, which has two crucial capabilities. Firstly, it can leverage large-scale social media data about vaccination to detect topics automatically. This is done by inserting a topic layer into an existing pre-trained language model.

Secondly, the algorithm can be adapted on a small set of [social media posts](#) labeled with vaccine attitudes to automatically detect particular patterns of topics and topic-associated attitudes. "This so-called adaptive

self-improvement capability has not previously been explored for vaccine attitude detection," says Lixing Zhu, a Ph.D. student at the Warwick's Department of Computer Science who implemented the VADet model.

Professor He added that "the WHO identified vaccine hesitancy as one of the top ten health threads to the world in 2019. By automatically detecting [vaccine](#) attitudes from social media, our solution has the potential to enable more timely intervention to address concerns towards vaccination."

The research is published on *arXiv*.

More information: Lixing Zhu et al, Disentangled Learning of Stance and Aspect Topics for Vaccine Attitude Detection in Social Media, *arXiv* (2022). arXiv:2205.03296 [cs.CL] arxiv.org/abs/2205.03296

Conference: 2022.naacl.org/

Provided by University of Warwick

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