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Virginia Woolf's letters and diaries inspire suicide prevention study

Researchers use computer algorithms to predict patterns of suicidal behavior in Woolf's writings

October 24, 2018 - By: Camila Raposo

A group of researchers from the Federal University of Rio Grande do Sul (UFRGS) analyzed the use feasibility of text classification algorithms to predict patterns of suicidal behavior. From the letters and diaries of the British writer Virginia Woolf, the computer program was able to identify with considerable accuracy - 80.45% correct - the texts written in the months immediately preceding her suicide. The results of the study were published in the scientific journal PlosOne and demonstrate the potential of machine-learning techniques for the detection of risk situations and the prevention of suicide.

Machine-learning is a branch of artificial intelligence focused on algorithms capable of learning from data extraction and pattern building to make predictions. Machine learning employs a set of techniques for the analysis of large amounts of data and identification of nonlinear correlations between them. In this study, the *Naive Bayes* algorithm was used. Based on text analysis and widely employed for spam filtering, the method estimates the probability of occurrence of an event. "It seemed a good idea to us to analyze the letters and diaries of the famous novelist Virginia Woolf, who was a very productive writer, even in the preceding days leading of her suicidal attempts. Basically, we created a model using her texts and the *Naive Bayes* algorithm to identify portions of texts that would signal that she was prone to suicide," explains Ives Cavalcante Passos, a professor of the UFRGS Faculty of Medical Sciences, and one of the members of the research group.

Virginia Woolf suffered from bipolar disorder and committed suicide in 1941, at the age of 59 - Photo: Press

Virginia Woolf's diaries are vast and rich written material, where she freely wrote about her feelings, recording in detail her states of humor. According to biographers and researchers, the writer suffered from bipolar disorder and had several depressive and manic episodes, until she took her own life during one of them, more precisely on March 28, 1941. She had attempted suicide on at least three occasions. Even a week before she died, she came home soaking wet after surviving one of those attempts.

"About 90% of people who commit suicide have some form of psychiatric illness. Although it is a tragic event, there are several ways to prevent suicide. The scientific literature, therefore, has increasingly sought models that can predict this event to identify which people are most at risk," says Passos. There are other studies that have also used machine-learning to predict suicide, including a few done by the same research group, like one that has used algorithms to predict suicide attempts in patients with mood disorders from clinical variables such as the presence of psychotic symptoms or of Post-Traumatic Stress Disorder. The one referred to here, however, was the first to use text data to identify patterns in pre-suicide writings.

The analysis comprised 46 texts written in the two months prior to Virginia's suicide and 54 randomly chosen texts from those produced in other periods of her life. Only letters and journals formed the research corpus; books, novels, short stories and articles were excluded. "We compiled these texts into an Excel spreadsheet and used a package called *Caret* from the software called 'R' to do the analyses. The *Naive Bayes* machine-learning algorithm was chosen for the analysis because it can classify with trusted accuracy when text data is used. The template is first created in a training database and then tested on letters that were not used in the training process," explains the researcher.

It is from the identification of textual patterns that the algorithm estimates whether or not a particular document is related to suicidal tendencies. Some terms appeared exclusively in the texts that Virginia wrote shortly before committing suicide, such as 'blue', 'miss', and 'war'. Others only appeared outside of this period, such as 'better', 'good', 'hope' and 'Virginia'. There are also those that, despite having appeared in both periods, were more frequent at one of the two stages. It is precisely such presences or absences of specific words that the computer estimates.

The algorithm was able to correctly identify whether a text was suicide-related or not in 80.45% of all cases – a very positive result. There were 69.23% of suicide-related texts correctly classified, and 91.67% non-suicide-related accurately identified as such. This study was done at an individual level and, therefore, has its limitations. The results, however, are promising.

As explained by Passos, machine-learning algorithms can be applied to patients with psychiatric disorders by collecting real-time data from their social network interactions - messages and emails, among others. "For example, when an adverse event is flagged as a result of interest by the physician (such as attempted suicide, relapse of a mood episode, or psychotic symptoms), the algorithm can analyze the text data to find patterns that allow predicting when these events are likely to occur again. This can improve patient assessment, enable early intervention, and provide real-time insights for physicians about mood and suicide risk. Additionally, such models can be customized for the patient, creating an artificial intelligence cycle that adapts as data is collected over time," says the professor. To him, machine-learning techniques, with their ability to capture non-linear signals and process large amounts of data, will revolutionize health sciences and mental health sciences.

Scientific article

BERNI, Gabriela de Ávila et al. **Potential use of text classification tools as signatures of suicidal behavior: a proof-of-concept study using Virginia Woolf's personal writings**. PlosOne, 2018.

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