

CovidNPI: A Sentiment Analysis Dataset for Evaluating Nonpharmaceutical Interventions of COVID-19

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Abstract

Coronavirus disease 2019 (COVID-19) has infected 1,587,209 individuals all over the world and caused 94,850 deaths, as of April 9 in 2020. To effectively contain COVID-19, many nonpharmaceutical interventions (NPIs), such as school closure, travel bans, are being taken. Are these NPIs – which have huge negative impacts on economics and society – effective for controlling the spreading of COVID-19? Different research studies have different opinions. It is necessary to collectively analyze the results reported by different studies all over the world, reconcile these results, and make a holistic and unbiased conclusion regarding whether an NPI is worthwhile to take. To facilitate such studies, we develop a sentiment analysis dataset that contains 200 labeled sentences from recent literature about COVID-19. Each sentence contains one or more NPIs. Each NPI in a sentence is annotated with a sentiment: either positive or negative. “Positive” indicates the NPI is effective according to the study results and “negative” indicates that the NPI has no clear evidence to be worthwhile for taking. The dataset is available at <https://github.com/UCSD-AI4H/COVID-Nonpharmaceutical-Interventions>

1. Introduction

Coronavirus disease 2019 (COVID-19) is an infectious disease that has infected 1,587,209 individuals all over the world and caused 94,850 deaths, as of April 9 in 2020. Key to combating COVID-19 is to contain the spreading of coronavirus. To achieve effective containment, governments, enterprises, and citizens have been taking nonpharmaceutical interventions (NPIs). NPIs are actions, apart from getting vaccinated and taking medicine, that people and communities can take to help slow the spread of illnesses. Examples of NPIs include school closures, travel bans, bans on mass gatherings of various sizes, and other social distancing approaches. NPIs have strong negative implications to economics and societies. For example, travel bans severely reduce the income of airline companies. School closures largely hurt the education quality. As a result, governments and organizations are very cautious about taking NPIs unless they are proven to be highly worthwhile. Unfortunately, the effectiveness of many NPIs is not easy to confirm. Different decision-makers have different opinions and would debate about whether an NPI should be taken. Such hesitation and debate may miss the best time to take actions. For example, in US, there has been a long

debate regarding whether the general public should wear facial masks. At the beginning, the Center of Disease Control (CDC) claims that there is no need to do so. But recently, CDC starts to encourage the public to wear facial masks. A long delay of this particular NPI probably have caused numerous infections.

There have been many studies evaluating the effectiveness of NPIS, through simulation models or social studies. However, existing studies are mostly conducted separately on different populations in local geographical regions, using different simulation models. Different populations have different social, economical, and educational characteristics. As a result, an NPI effective for one population may not be effective for another. This population bias incurs inconsistent or even conflicting conclusions regarding whether an NPI is effective. As a result, governments cannot make informed decisions on whether an NPI should be adopted.

To address this issue, one approach is to develop natural language processing methods to collectively analyze the results reported by different studies all over the world, reconcile these results, and make a holistic and unbiased conclusion regarding whether an NPI is worthwhile to take. To facilitate such studies, we develop a sentiment analysis dataset that contains 200 labeled sentences from recent literature about COVID-19. Each sentence contains one or more NPIS. Each NPI in a sentence is annotated with a sentiment: either positive or negative. “Positive” indicates the NPI is effective according to the study results and “negative” indicates that the NPI has no clear evidence to be worthwhile for taking. The dataset is publicly available.

2. Dataset

We develop Covid-NPI-Sentiment, a sentiment analysis dataset for evaluating the effectiveness of nonpharmaceutical interventions of COVID-19. The dataset contains 200 labeled sentences from scientific literature. Each sentence has at least one NPI and each NPI is annotated as being positive (effective for controlling the spreading of COVID-19) or negative (not effective). In these 200 sentences, 267 mentions of NPIS are labeled with sentiments. Among them, 194 NPI mentions are labeled as positive and 73 are labeled as negative. The average, maximum, and minimum number of NPI mentions in a sentence is 1.3, 5, and 1 respectively. Table 1 shows some examples of the dataset.

The sentences in Covid-NPI-Sentiment are from the COVID-19 Open Research Dataset (CORD-19) (Inc., 2020). In response to the COVID-19 pandemic, the White House and a coalition of research groups prepared the CORD-19 dataset. It contains over 45,000 scholarly articles, including over 33,000 with full text, about COVID-19, SARS-CoV-2, and related coronaviruses. These articles are contributed by hospitals and medical institutes all over the world. Since the outbreak of COVID-19 is after November 2019, we select articles published after November 2019 to study, which include a total of 2081 articles and about 360000 sentences. Many of these articles present studies on the effectiveness of NPIS.

We manually review NPI-related articles and select sentences that contain conclusions about the study results. Then we review each of such sentences, identify NPIS in the sentence, and annotate a sentiment to each NPI. For example, given this sentence: “Stopping mass gatherings is predicted to have relatively little impact (results not shown) because the contact-time at such events is relatively small compared to the time spent at home,

Table 1: Exemplar labeled data examples.

Sentence	NPI	Sentiment
Stopping mass gatherings is predicted to have relatively little impact (results not shown) because the contact-time at such events is relatively small compared to the time spent at home, in schools or workplaces and in other community locations such as bars and restaurants.	stopping mass gatherings	negative
Adding household quarantine to case isolation and social distancing is the next best option, although we predict that there is a risk that surge capacity may be exceeded under this policy option (Figure 3 and Table 4).	household quarantine	positive
	case isolation	positive
	social distancing	positive
At the same time, by implementing population-wide social distancing, the opportunity for onward transmission in all locations was rapidly reduced.	population-wide social distancing	positive
Overall, our results suggest that population-wide social distancing applied to the population as a whole would have the largest impact; and in combination with other interventions – notably home isolation of cases and school and university closure – has the potential to suppress transmission below the threshold of $R=1$ required to rapidly reduce case incidence.	population-wide social distancing	positive
	home isolation of cases	positive
	school and university closure	positive
This may need to be supplemented by school and university closures, though it should be recognised that such closures may have negative impacts on health systems due to increased absenteeism	school and university closures	negative

in schools or workplaces and in other community locations such as bars and restaurants”, the annotation would be (stopping mass gatherings, negative), where “stopping mass gatherings” is an NPI and its corresponding sentiment is negative, based on the conclusion – “have relatively little impact”. As another example, given this sentence: “Adding household quarantine to case isolation and social distancing is the next best option, although we predict that there is a risk that surge capacity may be exceeded under this policy option (Figure 3 and Table 4)”, we can make an annotation – (household quarantine, positive), where “household quarantine” is an NPI and the sentiment is positive based on the conclusion – “is the next best option”. In some sentences, there are multiple NPIS. Under such circumstances, we annotate multiple NPI-sentiment pairs. For example, from this sentence: “Overall, our results suggest that population-wide social distancing applied to the population as a whole would have the largest impact; and in combination with other interventions – notably home isolation of cases and school and university closure – has the potential to suppress transmission below the threshold of $R=1$ required to rapidly reduce case incidence”, we generate three annotations: (population-wide social distancing, positive), (home isolation of cases, positive), and (school and university closure, positive).

3. Conclusions

We develop Covid-NPI-Sentiment, a sentiment analysis dataset for evaluating the effectiveness of nonpharmaceutical interventions of COVID-19. The dataset contains 200 labeled sentences from scientific literature. Each sentence has at least one NPI and each NPI is an-

notated as being positive (effective for controlling the spreading of COVID-19) or negative (not effective). The dataset is publicly available.

References

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