DigEpi

DIGITAL EPIDEMIOLOGY: A NEW WAY FOR REAL-TIME MONITORING OF COVID-19

Project key information

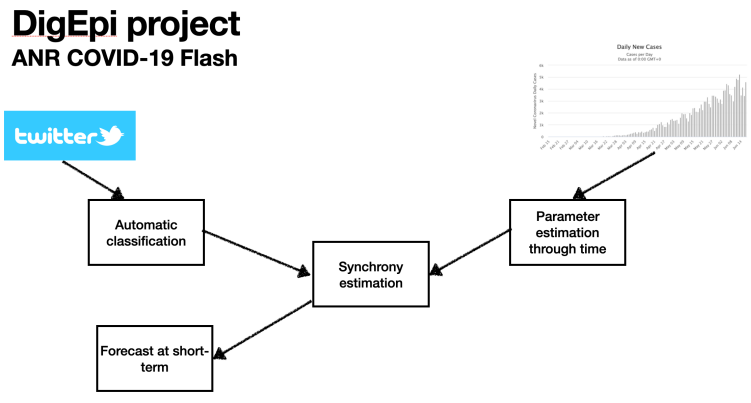
Project leader : Benjamin Roche, MIVEGEC, IRD, 911 Avenue Agropolis, 34390 Montpellier, France; benjamin.roche@ird.fr
Project duration : 18 months; Starting date : April 2020
IRD budget : 100 K€; Total budget : 100 K€

Partner institutions

IRD / UMMISCO, Bondy, France; Sorbonne Université; IRD / MIVEGEC, Montpellier, France

Context

The emergence of SARS-COV2 already had an impact that no other pathogens had during the last century. With more than 200,000 infected people and more than 10,000 deaths (at March 20th 2020) and a global economy slowing down critically, the consequences of this pandemics are already extremely heavy. Nevertheless, this situation will probably last for months, and it becomes critical to adapt public health responses according to this evolving situation.To do so, public health authorities need to understand, almost in real time, what is the level of local transmission intensity and the efficiency of confinement measures. However, both are very challenging to estimate because extensive individual testing to quantify transmission intensity is not possible during that period, and the efficiency of confinement measures relies strongly on human behavior which we always struggled to characterize.To this extent, digital epidemiology represents today an interesting innovative tool. Indeed, social networks are a popular place to discuss about a large variety of topics. From a psychological point of view, the discussion on social networks can reflect real behavioral changes and/or perception of a context that could be hard to catch for authorities. This is why analysis of these messages have already been used in epidemiology, and was quite successful in forecasting epidemiological dynamics (Salathé et al. 2012) or to infer human behavior (Roche et al. 2017) of emerging infections. A recent study has also shown that data from Twitter, despite the lack of its socio-economic representativity, within forecasting mathematical models produce similar results than models using large-scale poll data (Jourdain et al. n.d.). As it was expected, the appearance of the COVID-19 got an huge resonance on social networks. Therefore, the aim of this project is to use this enormous amount of data in order to identify, in real-time, when local transmission intensity is expected to grow or confinement efficiency is expected to decline.



Objectives

Our project is divided into 4 different tasks and will be concentrated within 4 large towns in France (Paris, Marseille, Lyon and Montpellier). All the epidemiological data from these towns could be accessed through Public Health France. First, we will develop simple mathematical models to estimate variation in time of transmission intensity and efficiency of confinement measures through time. Then, the task 2 will focus on developing a deep-learning methodology to classify automatically the thousands of twitter messages related to COVID19 within these towns. After that, task 3 will analyze the synchrony of the evolution of twitter message classifications with fluctuations in the estimated transmission intensities and confinement efficiency in order to identify classes of twitter messages that are rising/disappearing several days before an expected epidemiological change. Finally, task 4 will develop an application for public health authorities that will analyze, in real-time, the contents of Twitter messages in order to anticipate an increase of transmission intensity and/or a decrease in confinement efficiency.

Organisation and expected results

This project will be conducted mostly by four researchers. Benjamin Roche, Research Director at the French National Research Institute for Sustainable Development (IRD), will be the PI of this project. Involved in digital epidemiology and mathematical modeling since a solid decade, he will organize the research activities and communication with public health authorities.
Bernard Cazelles, Professor at Sorbonne-Université, is a biomathematician, member of the High council of Public Health, with a strong expertise on inference of epidemiological models and wavelets analysis.
Frédéric Jourdain, PhD student with Benjamin Roche and Jean-Claude Desenclos (Public Health France) is currently doing a PhD on understanding outbreaks of vector-borne pathogens. He has also a strong interest in developing digital epidemiology approach and will help on that part.
The one-year post-doctoral fellowship will have a computing background in order to test the different deep-learning algorithms for Twitter messages classification and to develop the decision-making platform for the public health authorities.

Applications in the South

This project aims to set up the methodology for using real-time data from social network to anticipate fluctuations in epidemiological dynamics. This method is currently implemented in different southern countries to improve epidemiological surveillance, especially in Mexico and in Cote d'Ivoire.

References

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