Subject: IA approaches to integrate population-based survey data into COVID-19 surveillance systems

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Abstract (up to 10 lines):

The COVID-19 pandemic in France has highlighted the need for public health surveillance systems that do not depend solely on biological tests. Based on the data collected through a population-based survey on virus history and transmission in the Haut-Rhin department (Alsace, Grand-Est region, France), the PhD objective is to explore how IA methods could be used to integrate information collected from citizens with hospital data into a surveillance system for emerging diseases. The program of work will include an analysis of the sociological and medical data from the 1500+ families that responded to the survey, using different IA approaches, in relation to hospital data, in order to understand the dynamics of virus transmission and the most relevant symptoms, looking for early warning indicators.

Skills:

The successful candidate should have a strong scientific background, a very good training on statistics and data analysis and significant knowledge on Artificial Intelligence tools and methods. Team player, he/she is expected to be curious about the medical, biological and mathematical dimensions of this multidisciplinary PhD. Hard worker and self-motivated, he/she must be able to carry on his research work in an autonomous way while being able to communicate it clearly.

Keywords: COVID-19, population-based survey, Artificial Intelligence, Citizen Science, Aggregates

Description (up to 1 page):

COVID-19 pandemic has highlighted the unpreparedness of western civilization to handle an emerging disease. Beside biological and hospital information, population-based approaches can play an important role to raise an early alarm. This was highlighted by an online survey that was conducted in April and May 2020 to study the virus history in the department of Haut-Rhin, one of the first clusters of the COVID-19 outbreak in France. About 1500 families answered to a large set

questions where social habits were put in relation to the occurrence of COVID-19 symptoms among family members.

According to the preliminary results obtained from data reported by 1 244 families representing 3 274 individuals [1], the epidemic threshold occurred several weeks before the alert was raised by local sanitary authorities on March 3rd 2020.

Based on this CODIV-19 experience, the goal of the PhD is to explore how Artificial Intelligence techniques could be used to merge biological, hospital and population-based data into an early warning system for future emerging diseases [3].

Several tasks have been identified to achieve this purpose, where different artificial intelligence tools and techniques (text mining, machine learning, etc…) will be used:

- Analyze the COVID-19 epidemic using the population-based survey data together with hospital information from Haut-Rhin hospitals.
- Improve knowledge extraction by automatic thesaurus creation from open questions
- Extract from this analysis key indicators relevant for raising an early alarm. The use of spatial scans for the detection of aggregates will be explored [2].
- Propose scenario or simulations of surveillance systems

Références (up to ½ page):

Breton, Vincent and Guiguet-Auclair, Candy and Odoul, Joséphine and Peterschmitt, Jonathan and Ouchchane, Lemlih and Gerbaud, Laurent, Population Based Survey of the COVID-19 Outbreak in the Haut-Rhin Department from January to April 2020 (May 11, 2020). Available at SSRN: https://ssrn.com/abstract=3601684

Kulldorff M., A spatial scan statistic. Communications in Statistics - Theory and Methods. 26 (6) (1997): 1481–1496. doi:10.1080/03610929708831995

P. Le Turniera, C. Leport, P. Martine, C. Jadand, B. Hoenf, J.-F. Guegan, Multi-sectorial research is paramount for preventing and controlling emerging infectious diseases, , Revue d'Epidémiologie et de Santé Publique 68 (2020) 133–136

How to apply?

Contact the supervisor