The Hospital Clínic and BSC will use Artificial Intelligence to predict the evolution of patients with COVID-19

An AI model based on information from more than three thousand clinical reports generated by the Hospital Clínic during the acute phase of the pandemic will be created.

The objective is to assist physicians in treating patients and those responsible for centers in logistics planning in the event of a new wave.

The model will be trained on the MareNostrum supercomputer at the Barcelona Supercomputing Center.

The project is part of the Plan to Promote Language Technologies of the Secretary of Digitalisation and Artificial Intelligence in which the BSC participates.
The Hospital Clínic de Barcelona (HCB) and the Barcelona Supercomputing Center (BSC) work together to create a model based on artificial intelligence (AI) that helps doctors predict the evolution of patients with COVID-19 and those responsible for the centers to plan their internal organization in the event of a new wave. The project is part of the Plan for the Promotion of Language Technologies of the Secretary for Digitalisation and Artificial Intelligence, in which the BSC participates, and it is open to the collaboration of more hospitals.

To develop these tools, the HCB and the BSC will use the information contained in the clinical reports of 3,051 COVID-19 episodes (corresponding to 2,440 patients) that the hospital treated during the acute phase of the pandemic and those that may arise in the future. With the information on the diagnosis, treatment and evolution of these cases (duly anonymized), a model based on artificial intelligence (specifically deep learning neural networks) will be trained so that it will look for common patterns and generate predictions on the evolution of new patients.

**Collaboration between technology and healthcare**

The participants in this project are in talks with other hospitals in the main Spanish cities that are interested in joining the project. The University Hospital 12 de octubre from Madrid is finalizing the procedures for this and the Virgen del Rocío Hospital in Seville is holding conversations.

For models based on neural networks to be effective, they must be trained with large amounts of data, such as those provided by the Hospital Clinic.

They also require great computational capacity (like the computational capacity provided by the MareNostrum 4 supercomputer, from the BSC), since the training sessions need to be repeated thousands of times so that the system learns to distinguish between what is important and what is superfluous, as well as to establish correlations between events.

**Xavier Pastor**, Chief Medical Information Officer at the Hospital Clínic de Barcelona, says that “the COVID-19 pandemic has offered the opportunity to materialize the necessary collaboration between Institutions so that advanced research has a return for the benefit of the patient in the form of substantive help to the doctor in making decisions. All procedures have been extreme to preserve the confidentiality of health data to the maximum through technological, organizational and legal solutions and submitting the project to the consideration of the Ethics Committee that has issued its favorable opinion. With this collaboration, it will be possible to obtain an added value to the great effort of Health professionals who, under exceptional conditions, have used the computerized medical history without interruption as a documentary record in real time of the situation of each patient, of the actions that are taken. have carried out and the results obtained”.

**Alfonso Valencia**, director of the Department of Life Sciences at Barcelona Supercomputing Center, says: "The clinical reports of COVID-19 cases contain essential information to analyze the evolution of the disease, the response to treatment and the previous conditions of the patients who they may have been risk factors. This agreement enables collaboration between BSC experts in data mining and natural language processing with experts in clinical information management in hospitals and is essential to answer critical clinical questions about the origin and evolution of the disease. The ultimate objective of the collaboration is to provide health systems, and in particular the hospitals with which we collaborate, with computer systems that can contribute to improving the treatment of patients in both this and future epidemics”.

**A project of technical complexity**
The elaboration of prediction models based on clinical reports has the added complexity that, before training the artificial intelligence models, it is necessary to automatically extract all the relevant information contained in the various hospital documents referring to the same case (laboratory reports, radiology, diagnostics, clinical courses, etc.).

To achieve this, natural language processing technologies (another branch of AI) are used, which analyze the texts written by healthcare personnel and turn them into “events” that the system must take into account (relevant diagnostic results, symptoms, treatments, evolution, etc.).

These events are used to train neural networks, which will search for common patterns and, based on them, will make evolution predictions for new cases.

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