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Cover Story

Pandemic Prevention Strategies

Smart Thinking:

Oxford, GE to use AI against COVID-19 pneumonia; French team builds database with GE software

With the COVID-19 pandemic ongoing, efficient collection, analysis and management of patient data may play a pivotal role in supporting clinical decision-making and improving outcomes. GE Healthcare is part of several AI-driven projects in the UK and France, which are aimed at assisting clinicians with diagnosis, triage and treatment of COVID-19 patients.

Scottish microbiologist Sir Alexander Fleming famously discovered penicillin in London in 1928, but it was a team at Oxford University that purified and tested the antibiotic just in time for use during World War II. Oxford is again stepping up to help the world fight back, and this time it's against the COVID-19 pandemic. Scientists at the British university's Jenner Institute are leading the global race for a vaccine for the new coronavirus, with the results of human trials likely to emerge any day now.

The city of dreaming spires, as Oxford is known, is also home to another important project that's studying how artificial intelligence (AI) could help the diagnosis and treatment of one of COVID-19's main complications: pneumonia. The University of Oxford-led National Consortium of Intelligent Medical Imaging (NCIMI) is working together with GE Healthcare to devise software tools that can analyze medical imaging, laboratory and clinical data to help predict which patients stand the greatest risk of developing severe respiratory distress, a key cause of mortality for COVID-19 patients.

"We hope to develop a simple, mathematical prediction model for COVID-19 pneumonia to determine how well patients will do," says Fergus Gleeson, a consultant radiologist and professor of radiology at the University of Oxford.

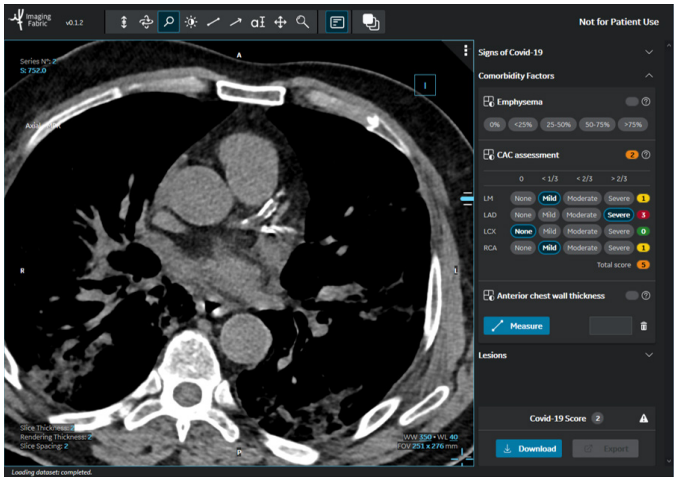
Gleeson says that COVID-19 patients with pneumonia generally fall into three categories: those who weather the disease well and might be able to recover at home, those who require admission and might either recover without significant interventions or deteriorate and require active monitoring, and those at risk of imminent deterioration, who may need to be admitted to an intensive care unit (ICU). But it is not always easy for clinicians to judge which category a patient belongs in.

The AI-enhanced COVID-19 Prognostic Algorithm study (HOST) may be a step on the way to allowing clinicians to more quickly make those calls. Gleeson says clinicians could enter key information about patients who present at hospitals with suspected COVID-19 into software that generates instant insights and predictions about them. These insights would help them diagnose, triage and treat with more speed and accuracy. "It would provide a base level of care for all patients," says Gleeson. It may also allow a hospital to prioritize its resources for the patients who are at the most risk.

The Oxford-based consortium will train algorithms developed by GE Healthcare engineers on mountains of imaging, biological and hematological data gleaned from thousands of machines and patients in the U.K. and beyond. "It's predominantly imaging-based [data], but we will combine this with as many other parameters as we can," says Gleeson, who splits his time between clinical care and academic research.

Across the English Channel in France, GE Healthcare is also collaborating with Assistance Publique-Hôpitaux de Paris to create a giant database around chest imaging in COVID-19 patients. This major study aims to analyze 10,000 thoracic CT scans to better understand patients' responses to COVID-19 and develop tools to automatically assess the severity of the disease.

A group of 20 expert radiologists involved in the project is using 3D image visualization software developed by GE Healthcare on the EDISON™ platform to analyze virus-affected areas and provide information on vascular, pulmonary or overweight comorbidity factors likely to



influence the course of the disease, such as the appearance of arteries, the appearance of unaffected lungs or the amount of fat in the chest wall.

"The physician reading the CT scan is interested in identifying early signs of the disease and assessing its extent," explains Professor Marie-Pierre Revel, head of the cardiothoracic imaging unit at Cochin Hospital in Paris, who leads the STOIC project (thoracian scanner for the diagnosis of coronavirus-19 pneumonia). "But the scan also provides other patient data, allowing us to establish a severity score that can be correlated with the patient clinical course. All this data is now available and should help us better understand why some individuals develop a severe form of the disease."

For example, most COVID-19 patients at hospitals in recent months have received a chest x-ray, while a smaller proportion have undergone CT scans, some of which have been performed as CT pulmonary angiograms – which allow clinicians to see how blood is flowing through the lung. The data from such images, such as the size and position of blood clots if present, will join that avalanche of biological and hematological data, which include electrocardiographic (ECG) readings, blood oxygen levels and biochemical measures of inflammatory responses. Added to the mix are data about the patient's treatment – whether they received high-flow oxygen or required mechanical ventilation in an ICU, or were sent home to recover. These caches are supplemented with data on clinical outcomes, allowing the algorithm to include the information on the patient's condition, treatment and outcome when it generates insights and predictions.

"As health systems manage COVID-19 cases, clinicians can benefit from new technologies to help triage and determine which patients are likely to develop respiratory distress and longer-term complications," said Kieran Murphy, President and CEO of GE Healthcare. "If we can help ensure patients are quickly placed in the right care setting, this may help to improve outcomes."

GE Healthcare is looking at other targets in this field. Recently, it announced its Thoracic Care Suite, a collection of algorithms that analyze chest X-rays and flag abnormalities for radiologists to review, including pneumonia, tuberculosis and lung nodules. The software also outputs a score for the eight possible abnormalities, which helps clinicians accelerate diagnosis and treatment. In one study, results showed a 34% reduction in reading time per case[1].

Back in Oxford, the HOST trial will last 12 months, and Gleeson hopes that, in the not too distant future, a clinician will be able to input a few data points about a patient – such as a blood oxygen level, an ECG reading and x-ray data – into a web-based picture archiving and communication system (PACS). The system is intended to instantly output a percentage likelihood that a patient will require admission to the hospital, or potentially admission for high-flow oxygen or ventilation.

In the longer term, Gleeson is optimistic about the potential for AI-derived insights in medicine. Also on his radar is AI modeled on international data sets that can generate insights about COVID-19 patients based on their ethnicity. "This is about the development of algorithms that can be validated at actual hospitals in the real world," he says.

The partners will also work with the U.K.'s National COVID-19 Chest Imaging Database and the British Society of Thoracic Imaging.

Article previously published on GE Reports.

[1] GE Healthcare data on file. - https://www.ge.com/news/reports/smart-thinking-oxford-ge-use-ai-against-covid-19-pneumonia-french-team-builds-data-base-ge