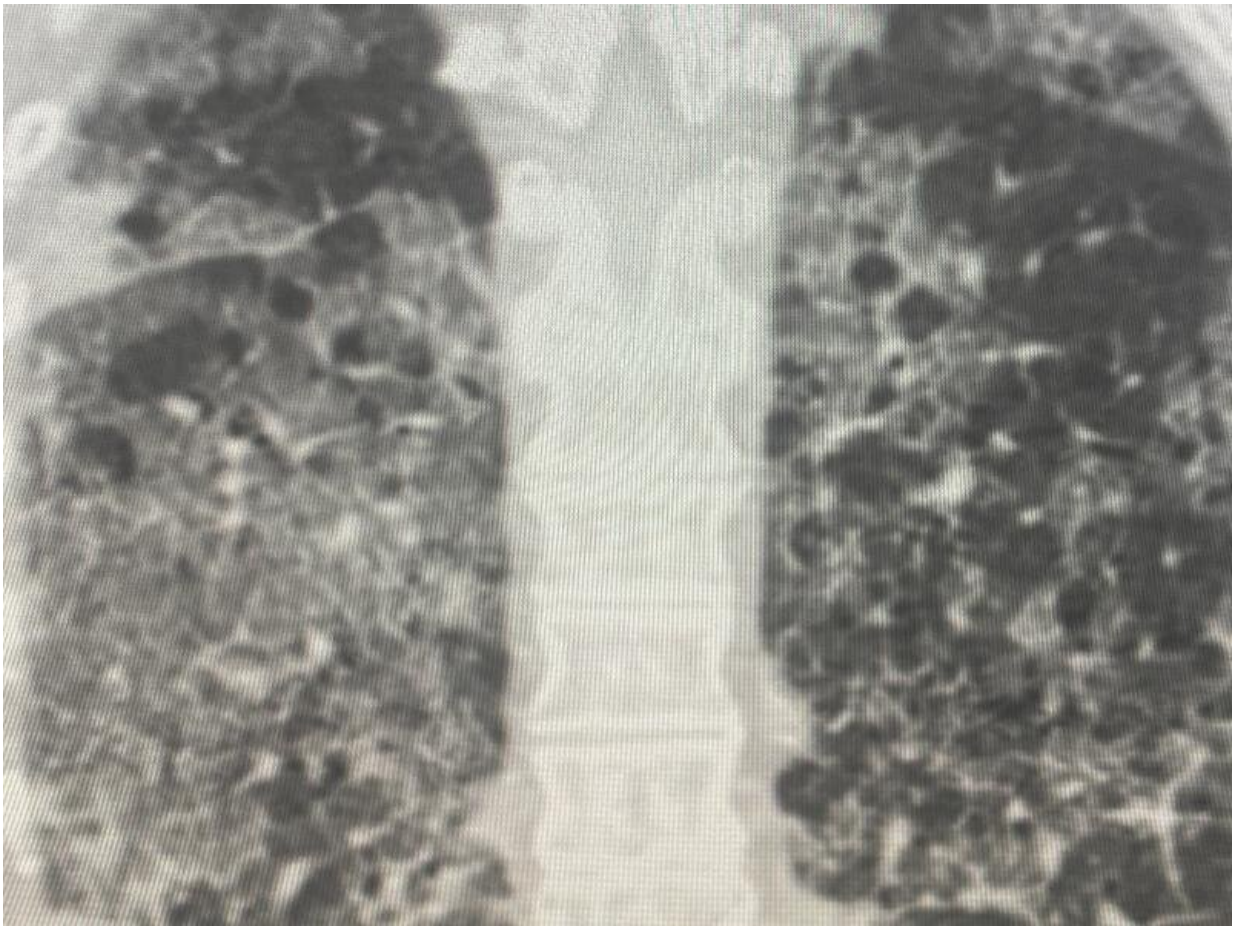
Algorithm accurately predicts COVID-19 patient outcomes

November 23 2020, by Torie Wells



Credit: Rensselaer Polytechnic Institute

With communities across the nation experiencing a wave of COVID-19

infections, clinicians need effective tools that will enable them to aggressively and accurately treat each patient based on their specific disease presentation, health history, and medical risks.

In research recently published online in *Medical Image Analysis*, a team of engineers demonstrated how a new algorithm they developed was able to successfully predict whether or not a COVID-19 patient would need ICU intervention. This artificial intelligence-based approach could be a valuable tool in determining a proper course of treatment for individual patients.

The research team, led by Pingkun Yan, an assistant professor of biomedical engineering at Rensselaer Polytechnic Institute, developed this method by combining chest computed tomography (CT) images that assess the severity of a patient's lung infection with non-imaging data, such as demographic information, vital signs, and laboratory blood test results. By combining these data points, the algorithm is able to predict patient outcomes, specifically whether or not a patient will need ICU intervention.

The algorithm was tested on datasets collected from a total of 295 patients from three different hospitals—one in the United States, one in Iran, and one in Italy. Researchers were able to compare the algorithm's predictions to what kind of treatment a patient actually ended up needing.

"As a practitioner of AI, I do believe in its power," said Yan, who is a member of the Center for Biotechnology and Interdisciplinary Studies (CBIS) at Rensselaer. "It really enables us to analyze a large quantity of data and also extract the features that may not be that obvious to the human eye."

This development is the result of research supported by a recent National

Institutes of Health grant, which was awarded to provide solutions during this worldwide pandemic. As the team continues its work, Yan said, researchers will integrate their new algorithm with another that Yan had previously developed to assess a patient's risk of cardiovascular disease using chest CT scans.

"We know that a key factor in COVID mortality is whether a patient has underlying conditions and heart disease is a significant comorbidity," Yan said. "How much this contributes to their disease progress is, right now, fairly subjective. So, we have to have a quantification of their heart condition and then determine how we factor that into this prediction."

"This critical work, led by Professor Yan, is offering an actionable solution for clinicians who are in the middle of a worldwide pandemic," said Deepak Vashishth, the director of CBIS. "This project highlights the capabilities of Rensselaer expertise in bioimaging combined with important partnerships with medical institutions."

Yan is joined at Rensselaer by Ge Wang, an endowed chair professor of biomedical engineering and member of CBIS, as well as graduate students Hanqing Chao, Xi Fang, and Jiajin Zhang. The Rensselaer team is working in collaboration with Massachusetts General Hospital. When this work is complete, Yan said, the team hopes to translate its algorithm into a method that doctors at Massachusetts General can use to assess their patients.

"We actually are seeing that the impact could go well beyond COVID diseases. For example, patients with other lung diseases," Yan said. "Assessing their heart disease condition, together with their lung condition, could better predict their mortality risk so that we can help them to manage their condition."

More information: Hanqing Chao et al, Integrative analysis for

COVID-19 patient outcome prediction, *Medical Image Analysis* (2020). DOI: 10.1016/j.media.2020.101844