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Computer Model Combats COVID-19: Finding a Solution Through Deep Learning

Dr. Turck:

As the COVID-19 pandemic continues to wreak havoc across the world, the hunt for potential treatments rages on, leading many to turn to technology to help us find effective solutions. And now, we might finally have not just one, but ten potential treatment options, all thanks to a new deep learning computer model. Coming to you from the ReachMD studios in Fort Washington, Pennsylvania, this is *COVID-19: On the Frontlines*. I'm Dr. Charles Turck and joining me to discuss this new computer model and its findings is Dr. Ping Zhang, Assistant Professor of Computer Science and Engineering and Biomedical Informatics at the Ohio State University. Dr. Zhang, welcome to the program.

Dr. Zhang:

Thank you for the invitation, doctor.

Dr. Turck:

So, let's just dive right in, Dr. Zhang. Can you tell us how this new computer model is able to find potential treatments for COVID-19?

Dr. Zhang:

Sure, of course. Actually, the new computer model is based on the concept of using gene expression to breach drugs and disease. We can think about the drug size. We can use gene expression to test how the gene expression changes across all human organs, which provides some drugs' signatures, which are discovery. And most recently, at the beginning of the pandemic, in May 2020, two papers were published in the *Cell* journal about how human gene expression has a response to COVID-19, which provides some disease signature for COVID-19. So, we can think about, we have both drug signature, we have disease signature. Once we have both these, the job is pretty easy. Whether we find the drug and disease shows some obvious gene expression profile, suggesting the drug and whether it was the effect of the disease. Then we can find that some drug may treat the disease – in this case, COVID-19.

Regarding the differing techniques, it sounds like it's very easy to get the drug signature. But actually, during the L1000 projects, there only were a limited number of drugs that had been tagged through the gene expression. So, this is the reason we use the deep learning model, especially like the Gruff Neural Network and the Moffat Attention Network, to predict all of the drugs across the gene expression, across the different human tissues. This is the way we gather the at least ten different drugs for COVID-19.

Dr. Turck:

For those just tuning in, you're listening to ReachMD's *COVID-19: On the Frontlines*. I'm Dr. Charles Turck and I'm speaking with Dr. Ping Zhang about a new computer model that has identified at least ten potential treatments for COVID-19. So, Dr. Zhang, now that we've discussed what the computer model found, let's zero in on the technology's potential impact. What benefits does this model bring, especially in the middle of a pandemic, when it's a race against time?

Dr. Zhang:

Sure, sure. So, the ten drugs, we predicted at the very beginning of pandemic and the validation experiments, proposed by some human experts, was after our prediction. Now, there are so many different COVID-19 variants. Whether the vaccine works or not -- this is still problem. So, what I want to mention is in this model actually, we intake the patient's condition into consideration -- so, what if we have some patients with COVID-19 variants? We can quickly rerun COVID predictions for more accurate or more personalized recommendations for new patient cohort. So, this is exactly what I hope.

The second area I want to mention, in the drug companies, and there are hundreds of millions of potential drugs. Maybe the next great

antivirals may already be in the lab somewhere, right? And previously, with all new drugs, you just take some time to propose for some new indication, and by using these different arguments, you can tell us which compound is worth testing, and which compound is worth it for the clinical trial.

Dr. Turck:
And if we look beyond the pandemic, in what other ways do you see this type of research and technology having an impact?

Dr. Zhang:
Sure. Actually, this is exactly to the point of my research. So, I'm focused on artificial intelligence in medicine. This is the reason I call my lab AIMed in Medicine Lab at OSU. So, my research really focuses on the deep learning and the application to medicine. But besides, like the extra discovery and the drug repurposing projects, I'm also starting clinical risk prediction. For example, most recently we published paper in the *Patterns* Journal to predict which patients in the emergency department and ICU will contract sepsis. We also have some research about a medical image; in other words they use artificial intelligence to predict the risk of patients for stroke, based on their brain MRI imaging. So, regarding the impact of artificial intelligence, I just say whether computer, whether artificial intelligence will predict, you still need some further testing. The A.I. is not likely to replace a human expert for any time soon. However, artificial intelligence plus clinicians will replace the clinicians without A.I. very soon.

Dr. Turck:
Well, I think we can all agree that COVID-19 treatments are an area of active need, and I want to thank my guest, Dr. Ping Zhang for joining me to discuss how this new technology might help us find effective treatments and turn the tide in the pandemic. Dr. Zhang, it was great having you on the program.

Dr. Zhang:
Yeah, thank you so much. Thank you for the invitation. Great to work with you.

Dr. Turck:
I'm Dr. Charles Turck, and this is *COVID-19: On the Frontlines*. For more episodes about COVID-19, and to add your perspectives on the fight against the global pandemic, visit us at reachmd.com and become part of the knowledge. Thank you for listening.