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Artificial Intelligence in Wearable ECG Monitoring Technology

Announcer:
Welcome to CME on ReachMD.

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Here's your host, Dr. Ben Caref.

Dr. Caref:
Coming to you live from the Heart Rhythm Society Annual Scientific Sessions in San Francisco, welcome to this evening's program. I'm Dr. Ben Caref, and with me joining us this evening is Dr. Hamid Ghanbari. Dr. Ghanbari, tell us a little bit about your background.

Dr. Ghanbari:
Thank you, Ben, for having me. I'm a clinical cardiac electrophysiologist and Assistant Professor of Medicine at University of Michigan in Ann Arbor. I'm also the Vice-Chair of Innovation at the Cardiovascular Center in Michigan. My research interest is in digital health, specifically in artificial intelligence and deep neural networks and using those technologies to make better predictions that improve patient outcomes.

Dr. Caref:
All right, so we're going to be talking about ECG monitoring and wearables. What is wearable ECG technology, Dr. Ghanbari?

Dr. Ghanbari:
Wearable ECG technology is a biosensor that you could wear that records ECG on a continuous fashion. It can record the ECG and then send it to the Cloud where computations can be performed and the diagnosis is made and then is transmitted to the physicians so they can make a diagnosis and make decisions.

Dr. Caref:
So I think it's become more increasingly popular over the years, and part of the reason for that is some of the new technology, some of the things you're talking about with artificial intelligence. Tell us a little bit more about how artificial intelligence fits into this wearable technology.

Dr. Ghanbari:
Artificial intelligence is really not intelligence. It's bringing us a key component of intelligence, which is prediction. Prediction is taking the information that you have, which is data, and generating information that you don't have, which is an output, so essentially, artificial intelligence is just better and cheaper predictions for us.

Dr. Caref:
That's interesting. And I understand that artificial intelligence also involves deep neural networks, and that's something that you're working on. How do the deep neural networks help us to predict ECG waveforms better?

Dr. Ghanbari:
Artificial intelligence is science and engineering of building intelligent machines. A subset of that is machine learning, and a subset of

machine learning is deep learning or deep neural networks. Essentially, it's helping us take the ECG data as the input into our prediction machine and make a prediction, which is a rhythm and what the rhythm is. And the deep neural networks are powerful because they can take the data; they can do complicated math. Not only that, the layers are hidden, and you can do lots of computation and make very, very good predictions about what the rhythm is.

Dr. Caref:
I guess that with the use of these deep neural networks you're getting greater sensitivity and specificity and accuracy?

Dr. Ghanbari:
They have been shown to increase the precision and sensitivity of rhythm classifications much better than what we have had traditionally. This is a big deal, because as you improve the precision and sensitivity of these tests, you can make better decisions, which can improve the patient outcomes.

Dr. Caref:
That's interesting. But I suppose that in order to make these artificial intelligence algorithms work better, you probably have to have pretty robust data sets for them to work properly. Is that correct?

Dr. Ghanbari:
That's a very good point. Data is the key component here—not only just data, you have to have lots and lots of data that is labeled. You have to also have lots of diversity within your data. By that I mean you have to have lots of different kind of rhythms and different durations and different noise levels so the networks can learn to make those predictions in all circumstances.

Dr. Caref:
And this is also fascinating, but once you have, say, an ECG prediction algorithm, say, using artificial intelligence, it still has to be embedded into a system that can deliver usable data to the physician or to some service. Does that exist now?

Dr. Ghanbari:
Yes. I think that with the rise of graphic processing units in combination with the rise of Cloud computing and open source platforms like TensorFlow, this capability has gone from theory into clinical practice. Now, today, you can wear the ECG monitor, the data can be transmitted to the Cloud where a computation is performed and the predictions are made, and that is quickly communicated to the physician and implemented into clinical practice, so it's here now.

Dr. Caref:
Oh, that's amazing. And what else do you see on the horizon for artificial intelligence in cardiology?

Dr. Ghanbari:
I think this is an unprecedented opportunity in our lifetime. These technologies are able to make predictions where we have not been able to do in the past. This is an opportunity for us to take data from multiple sources, put it together and try to come up with better predictions which can help us make better decisions to help our patients. If we do this right, we have an opportunity to transform care like we have never seen in our lifetime, but there's lots of obstacles, and we have to really focus on trying to put the patient at the center and design human-centered algorithms that can improve patient outcomes and reduce costs.

Dr. Caref:
This has just been an amazing time spent with you. I hope that our listeners enjoyed this conversation. I'm Dr. Ben Caref, and I'd like to thank you, Dr. Ghanbari, for joining me this evening, and I hope you all have enjoyed this program.

Dr. Ghanbari:
Thank you, Ben.

Announcer:
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