



Anusha: Hi, and welcome to DigiHealth Talks, a podcast created and hosted by the Brown-Lifespan Center for Digital Health in Providence, Rhode Island. I'm your host, Anusha Rahman. Join us as we meet some of the masterminds behind the field of digital health, leveraging the innovative technology around us to help the public improve their well-being. Today we are interviewing Dr. Zhicheng Jiao, an Assistant Professor of Research. He is a computer science expert, focusing on artificial intelligence in medical image analysis. Thank you so much for joining us. We are so excited to have you!

Dr. Jiao: Thank you for this opportunity. It's my great pleasure to talk something about my medical AI research today.

A: I love it. Thank you. To start us off, can you tell us a little bit about your educational background and your current research focus?

J: Yeah, sure. I got my bachelor's degree of electronic engineering and a Ph.D. degree in medical image analysis, both from China. Then I worked with Professor Dinggang Shen at the University of North Carolina at Chapel Hill for my postdoc training. He is the reason I came to the US because I think that it's a very amazing experience working with him because he is definitely the top and leader of this field. I work with a very diverse group of radiologists, neuroscientists, and the computer scientists on several very interesting projects, such as we use image to predict their cancer and predict the arc of the disease. Then Professor Shen left there, and he co-directs medical image company now. I think I need to receive more academic training and continue my academic career. So he recommended me to the University of Pennsylvania. We have a very huge medical AI research team, and this team is also among, I think it's the top in the world. So I also really appreciate my experience working with Dr. Fan and my other colleagues at Upenn. Last summer, I decided to step into my next career stage. And then I joined Brown and Lifespan and now co-direct medical AI research team here with Dr. Harrison Bai. I think our research focused on developing AI method to estimate the disease progression and the clinical and to provide reference for personalized treatment planning. We have a great hybrid in here with radiologists, and the top level medical, biomedical engineering, and computer science students at Brown. Thank you.

A: Thank you. It sounds like a very diverse group of people who work on this project. How does that feel, to be part of such an interdisciplinary group of people?

J: I think it is very important to communicate with people with different backgrounds. So I think this, what I learn from my postdoc experience, because I always work with very hybrid groups of people. Now I think I know how to think from both sides of the knife from you know, if I think only from a technical side, I can't totally understand the clinical meaning of some projects. So

after working with more radiologists and neuroscientists or neurosurgeon, I know how to think from their side. I think this is the most important thing.

A: Would you mind giving us a quick description of, I guess not a quick description, but the details behind what it means to use AI in healthcare and how it is used?

J: Yeah, I think I can briefly introduce this from, use some example of our on-going studies. We can regard AI as assistant of doctors. After we feed them some the electronic health recordings, the EHR data, and use some medical imaging data, the CTs, the chest X-ray, and the MRI, and the clinical report, and then the clinical follow-up, and the clinical outcome of the patient, then we can learn to extract some textual or visual information from these input data. We could also link the visual findings with manually-labeled clinical findings from the radiologist or other doctors. Then AI method can learn the diagnostic information from the doctor's experience in this data. When we have new patients data, we can feed this data to our AI system. Then we can build the prediction based on their previous experience, and learn from doctors.

A: So it sounds like you're using the previous pattern to predict new patterns or to predict new diagnoses in the future.

J: Yeah, this is the work we focus on our ongoing projects. For example, for the COVID-19 progression prediction and for their cancer survival or recurrence prediction, yes.

A: Yes, that's fascinating. Thank you for that. How did you get into this field?

J: Yeah, actually, I think this is a very, very interesting story. I grew up in a physician family. My father is a cardiologist and my mother is an ultrasound technician. You know, this maybe not a very good thing for me because they are very busy and they talk a lot about their clinical tasks in even at home, you know? So they spent not that time with me. So I've always been thinking about if I could develop a robot to assist the doctors to relieve their workload. Actually, I didn't know if this should be the work of medical AI when I was a child, or even when I was an undergraduate student. I started the electronic engineering when I was in undergraduate because I thought this is the way to develop a robot, you know? But I think it was the third year of my undergraduate, and I notice there is a summer research program on AI, artificial intelligence. I applied for it, and then I learned some basic concept of AI and how AI works. Then I chose a PhD program in medical AI with my PhD supervisor, Professor Goh. I think he's definitely a role model and I learned so much from him about how to become an independent researcher and how to lead a research team. Also, my wife is from a physician family. Her grandfather was previously a president of a hospital in our city. She is an artist and designer. Her knowledge seems so different from our scientific community. But I think out is very important to relieve the mental load of persons. So I think she's also doing what she thought that can relieve the mental load of doctors and physicians. And I think I also get a lot of inspiration from her great artwork.

A: Yeah, it sounds like you're used to working with people with different backgrounds in your home life, in your work life, and you've kind of brought them all together and created this awesome niche that's just for you. It sounds brilliant.

J: Yeah, I think so, because I think actually we are a very hybrid team, and we do the cross-discipline research. So we should be open to all kinds of ideas. Because if we only think from our background or our background knowledge, we usually limit our thoughts in a certain place. That's not a good thing for research, I think.

A: Sure. Thank you. So you've talked a lot about how awesome and modern this AI research is. What are some of the advantages and disadvantages to using AI in healthcare?

J: Actually, I have been always asking this kind of question. Especially when we talk about the collaborations with some doctors. They usually want to know, how could they assist them or if or if you know, they want to know how they could teach AI from their view to relieve their very specific workload. From my view, AI methods are better at some rapid work, when we have very large-scale data that really need a lot of manual effort to label or annotate them. So if we have these kind of large-scale data, for example, with the help of very advanced image processing device and algorithm, we can simultaneously segment multiorgan from a single input CT data and evaluate different organs in one second. This usually takes much longer for doctors to manually label and evaluate, but most of existing AI methods are not adapted well to different clinical situation. For example, different hospitals usually use different devices from different vendors. If we only train off him by AI models from one hospital, we usually have decreased performance on other situation. But people, all radiologists or doctors, are more robust to this kind of situation. They have very great domain knowledge and they have great experience. I always think that it's best to collaborate between AI and the doctors. That could be a better solution.

A: So that's kind of moving into the next question I have about some of the controversies surrounding AI in healthcare. There is a lot of talk that AI is an attempt to replace human beings in the medical field. It sounds to me like that's not your goal. Is that right?

J: No, that's definitely not my goal. Also, I think that's a great question. About five years ago, I remember that the New England Journal of Medicine predicted that machine learning or the AI method will displace much of the radiologists' work and pathologists' work. The same year, Professor Geoff Hinton, the most famous AI research in the world, he declared that we should stop training radiologists. Actually, in my view this is the way media wants to publish this kind of news. They want the news to be the breaking one. The fact is that in these years, AI and AI researchers have been devoting to collaborate better with radiologists. I think research should be human-centric, and the ultimate aim is serving the community in the field of medical AI. I think it should be the doctor-oriented, serving diagnostic decision of doctors and health care of patients. So I think this is also the reason the department chair Doctor Cronan invite me to work at Brown University and support me so much. Since the medical AI is becoming a very hot topic today, more and more medical students are reaching out to join our research projects, and

more doctors are interested in collaborating with us. So I think that's really helpful to this research and the clinical practice. In addition to the diagnosis, I think there are too many healthcare situations that need humans. For example, I think the humanistic care is even more important. Unfortunately, the medical AI system is not good at this, so I would rather say that medical AI who can collaborate with doctors will replace AI who can't. So I don't think AI can replace human beings in healthcare. Instead, I think human beings will play a more important role in the field of healthcare with the help of AI.

A: I really appreciate that perspective. Thank you. Also kind of reassuring honestly. So you've been conducting some work involving AI during COVID-19. Can you tell us a little bit about that project?

J: Sure. Dr. Bai and I do some image-based AI study during the COVID-19. For example, as I mentioned we developed AI methods that can automatically segment the lung regions from chest X-ray image and the CT image. Then we can leave the visual information in lung region with their disease progression. For example, some certain group of people need the ICU. Some others' disease, may not very severe. So we further combine the image with the result with some demographic and their clinical features, some lab results. Then we find this could further improve the prediction performance. We also find that when teaching the AI model on data from a single institution and deploy it on other hospital data, the accuracy will be not that good as before. So that's what we call the "challenge of data heterogeneity". So we are collaborating with Harvard University, their medical school, and we are organizing a very large-scale and very diverse data set from 30 to 50 different institutions all over the world. And we want to learn if AI model could be more generalized if we teach them on such a heterogeneous data set. And this could help to build a more clinical use for AI model. We hope that. And also I noticed the digital health research of Dr. Megan Ranney during the pandemic, and I think also we are looking forward to collaborate in some certain topics that will be amazing.

J: A kind of continuing on that path, what do you want your future research studies to focus on?

A: My collaborators and I, I think we have very aligned goals that we will focus on integrating AI in real clinical practice and integrate them into the clinical pipeline. You know, we also developed AI algorithm to apply for some FDA-approved method. I think maybe in the future we can focus on more clinical tasks. And that helps to provide the human-centric diagnostic decision and deliver the high-quality treatment to patients. I think this also aligned with the mission of Lifespan Healthcare, deliver health with compassion, accountability, respect, and excellence. Also according to the childhood experience of myself, I wish I could help to relieve the workload of doctors, so they can spend more time with their family member and spend it with their children.

A: What would you consider that the overarching goal of your work?

J: The overarching goal of my work is develop AI system that can collaborate but not compete with doctors. So I think we could, you know, we could collaborate with not only researchers in

the field of healthcare, but also in a broad range of researchers in other AI research, such as self-driving car or other intelligence system that we can build AI as an infrastructure of the society. Then we can integrate AI into the whole system. Under then maybe we can relieve the workload of other people and which finally improve the life quality of the whole community or the whole society.

A: Yeah, that's a really big goal. OK, cool. And is that where you see AI in the future, say 30-40 years from now? AI healthcare integrated in everything?

J: Yeah, yeah, yeah. In my, in my view, as I mentioned AI will be a very, very basic and infrastructure everywhere in our lives. It will not only in the field of healthcare but also other fields. I mentioned the self-driving car. Also yeah, AI method in healthcare will be greatly developed in two opposite directions. I think the generalization and specialization. The generalized AI model will be more helpful when handling large-scale healthcare issue is fairly for some public. We also use because they have very large-scale data. On the other hand, I think that a variety of specialized AI model will be deployed to different diseases and the clinical end. This could assist the specialist and could help to provide more personalized treatment. Yeah, that's my, my view.

A: I love it. Final question. You spent most of your educational career in China and then you came to the US for your postdoc. What advice do you have for people who are in a similar boat as you were?

J: I think I don't suffer too much from, you know, shifting from my project in China to a US job because my background is aligned well with my postdoc project. These are my experience. I think the most important thing is to choose the research field that you are really passionate about. Since medical AI has always been my dream, so I naturally devote myself to becoming medical AI researcher. So my advice is it's better to choose what you really love.

A: I completely agree. Thank you so much for being on this podcast. I really appreciate all the insight, all of your wonderful humor, and I'm really excited to see where AI goes in the future.

J: Oh, thank you. Thank you for this opportunity to share our research here, and I hope this topic can inspire some listeners to become medical AI researchers in the future. Thank you again.

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