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Qi Dou is currently an Assistant Professor in the Department of Computer Science and Engineering at The Chinese University of Hong Kong. She is co-affiliated with T Stone Robotics Institute at the university.

Qi, can you tell us more about your work?

I am a new faculty here. I just joined starting in February of this year. I have been involved in the research field focusing on AI for medical image analysis for the past five years. What I focus on is automated detection of the lesions on medical images, for instance, CT and MRI images. Also, I do tasks of segmentation for lesions, which can be used for the quantification of the disease, for the diagnosis part and intervention. That is very meaningful.

In terms of the technology part, applying computer vision methodologies into the medical image analysis area is not straightforward because these two areas have many differences. Specialized techniques need to be tailored and adapted to be fitted into the specific problems in the healthcare domain, especially medical images. Part of my work is to do this kind of technological development for medical data.

One representative work is about 3D Convolutional Neural Networks. It was my first project in PhD studies five years ago. I think that work was very



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meaningful as we tried to figure out how to more effectively extract the high dimension of the volumetric information in the medical data, because that was different from 2D images or 3D images. Then we continued to go deeper into 3D Convolutional Neural Networks. I'm very excited to do more work in computer robotic surgery, like minimally invasive surgery, so that procedures can be less invasive and safer, and the patient can have a better recovery. In minimally invasive surgery, the surgeons face more challenges than in open surgery. What I'm driving now is to bring more intelligence into the robotic surgery

systems to help in cognitive assistance for the surgeons, to help them perform better, more efficiently, and more safely in the procedures.

Have you found yourself in the operating room already?

Yes, I have visited the operating room multiple times, starting from my PhD studies. I watched a whole surgery procedure last fall for four hours standing in the operating room. It's kind of shocking to enter the operating room. I watched the whole minimally invasive procedure with the patient laying down on the bed. That's amazing! That reinforced my determination to devote my career to the medical area to help surgeons and doctors.

Especially in the past three years, I intensively talked with doctors from multiple disciplines, like radiologists

because we do a lot for CT and MRI. We go into the radiologists' offices when they are sitting next to each other to interpret the images. We talk about what they need, their challenges, what they enjoy in their work, if they're happy with their existing computer tools, and how to help them improve. We also talk to physicians and surgeons; we go to their offices to see their working environment; we communicate with them. Doctors are very open. They are willing to try new technologies. They give very positive feedback. As the technicians, we need to technically sort out what they need and how to solve the problems in a technical way. So those are the kinds of things we need to do as an interdisciplinary researcher. We are happy and ready to do this, to make better tools to help the patients, to help doctors, and also to help treatments and diagnosis become more cost effective and accessible.



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Are you ever impressed by what you see in the operating room?

I'm very impressed with that. The surgical room, in the first place, is quite cold: temperature is very low. The surgeons are very focused on their procedure and communicate when they need some assistance. Since it's minimally invasive, the images are shown on the screen. I'm impressed by the patient, who is lying there, totally unconscious, kind of sleeping. My deepest impression at that time is that I feel sorry for the patient. When you are a patient, you are lying down there, and you don't know what is happening to your body. The doctors have to recover their health. It motivates me to do something, to improve early diagnosis, to prevent the disease from going that far into the operating room.

The patient trusts the doctors, that are working for their welfare. It's true that patients are vulnerable, but they're also lucky because everyone around is trying to help.

Exactly, so that's why we respect the surgeon. They work in the operating room day to day. They work very hard. They also have their own research to take care of. Doctors work very long hours every day, of course longer than I do. Yes, I agree with you. The patients are very lucky that we have the public health and healthcare systems provided for treatment. For our technology aspect, as researchers, we are thinking to make the patient suffer less. That is our value. One thing is to do early diagnosis, to make decisions from an early stage, and to optimize the treatment procedure. This kind of open surgery is replaced with minimally invasive surgery, so recovery happens faster. How can we protect the patient in a technically rich



way? For instance, in robotic assisted surgery, you provide a kind of cognitive assistance for the doctors to make them more strong-minded: they take care of lots of things at once during a surgery. Research assistance can reduce adverse events during the surgery, to reduce the potential of harm for the patient. Solving every single problem has lots of challenges. We are extremely excited, and I feel it's very meaningful to be in this kind of research field.

You also teach, is that right?

Yes, I teach. Actually, I haven't been teaching a course due to the COVID-19 situation. Some courses changed to online, and some courses were suspended. As a new faculty, I haven't started teaching courses yet for undergraduates. But I do mentor, supervising PhD students.

How do you like it?

Currently, I have ten members in my lab, including PhD and RA. Teaching is one thing that attracted me most to devote myself to an academic career. When you are mentoring the young guys as they grow in their future, that's a beautiful thing. That's the value of education. You teach what you have learned so that they can get a direct sense of what will happen, to help them grow faster with your guidance. That's a very rewarding thing. I enjoy that very, very much. That's the most beautiful part of my career.

Where do you see yourself in the future?

I'm very determined to stay in academia for my whole career. I enjoy the educational perspective of academia very much. Also, I enjoy the freedom of academia. It is relatively relaxed, in a way. With my personality, I like to explore things creatively. Also, I think academia is a good field for females to stay in. One thing is freedom. You can realize your own value in this field, especially in the MICCAI community. It's a very nice community, especially for females. It encourages female leadership. A leader such as **Tal Arbel** is a very good role model for me.

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You mentioned that you really enjoy being involved in this community. You are even serving as an Area Chair and Session Chair at MIDL.

Actually, I started in this research area almost since the beginning of my undergraduate. My major was biomedical engineering. At that time, I started to enter the field of medical image analysis. I didn't know the community yet. Then I started to publish papers at MICCAI. I got to know this community and gradually, I fell in love with it.

Do you have any stories that happened in the operating room, or close to the

operating room with surgeons?

One story I want to mention is actually very happy. I had a project about lung cancer screening. At that time, we developed a software platform, together with our colleagues at the university. We deployed the system into real hospitals, into the PACS systems for doctors' use. We found one case. The algorithm processed a patient and detected lesions. The doctors said: "This is something we missed!" We have had these things happen multiple times in different hospitals. So that is very rewarding. It confirmed to me that we are really helping them.

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Here is an added value that comes from computer science to medicine!

Exactly! You spend one year creating an algorithm, then you spend a half a year to develop the software and establish it in the hospital. Then it helps the doctors! That is very encouraging because we are not very confident in the beginning as to whether it will be helpful or not. We feel very proud of ourselves!

At what age did you feel you wanted to contribute to medicine?

It happened in different stages. In the very beginning, I went to college. I did my undergraduate in Beijing. At that time, I was assigned to biomedical engineering. Gradually, I liked it. I went to a relatively newly established college. There were more than enough teachers, so our college allowed undergraduates to enter labs and learn about research. I started to enter the lab starting from my second year as an undergraduate, helping my colleagues with medical image analysis. I wanted to learn more about it, and I felt that it was meaningful. Then I continued to do it. I felt I had the capability to learn the skills. I think that's a meaningful thing. After I graduated, I decided to pursue a PhD. I applied here to The Chinese University of Hong Kong. At that time, I was determined to go into the healthcare field. I think it is a very promising field. It's very meaningful, and it helps people. Around 2014, I started my PhD. That's when deep learning

really started to boom. I quickly picked up this new technology and applied it to medical imaging. This field started to attract more people. My PhD has been very busy, but I enjoyed that very much, because I'm very self-motivated. I work day to night, day to night, but I don't feel much tired. That's the magic. After graduating with my PhD, I did some deep thinking about whether to choose academia or industry. Different offers came to me. After very careful consideration and discussions with professors, family, and friends, I got determined to go into a full academic career for AI and for healthcare.

What would be a dream accomplishment in AI and healthcare?

Wow! That's a big question! If I had to choose, one thing that makes me super excited is to develop software for machine learning that can be widely applied to multiple hospitals. The "widely" is important. The generalization capabilities of the technology matters. That's what my current research emphasizes. It can work for one patient, for ten patients, for many patients. If it can work for one hospital, that is also another big thing. But when it can be widely deployed to multiple hospitals, in multiple regions, in multiple countries, and it really works, then it has a scalable benefit for the patients. That's the thing I'm excited to do.