

IBM AND THE FUTURE OF MEDICAL IMAGING

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What if algorithms from the high-resolution gaming industry and analytics from oil exploration were applied to the field of medical imaging? Using supercomputers to integrate data from multiple sources and display it in a 3D representation could help doctors improve the accuracy of diagnoses, while reducing costs to make these advancements available to more patients.

LUEDKE: Hello and welcome to an IBM podcast. Today we'll discuss how in the next three to five years, the application of technology will advance medical diagnosis and improve the lives of patients.

I'm Laurie Luedke and my guests today are Dr. Brad Erickson, director of radiology informatics lab at Mayo Clinic and Bill Rapp, IBM's chief technology officer for healthcare and life sciences. Welcome gentlemen. Let's start with you, Brad. Can you tell me a little bit about radiology informatics?

DR. ERICKSON: Sure. Radiology informatics is a new field that includes radiology imaging which is how we produce images. It includes computer science and the algorithms, how we can process those images. And then finally it includes medicine which is the application of that medical imaging to solve a specific problem.

So for example, we might do a CT scan of a patient's abdomen, and then we can apply algorithms that would automatically extract the liver and its vascular supply and identify that there are tumors within a portion of that liver. Then we can produce a 3D representation from which the referring physician can determine whether or not they might, for instance, perform surgery and resect a portion of the liver.

LUEDKE: Looking into the future as far as medical imaging, what role do you see technology playing?

RAPP: Well, it's interesting that a lot of the technology that we're applying to the medical imaging space comes from two ends of the spectrum.

First of all, the supercomputers are helping us to find the high-performance computing needs, the infrastructure, the connectivity that's needed to run these massive algorithms that it takes to analyze some of these images, especially as we get into 3D and 4D.

So at that end you've got the high-performance computing infrastructure and then at the lower end, you've got the gaming chips that are showing us how to visualize this information in 3D and 4D and being able to process these images and visualize them much faster than traditional processors.

LUEDKE: How do you see the patient's visit to the doctor in the future?

ERICKSON: I think going forward we're going to be able to have computers extract more information than perhaps we can visualize, that they can detect, for instance, the way that the heart is perfusing tissues; that they may be able to identify textures within the images that may not necessarily be perceptible.

We're now starting to move towards more and more image guided therapy and minimally invasive surgery. And I think the interaction with genomics, being able to tie in genetic, shall we say latent disease -- your genes are building you to do a certain thing -- but imaging reflects what actually your body has inside of it. And that combination of what we call genotypic information from the genes and phenotypic data which is what you actually have, could be the combination that helps us move to the next level in medicine.

RAPP: And the other thing is that being able to view these images anytime, anywhere, is another important trend coming along. And it's not just the radiologist that need this technology, it's all the other clinicians, the surgeons who need to do surgical planning, the oncologists who need to look for changes in tumors and tumor growth and things like that. And the clinicians who want to be able to show the images in 2D and 3D to their patients. And that's especially important in the future where patients are getting more and more involved in their own healthcare and making healthcare decisions and having them being able to view useful visual representations of their own diseases, is very important in helping them make that decision process.

ERICKSON: I think that's a really important point, too, that the importance of having access to imaging everywhere. Now with electronic technologies, the other specialties that produce medical images can also share the information.

And I think that while sharing your images always makes us who produce them a little bit uncomfortable because everybody's kind of looking over your shoulder, second guessing you, well, is that really what's in that image, I think it also forces us to be the best that we can be -- that because we know somebody's always looking at that image, a second pair of eyes does result in the best care for patients.

So the pathologist who for instance is looking at, say, a tissue sample from the O.R. may have one diagnosis that he thinks is most likely. But if the surgeon then says, well, I actually took it from this part, that may shade the interpretation of that image slightly differently.

Similarly, if a sample was acquired years in the past at a different facility, seeing well, actually I can see how it could transition from that old tissue to this new one might impact the diagnosis or the implications or the prognosis for that patient.

RAPP: So I think another trend we're seeing is teleradiology where you're able to transmit the images and have radiologists reading it 24 hours a day, anywhere in the world. And that requires high computer networks where you centralize the processing of all these images for all these advanced analytics like image alignment and segmentation and change detection and things that require high compute power to be able to do that but we can't expect every radiologist everywhere and in fact, radiologists working at home, to have that type of computing capability at their home or at their desktop.

And that's what drives more and more server-based processing of these images and doing the analytics at the server and just displaying the end result at the radiologists' workstation or in some cases, the surgeon's workstation.

LUEDKE: IBM and Mayo Clinic researchers have created a collaborative research facility aimed at producing the next level of imaging innovations. Can you tell me a little bit about that?

ERICKSON: Sure. So as you mentioned, this is a joint collaboration between Mayo and IBM. Oftentimes when physicians are involved in medical care, they don't have easy access to the resources to make an idea actually result in a prototype that validates whether that idea really is helpful.

Some of the ideas include things like medical image registration so that the computer will automatically take the prior examination and line it up and we can even subtract it to help highlight differences.

And so patients who have chronic diseases like cancer or lung disease, it highlights the differences between the two and makes radiologists both faster and more accurate which is kind of a rare thing in medicine -- to be less expensive, as well as better. But there are other things that we're doing in the lab that we think are interesting as well.

RAPP: Yes, the Medical Imaging Informatics Innovation Center is really a physical manifestation of the larger resources that both IBM and Mayo have to offer.

In fact, we're bringing things from other industries, obviously the gaming industry is key to some of the algorithms that we're bringing in here. But also some of the analytics that we've learned in oil drilling and other industries like that we're able to bring into this to do, you know, volume rendering and things like that. So it's really, it's a focus point where we can pull the facilities of both companies

together.

ERICKSON: I think this is a trend that is happening generally in the medical industry and in fact, a number of grant requests that have come out of NIH [National Institutes of Health] have specified that academia and for-profit industry entities are required in order to have a successful grant that just academia or just industry doesn't cut it anymore. That you need this partnership¹ of academia who bring some of the content, the ideas and perhaps algorithms and industry that has technology and knowledge about how to actually put something into a product. And that partnership is critical. We're not the first to do it. We recognize there are other industry and academia partnerships that exist out there. We're just aiming to be the best.

LUEDKE: I want to thank my guests, Dr. Brad Erickson, director of radiology informatics lab at Mayo Clinic; and Bill Rapp, IBM's chief technology officer for healthcare and life sciences. This has been an IBM podcast. I'm Laurie Luedke and thank you for listening.

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¹ "Partnership" refers to a collaboration rather than a legal partnership.