JPMorgan Global Healthcare Conference

Company Participants

- Kimberly Powell, VP of Healthcare

Other Participants

- Harlan Sur, Senior Analyst, JP Morgan Chase & Co, Research Division

Presentation

Harlan Sur {BIO 6539622 <GO>}

Good morning. Welcome to JPMorgan's 37th Annual Healthcare Conference here in San Francisco. My name is Harlan Sur. I'm the semiconductor analyst here for the firm. And for the first time in the history of the health care conference here at JPMorgan, we have a semiconductor company presenting, NVIDIA, a leader in visual and accelerated computing silicon and systems in areas like artificial intelligence and deep learning. And here with us today is -- from NVIDIA is Kimberly Powell.

Kimberly is Vice President of Healthcare in NVIDIA. She's responsible for the company's worldwide health care business, including hardware and software platforms for accelerated computing, AI and visualization, the power of the ecosystems of medical imaging like sciences, drug discovery and health care analytics. Previously, Ms. Powell held the company's higher education and research businesses, led the company's businesses along with strategic evangelism programs, NVIDIA AI labs and the NVIDIA Inception program with over 3,000 AI start-up members. She joined NVIDIA in 2008 with responsibility for establishing NVIDIA's graphics processor platforms as the accelerator platform for medical imaging instruments. She spent her early career in engineering and product management of diagnostic display systems at Planar Systems. So very pleased to have the NVIDIA team.

Kimberly, thank you for joining us today. And let me turn it over to you.

Kimberly Powell {BIO 22021217 <GO>}

Okay. Harlan, thank you very much. I'm so excited to be here. And thank you for coming on the last day of JPMorgan. I know this is an incredibly busy conference.

This is just an amazing and exciting time for health care. I think you're all familiar with the safe harbor statements. I just want to get through this and really get going.

I'd like to introduce NVIDIA. We invented the GPU in 1999. We created an ability, something called programmable shaders, that allowed artists of all kinds, artists creating games, creating movies, to really unleash their creativity and start creating virtual worlds.

As you can see, this is an image of the latest games of Star Wars. The amount of computation that they need to do in order to allow the light to bounce off of the surfaces and look to your eye as if it's photorealistic is incredible. That same computing platform and technology is used by designers and engineers of all kinds to design the chairs you're sitting on, the shoes you're wearing, the jet engines that go inside the planes you're probably taking this afternoon. And they need that same kind of interactive 3D experience to know what are they designing, how does it look, how does it perform in simulation. They need to be able to iterate on that. And that is the basis for what NVIDIA created in its first 10 years.

But if you think about how do you make hair look like hair? How do you make smoke look like smoke, fire look like fire? This is an incredible amount of math and computation and physics. The same kind of math and physics that the scientific community was really longing for. They were approaching a very critical end of what's called Moore's Law. And they needed a huge leap in computing performance. And they needed to get to new levels of being able to attack different sized problems, things that they've never done before, work with data that was just exploding for the new kind of sensors that were being created, whether it's in astronomy or it's in climate and weather simulation. And this platform, because it's so fantastic at creating these math and physics, it was a perfect platform for accelerated computing and high-performance computing.

We decided to create a computing platform called CUDA. And CUDA is that computing platform that allows you to do high-performance computing, accelerated computing. We put that technology on every product that we made, whether it was a gaming card or it was something that went inside the data center. And because we made it so accessible, researchers, any researcher in an academic institution, can get their hands on this technology. And so just about 6 or seven years ago, the computer vision research community, they were dusting off the shelves with an algorithmic approach called neural networks. Because we were living in this sea of digital data because of our mobile phones and what's going on in the consumer Internet, they knew that these neural networks could be very effective if they had more data. But they needed to have a massive amount of computation. And so they turned to NVIDIA GPU computing platform in order to do that. We've been dedicating ourselves to make deep learning and artificial intelligence as accessible as possible and make it run as fast as possible. So we can be iterating and making breakthroughs like you're experiencing every day when you talk to your phone.

Then we have also -- there's this giant 20-plus years of data science that's been based off of machine learning methods. And just this past year, NVIDIA has put out into the marketplace the work that we've been doing for several years, which is accelerating -- GPU accelerating also the machine learning and traditional approaches that all industries use to sense what's going on and the trends in their markets. So that they can have predictions that allow them to make informative decisions on how they're going to drive their business. This has opened a gigantic market for NVIDIA.

But what's really critical here, as you think about this one computing architecture has so many critical, critical high contribution personalities, I call them. It can do incredible computer graphics. It's a world leader in high-performance computing. We're absolutely the de facto platform for doing deep learning. And now we're entering to this large space of data science and machine learning as well. These are the kind of technologies that all industries need. But there are a couple of industries that need it the most. They're complicated industries. They have lives at stake. And 2 of those industries that we think we can make a contribution towards are automotive transportation as well as health care.

So let me talk about accelerated computing for a minute. Accelerated computing is our platform. It has all of those personalities to offer you. And what it does is it allows people to do things they have never done before. Just this past year, we built the world's fastest supercomputer. And it's here in the United States at Oak Ridge National Lab. We also helped build Japan's fastest supercomputer and Europe's fastest supercomputer. These are the instruments of doing breakthrough science. We surpassed over 1 million developers this year. We have over 13 million downloads of the platform year-to-date. But we're seeing over 500,000 downloads a month now. We are -- this platform is gaining momentum like we have never seen. And it's because we're allowing people to do things they haven't done before. We're reaching the scientific community. We're reaching the mainstream artificial intelligence community. We're now reaching this large population of enterprise computing and machine learning.

But what's so incredible and so fun to think about is what are the things that we're able to do now that we couldn't do before. Four of the 5 high-performance computing awards this year were actually a combination of high-performance computing and AI. So there's a huge paradigm shift going on, even in these 40-year-old application areas of climate simulation, earthquake simulation. Now we're doing biology simulation. This year, they broke the record of the fastest computation ever achieved. And it was in genomic simulation. This is going to create an ability for us to look at dataset sizes and make correlations and predictions we've never done before. And we can do that through simulation and computation.

So data-driven science is this awesome combination of lots of math, being able to do things in simulation because you can't always do things in the real world in a feasible amount of time, where it's just impossible to do so. And now artificial intelligence. So this platform has also allowed NVIDIA to do things that we've never been able to do before. And I want to show you a video.

We just came out of the computer electronics show. NVIDIA has been working on self-driving cars. We've created a platform that allows a car to drive around Silicon Valley without anyone touching it. It can change lanes, change highways all by itself. And we've created the platform from the application to the neural networks to the computing stack and the hardware. And all of the infrastructure you need to build in order to train a car how to drive. And we've done this so that we can hone our skills in artificial intelligence. And it's just incredibly fun. And I want to share this video with you.

One thing I'd like you to look for is look for where it says it DRIVE SIM. This is where we're doing simulation. And it becomes really difficult for you to really sense what is reality, what is the real side of the video and what has been simulated. So take a look here.

(presentation)

You're seeing -- the car you're seeing on the left-hand side, you're seeing the way that it's detecting the car that creates a big space that it's living in. There's a massive amount of perception that goes on. Here, can you tell the difference of which video is real footage and which had been simulated? This is an amazing leverage of what we feel is in the gaming industry.

Simulation is going to be incredibly powerful to all industries. And it certainly allowed us to make a massive amount of progress in a short amount of time.

This is why I'm so excited about health care. If you think about what are some of the fundamental instruments that drive what is going to be precision medicine and what we use in health care today, the amount of diversity and the kind of sensors that we have and the data that we collect, the size of the data that we're collecting in these times is unprecedented. And I believe the health care industry will be one of the greatest commanders of high-performance computing. Everything from what happens when you're born and your genetic makeup. And now we have this capability of continuum from how does your life change and what you're exposed to, how are you being treated over your lifetime and what is happening in your environment around you. We want to be able to accelerate and bring insights into all phases of not only the acquisition of these datasets. But the analysis and integration of how they work together so that we can really forge a trail towards personalized medicine.

So let's talk about that a little bit and how NVIDIA is making a contribution into some of these critical instruments that drive the compute pipeline of precision medicine. At the data acquisition side, NVIDIA has been making a contribution to all of these sensors. These detectors are continuously improving. We're getting new types of detectors entering the market all the time, with next-gen sequencing, with ultrasound, liquid biopsy, of course, our traditional diagnostic instruments, the Noble prize-winning cryo-electron microscopy that's allowing us to look at protein structures that we couldn't look at before and even robotic surgery. These instruments are what start us down the path of being able to use computing and use data to do data-driven science and data-driven health care.

We then want to do a -- how can we -- what can we do with that data? And how can we make the analysis of it more efficient? If you look at the amount of data that's being generated by these instruments, there has to be a computing paradigm shift that goes on in the downstream analysis of it. Then finally, how can we integrate that data so that we can bring true insights into the prediction and more accuracy and efficacy to what's going on? And these contribution across this continuum is something NVIDIA is helping the industry address. We have platforms that are embedded directly into instruments. And up until just a few years ago, they were largely used just for computation. But rapidly, people are integrating artificial intelligence directly into these instruments, either to make the image acquisition more -- to make it faster, to make it more real time. Maybe they don't need as much time to acquire the data because artificial intelligence can get back to the quality that it needs. It can completely transform what's going on in acquisition.

So let's talk a little bit through what's happening in a particular domain of health care that has had an immense amount of progress and we're very excited about. Radiology had a breakthrough year in 2018. Over 70% of the research that's going on in medical imaging is now based off of deep learning methods. There has been just a continued massive investment. And I'm delighted about it, of artificial intelligence start-up companies. Over $2 billion at least invested in 2018 in over 130 deals. These companies are getting FDA approval. These companies are striking deals with the leaders in medical imaging. And they are making an impact in the clinical practice.

What's very, very telling is the Radiology Society of North America, the largest radiology conference. There, we have over 20,000 radiologists who are getting trained on AI. There's over 270 sessions. Last year, there was -- two years ago, there was only 8 sessions. Some of the leaders in medical imaging had made some pretty critical announcements that talk to you about that acquisition, processing and integration. One of those is Canon, who is also Toshiba Medical before that. They have a new AI reconstruction algorithm for CT. They can now take a low-quality image, which essentially means they can take a low-dose image. And they can get back to the very high-resolution imagery through an artificial intelligence algorithm. And they can do it at 40 frames per second, which is real time.

Then there's GE Healthcare. They announced their Edison platform, which is their intelligent platform for radiology workflows. They have a brain hemorrhage detection algorithm that when they detect that, they automatically reorder the work list of the radiologist.

We think about what Siemens is doing. They have a 16-PetaFLOPS supercomputer to develop hundreds of AI applications that are actually already in production. They have a new platform called AI-Rad Companion. This Rad Companion helps them -- helps radiologists automatically quantify and measure and then look at all the anatomy in the image, not just a single anatomy, all of it. And then look at reference points to say, is there something wrong with this anatomy that we should maybe alert our physicians to?

This is why NVIDIA has also announced this past year our NVIDIA CLARA platform. This is a hardware and software platform that allows these instrument pipelines to be efficiently processed, from the acquisition to the analysis to even the integration. It can run -- this platform can run on an edge device that's inside the computer, inside the instrument. It can run in a data center. And it can run on every public cloud which NVIDIA is in.

This is so exciting because if you now think about what is happening in drug discovery, we have new modalities entering the market in more of a mainstream fashion. There's been breakthroughs. Just 10 years ago, yes, cryo-electron microscopy was present but not at the resolution that it is today. We're in this resolution revolution with electron microscopy. Users of these instruments can create 2,000 movies a day, 3 terabytes of data a day. And it's incredible that they do it because they're able to image proteins at atomic level scale. They can see things that were not possible before. They can analyze and understand structure of new targets that were not possible before.

So how can we enhance the acquisition of this, because the detectors are so incredibly good? How can we make sure that that's -- that processing at the detector is happening? Then the analysis, how can we do automatic particle picking or reconstruction of this? And how can we feed that into the next stage of the pipeline, which is the simulation of molecule and target in a most efficient way? And we're working on these problems. We're making a contribution here across that continuum.

And of course, as you know, genomics is absolutely becoming mainstream. We've seen some incredible breakthroughs in 2018 and of course the years prior. But we're seeing genomics be integrated into the standard of clinical care. Oxford Nanopore this year released what's called, they released it before, the MinION in 2014. And they continue to iterate on what that flow cell can do from a data generation perspective to get more and more accuracy and address more and more markets. They're able to create 30 gigabytes of data off a single flow cell. And they've evolved that. This is a genetics -- a genomic sequence that you can hold in the palm of your hand. You can take it into the field. And they use NVIDIA technology to do that sequence analysis. And that's why you see that middle chart, came from the NIH, thinking about what we thought was going to be our trajectory of genomic data and what is actually happening. We have to think about new paradigms in computing for doing genomic analysis. So we're working with some start-up companies. ParaBricks has gotten a 40x improvement on bioinformatics and secondary analysis.

Then back to what happened recently on our world's largest supercomputer. The researchers at Oak Ridge, they created this application called CoMet to do population genomics. What can we understand about the variations and then these complex networks of variations to say what are the traits of these populations? What are the variations in these networks? How do they correlate to some traits that we're trying to understand? They're looking at opioid addiction, Alzheimer's, cardiac disease, some of the things that we all deeply, deeply care about. And they put to use 27,000 order of magnitude drop -- 27,000 GPUs they put to work to do this level of analysis on population genomics. And this is just the start. This computer just got installed. So you can imagine what are the type of problems that we are going to address with this level of computation.

Another really, really great story is Geisinger. As you know, Geisinger has always been pushing forward on adopting technology to better serve their patient population. They're putting AI into practice all over the place. They adopted electronic health records well over 20 years ago. So they have some of the greatest data out there that has 20 years of electronic health record data, lots of imaging data. And as you know, they declared that they are going to be and are integrating genomics into their standard of clinical care. So they've employed algorithms where they can detect a similar hemorrhage in their patients and 96% decrease in time to do that. They've increased the accuracy of predicting clinical outcomes immensely by incorporating echo as well as EHR data. They can understand the survival of their patients a lot better and offer them different kind of clinical care. And now they're incorporating genomics and really thinking about how can we do things like optimizing the deployment of our clinicians. And they're really thinking about all of the interesting applications from a provider's perspective, if you have this capability, of course, they have the data, how can they put it to use for better care.

And it doesn't just stop there. The drug companies are -- if you think about biology, it must be one of the biggest data challenges of all time. No human is the same. There is no equation that governs biology. And so that means that it has to be one of the biggest consumers and drivers of accelerated computing in the future.

AI is boosting discovery in all -- boosting new breakthroughs in all facets of what drug discovery is doing, from discovery to improve its efficacy and understand more about toxicity and bringing efficiency into this, whether it be searching the literature, which CloudMedx has a platform to do that, which is a start-up company, whether it's ParaBricks being able to accelerate base calling and variant calling. You have Vyasa who is thinking about how can we do different compound prediction. We -- Phenomic AI, which has incredible AI algorithms for high-content screening. These startups are addressing really, really important problems that are going to accelerate and make more accurate to the drug discovery process so we can help paradigm shift what needs to happen in pharma. And we're just so delighted to be able to work closely with these ecosystem partners and really transform the way that drug discovery is done.

So I have to say, that is why NVIDIA is so excited about health care. Understanding that biology is going to be -- it's messy data. It's huge data. There's actually no other answer than artificial intelligence. And we have this opportunity to work really closely with the ecosystem and we are, to help create new applications, new platforms that allow us to acquire data differently, analyze it and truly bring together the data integration.

I hope this industry thinks of NVIDIA as the instrument for discovery. We are the instrument for discovery. We're the instrument of this journey that I think we're all marching towards, which is how can we get to precision medicine.

So with that, I'll thank you. We are going to take Q&A in the breakout room. Thank you, Harlan. Thank you.