EPISODE 83

[INTRODUCTION]

[0:00:10.4] SC: Hello and welcome to another episode of TWiML Talk, the podcast where I interview interesting people doing interesting things in machine learning and artificial intelligence. I'm your host, Sam Charrington.

This week on the podcast we're featuring a series of conversations from the AWS Reinvent Conference in Las Vegas. I had a great time at this event getting caught up on the latest and greatest machine learning in AI products and services announced by AWS and its partners. If you missed the news coming out of Reinvent and want to know more about what one of the biggest AI platform providers is up to, you'll want to stay tuned, because we'll discuss many of their new offerings in this episode. A roundtable discussion I held with Dave McCrory, vice president of software engineering at wise.io at GE Digital; and Lawrence Chung, engagement lead at ThingLogix.

We cover all of AWS's most important news, including the new SageMaker and DeepLends, the recognition and transcription services Alexa for Business, Ggreengrass ML and more. This kind of discussion is something a little new for the show, but it's also a bit reminiscent of my days covering news here on the podcast. So I hope you'll enjoy it.

Before we dive in, just a few short announcements. We're quickly approaching our last TWiML online meet up of the year, which will be held on Wednesday, December 13th at 3 p.m. U.S. Pacific time. We'll start out by discussing the top machine learning in AI stories of 2017, and then for our main presentation, Bruno Goncalves will be discussing the paper; Understanding Deep Learning Requires Rethinking Generalization by Chiyuan Zhang from MIT and Google Brain and others.

This would be a fun meet up and one you don't want to miss, so be sure to register at twimlai.com/meetup if you haven't already done so.

Over the weekend we hit another exciting milestone for the podcast. You might remember that back in August, we served up our 500,000th listened to the show. Well, momentum has been on our side and we are excited to share that we have already hit the 1 million listen mark. What an amazing way to close out an amazing year. Thanks to you, our TWiML family, for supporting everything we're doing, being engaged and mostly for appreciating our efforts in getting you the best show we can each and every week.

Finally, I'd like to thank our good friends over at Intel Nirvana for their sponsorship of this podcast and our Reinvent Series. As you'll hear, one of the big announcements from Reinvent is the release of Amazon DeepLens, a fully programmable deep learning enabled wireless video camera designed to help developers learn and experiment with AI both in the cloud and at the edge. DeepLens is powered by an Intel Atom X5 processor, which delivers up to 100 gigaflops of processing power to onboard applications. To learn more about DeepLens and other interesting things Intel's been up to an AI space, check out intelnervana.com.

Now, on to the show.

[INTERVIEW]

[0:03:37.3] SC: All right, everyone. So I am here at AWS Reinvent and we're doing something a little different this time. I've got my buddy, Dave McCrory, who I've known for years. Dave is the VP of engineering at wise.io at GE Digital, a name that you've heard before in the podcast if you have been listening for a while, and maybe we'll get into a little bit of that story when you introduce yourself, as well as Lawrence Chung. Lawrence is a managing partner at Perimeter, which is an SI focused on the IoT market, and Lawrence and I first got in touch when he reached out as a listener of the podcast, and we connected here at Reinvent.

Dave, Lawrence, welcome to the podcast.

[0:04:18.2] DM: Thanks, Sam.

[0:04:19.5] LC: Thanks for having us.

[0:04:20.3] SC: Why don't we let folks get to know you. Dave, tell us a little bit about your background.

[0:04:25.8] DM: Sure. Before joining wise.io, which is part of GE Digital, I was the CTO of Basho Technologies which made React and open source and SQL database. Prior to that I was the SVP of engineering at Warner Music Group, and before that I worked at VMware on the team that built the Cloud Foundry before it was spun out into Pivotal. Prior to that I did quite a few other things including two startups in the systems management and virtualization spaces.

[0:04:56.5] SC: Yup, and we met back in those Pivotal Cloud Foundry days.

[0:05:00.4] DM: That's right.

[0:05:01.4] SC: Long time ago. At least it seems like a long time ago.

[0:05:05.0] DM: It was a while now. Yeah, it's been 5+ years. I know that absolutely.

[0:05:11.2] SC: Awesome. Lawrence.

[0:05:12.7] LC: Yeah, I began my career right at the .com boom in 2000. So I spent a good chunk of time working with Deloitte's Consulting and just for various industries, and spent some time in the nonprofit sector doing some significant work that was more meaningful personally, and now I'm back here in the software sector focusing on IoT, like you said the IoT clients and markets. Helping them implement solutions based on the AWS ecosystem.

[0:05:42.2] SC: Nice. We've all been here for a few days in sunny Las Vegas, or at least the first day, it was like windy Las Vegas. I don't know what was going on with that. There had been a ton of announcements here, as there always are at Reinvent, and a ton now focused on machine learning and AI as well as the IoT ecosystem, and like these are kind of a Venn diagram with some intersection in the middle.

I figured a good way to get started would be to maybe just we each go around and say what we're most excited about that. I don't know. That may be difficult, but we can give it a try. Lawrence?

[0:06:21.7] LC: Yeah, sure I'll start off. Yeah, SageMaker made a big splash yesterday during the keynote. So that's going to be an interesting product for a lot of developers. I think it's going to simplify and accelerate time to market and maybe leave the complexity, technical complexity of training models and all those other aspects of building a solution.

[0:06:46.0] SC: Do you want to give a description of it?

[0:06:47.6] LC: Yeah, from what I understand there is a various, I guess, functional components to SageMaker that's been released. So there's this aspect of being able to set up a — I believe it was a Jupiter compute instance. There's the ability to run jobs. I believe there is an aspect ability to scale jobs, scale some training models and then quickly host and deploy some of those models.

[0:07:14.5] SC: Anything in particular you're most excited about for SageMaker?

[0:07:18.7] LC: I think overall It's just the ability for, again, those looking to build solutions that have a practical market-facing component to be able to deploy as fast as possible. I think that's the most exciting aspect of this announcement.

[0:07:35.8] SC: Yeah. AWS made a big deal about SageMaker. When I think about like the AI in the cloud, and I've talked about this in my newsletter, like there are three layers of the AI in the cloud stack. At the lowest level there's AI enabled infrastructure. People often think about this as GPUs, but it doesn't necessarily have to be GPUs.

Above that there is like this platform layer, and these are targeting data scientists that don't want to have to mess with all the underlying infrastructure muckety-muck, like getting their GPUs to actually work.

[0:08:11.6] LC: Right.

[0:08:12.6] SC: Above that is like the AI enabled services. Actually, Amazon announced stuff in all three of those layers this week, but SageMaker is their second offering in the middle layer of that stack. They had Amazon ML, which allowed folks to develop and train machine learning models. In like kind of the pure AWS fashion, just like via API, like it's arcane. There's like no usability, right? API level usability, but it is not like a user interface or anything like that, at least as I understand it.

Whereas SageMaker, they've adopted, as you mentioned, the more — The increasingly popular Jupiter Notebook paradigm. When I first saw it, I actually had a chance to play with it yesterday and one of the DeepLens workshops. When I first thought, I was like, "Okay. I hosted Jupiter Notebook. That's not really all that interesting," but then they've got this one click deploy, or one click train and they handle all the training infrastructure, and then one click deploy, which that's not all that uncommon. Like everybody's got a version of that, but the one click train is pretty cool. Then they've got like — They've done some work at the framework. First of all, it's framework independent. You can use whatever, but they don't some work to be able to get — They've got these 10 primary algorithms write that they've increase performance 10X. So they say.

[0:09:45.4] DM: I'm willing to bet they have. If you optimize the algorithms properly, at least in my experience, it's roughly a 10X improvement over what you would see standard out of, say, a general purpose framework or suite of algorithms. Maybe it's nine for this. Maybe it's 11 for that. 10 being the average. Yeah, absolutely.

[0:10:06.8] SC: Put all that together and it becomes a pretty interesting package, and I think for me the thing that struck me is just the — It's an ecosystem play. Like it hooks into everything that AWS has, and in one of the keynotes, Andy Jassy like put a slide, if you can call that a slide of like their different services, and it took like five screens wide in order to display all the services.

[0:10:35.2] DM: It did.

[0:10:36.0] SC: So that's SageMaker. Dave?

[0:10:38.9] DM: I'm curious about what SageMaker is really going to enable. They've obviously had customers using SageMakers. We saw it today during the Verner keynote that was an example customer that was talking about how they developed a service using SageMaker, which means obviously they've gone to companies and had them use it prior to the announcement, which is common with Amazon. They have some type of pilot customers in such so that they can ensure that the service meets the needs of their customer base.

What I'm curious about; there are a lot of questions when you're doing machine learning in my mind of those 10 algorithms. If you're a novice, how do you know which algorithm is appropriate for what you're trying to do? How to SageMaker tell me that or not? I'm not saying it doesn't. I'm saying I don't know. How does it do that?

There's also labeling of data. When you're bringing data in to do machine learning, how is that achieved? Do you have to figure all of that out yourself before you feed it into SageMaker? Again, I don't know, but I'm curious about that.

I'm curious about how you decide what futurization needs to take place. So how do you choose the right label data to apply to perform the machine learning? If you have a small dataset or your dataset is simple or it's highly structured, probably not that difficult. Highly unstructured, say you have thousands or hundreds of thousands of potential features, how do you drill through and select those? Even if you're a highly qualified data scientists, you're still going to need domain expertise if you're trying to solve a problem in a domain that you're not an expert in. How do you go about that? Again, I don't know. I'm curious about it.

As you begin to get results, how do you constrain your problems so that you're getting a high enough level of confidence in what's being predicted out of the algorithm. Obviously, there're hyper perimeter optimizations. It's cool that they do auto tuning using machine learning for all the different hyper parameters. That is something valuable. I have seen that done. It is very valuable. It does work. It's very useful. So absolutely excited about that.

Then the other thing that I would question is — And what we haven't seen is what happens when we introduce what I would call the chaos components into machine learning? So think of

the — Again, today we had the chaos presentation where they were talking about continuously injecting failures into the system. What happens as you feed data into the model and you get unexpected results out? How do you go back and refine your model and what is the process to then update the model? It doesn't seem very clean right now to do updating of models in SageMaker. It may be. Again, from the presentations and what I've read so far, I don't see that. So I'm very curious to see.

Also curious how reinforcement learning would be done. How can my model then take the feedback and continue to develop, and again how do you deal with bad data when that occurs so that your model doesn't end up skewing and ending up providing horrible results, because you got a bad batch of inputs? Those are some of the curious things that I believe are harder and make it a little bit more difficult than just have the kind of pushbutton experience.

So I want to know how did they address those things. What are the aspects that they have overcome? Because maybe some of these things they have already overcome, and if they have, I would love to see how they've done it. If they haven't, how far away are they? Because those are all going to be things that I think will hit people when they try and leverage this for real world applications.

[0:14:23.6] SC: I think those are really interesting points. I think when we think about SageMaker as — Maybe democratizing is probably too — Not only overuse, but too broad for this, but in terms to Lawrence's earlier point, making machine learning, if not more accessible, just taking some of the crap out of the process. Like even getting AMIs set up email can be a major pain in the butt and in theory, you're just supposed to launch them and they can work you can go to a URL and pull up a Jupiter Notebook. But that doesn't get into like where you're training and all that kind of stuff.

This certainly takes a lot of the chopping wood and carrying water, the saying goes, out of the equation for data scientists. Probably the most disturbing thing I've heard here on a couple of occasions is that SageMaker will allow developers to develop AI applications. Like we're not quite — All of the questions that you brought up are data science. That's the stuff that you need to know and we're not at the point where we're not there yet. But that's not the case for like the

APIs on the higher-level APIs, which are kind of interesting, but you haven't given us the thing that you are most excited about. Dave.

[0:15:54.8] DM: What am I most excited about? I would say the combination of what's trying to be done with SageMaker with what's happening with what I'll call the less announcements. So that would be all of the Lambda stuff, a.k.a. serverless, the container lists announcements with EKS and such, and then being able to tie those things together with machine learning. Being able to run your own algorithms outside of the ones that AWS supplies. That's pretty exciting to me. Being able to kind of wire all of those things together.

I would say the idea that people are now able to build complete solutions out of entirely AWS managed services without needing to then build and run their own services to still have what I call a viable business or a viable infrastructure for their business. That's pretty exciting to me. That begins to, again, the overuse where democratize the infrastructure much more, because now I don't need an army of experts just to build and operate the core infrastructure components, like run my database or something that should have been trivial a long time ago.

[0:17:08.7] SC: Right.

[0:17:09.8] DM: That's pretty exciting to me.

[0:17:11.1] SC: Yeah. For, like there's a bunch of stuff that's — I have all the questions, right? But there's a bunch of stuff that's interesting. Like outside of the realm of the AI stuff. So we don't go into this in a lot of detail, but elemental. Did you see the elemental stuff? It's basically like spin up your own Netfli. Like all of the every pieces that are required to build a media surveying business there as a service, pay by the second or minute or hour or whatever it is for this one. That's amazing.

I remember trying to solve that problem. This was probably like five years ago. I'm like you had to spin up. I remember the thing that I was trying to do was like a transcoding thing. You could only do it on a Windows AMIs. You had to spin up a Windows AMI, which was in and of itself a pain in the butt, and then you had to like put together all of your — I had messaging services,

and like batch runners, and this was like a small sliver of what one of those APIs offers, and now they're basically giving you like Netflix business in a box.

[0:18:19.9] DM: I'm wondering what service that evolved out of. Did it evolve out of Prime or did it evolve out of Twitch?

[0:18:25.8] SC: They acquired a company. I forget the — Probably it was Elemental. I forget the — It might have been Elemental, but they acquired a company based in Seattle, I think. Do you know that story, Lawrence?

[0:18:37.2] LC: Elemental. Yup, that's right.

[0:18:38.2] SC: Okay. Actually, they've had the company. It's been a couple years since that acquisition, right?

[0:18:42.5] LC: Years, yup.

[0:18:44.2] DM: That was Cloud 9 today with the IDE. That was an acquisition. Now it's the Amazon IDE, which actually looked pretty cool to me as well.

[0:18:55.7] LC: That's got to be exciting for developers. That's quite an improvement on the console, the experience.

[0:19:03.0] SC: Does it change the AWS console itself or can you access the AWS services straight out of Cloud 9?

[0:19:09.9] DM: It has a CLI, direct CLI interface, a direct terminal interface, and it has the ability for you to locally deploy a lambda function. Try it out, debug it and then remotely deploy it on to AWS Lambda. All baked in. That's pretty, pretty cool. Plus, it has a syntax highlighting and all of the other juicy things you would expect, and collaborative features where you can do simultaneous code editing and messaging.

[0:19:38.6] LC: It's Google Docs for IDEs. It's essentially what it is.

[0:19:43.0] SC: That sounds incredible. Yeah, i forgot that they even acquired Cloud 9.

[0:19:46.4] DM: Yeah. I had forgotten as well. I saw it on Twitter. One of the founders or something or Cloud 9 kind of confirmed. Yup, that's our stuff.

[0:19:58.9] SC: Interesting. Along kind of the point of the integration, the thing that I'm most excited about is actually — It's hard to choose, but this DeepLens.

First of all, what is DeepLens? DeepLens, it's not a production service. It's not something that they're trying to get people to use. It's a developer's kit, and it's basically a camera mounted on something analogous to a Raspberry Pi, right? From that perspective, like SageMaker. I think you my first impression was, "Well, it's kind of like a camera mounted on a Raspberry Pi. Is it really that big a deal?" But then you get into like all of the integration with all these other things. So, for example, I mention I sat in on this workshop and basically deploy the hotdog, not hotdog app. But to do that, like you're cooking and with the identity access management obviously, where it does there. You're hooking in with —The device is running Greengrass, right? You know Greengrass?

[0:21:08.9] LC: Yeah, it's their IoT. Part of their IoT platform.

[0:21:12.0] SC: Yeah, basically it allows you to execute like AWS API commands on a local device.

[0:21:20.5] LC: On [inaudible 0:21:21.4] devices. Yup.

[0:21:22.5] SC: Yeah. Thing is running Greengrass. The developer experience is like you go to Sage, you build out your application in Sage, and we used like a SqueezeNet, it's like kind of a compressed CNN built on MXNet. Build this thing, you deploy it out via this connection with Greengrass, it's just like deploys out to this box. Then it's super easy to hook it into Lambda functions and to trigger, like hook into the IOT suite and stuff like.

[0:21:59.3] DM: I think that's one of the interesting things is that they are making Lambda kind of ubiquitous. Greengrass allows you to run Lambda all the way out at the edge. Now you're able to run arguably Lambda functions on devices and you can obviously run lambda functions on Lambda services up in the cloud. I think that's kind of telling of where things go. It, to me, harkens all the way back for those people that remember the early days of Java and the idea of running Java anywhere. They had the micro JVM that would run on phones and things all the way to the idea of running it in set-top boxes to then running it on your computer at home, to running it in servers. I think Lambda is kind of the evolution of that idea to run out at the edge. I think that's pretty exciting.

One other little point about the Raspberry Pi analogy for the DeepLens device itself. From what I understand, the hardware in that DeepLens device is incredibly powerful to the point of being almost 100 times as powerful as which you'd see in Raspberry Pi.

[0:23:06.7] SC: Yeah, in fact — So the hardware, it's an Intel Atom processor and somehow they've managed to get 100 gigaflops a second out of that device. That's the number they're claiming.

[0:23:18.2] DM: Wow! 100 gigaflops.

[0:23:20.7] SC: 100 gigaflops.

[0:23:22.5] DM: Wow!

[0:23:23.5] SC: That's the same order of magnitude as the like an NVIDIA Jetson with the GPU. That's like 150, right?

[0:23:32.7] DM: Right, with an Atom processor and a camera.

[0:23:34.3] SC: With an Atom processor and a camera.

[0:23:36.6] DM: Wow!

[0:23:38.6] SC: Clearly, you're not going to train there, but that's not the point. Like you've got the cloud for that and you just one click push your models down to this thing and you're doing inference with 100 gigaflops.

[0:23:50.7] DM: Which arguably gives you as close to real time as you can get at least today with the computer power, which seen the opportunities of having a real time identification model that you can apply to video and to images. The number of applications that there are for something like that, I can think of 100 off the top of my head, let alone all of the ones that I'm not aware of in thousands of other places.

[0:24:19.8] LC: That seems to be strategy for Amazon; let's empower developers to get creative and really build out as many solutions and POCs as possible and hopefully some of that will stick and make it to the market. For $249, what do you think?

[0:24:37.6] SC: Right.

[0:24:39.9] LC: Are you surprised by that number?

[0:24:42.3] DM: I think it's a good number. What struck me just now was this should've been the path that Google Glass took, and I think Amazon's going to get a heck of a lot more uptake with this than Google did with Google Glass.

[0:24:57.4] SC: How should Google have applied it to Glass, the price point or integration?

[0:25:02.9] DM: I think integration, ecosystem and the — Well, Google Glass had a cool concept with you just wear these glasses all the time and such. Some people found it invasive. Whereas if you have a camera or you have a device that's like your phone and I'm holding it up, you know that I'm filming you, unless you're like really crafty, but overall you know someone is filming or taking your picture or they're using the device. So that kind of eliminates a lot of the perceptive privacy concerns, and then having this incredible set of capabilities beyond just, "I can look at my email or something like this." This is more of a developer approach of all of these amazing things that I can integrate and do with DeepLens versus Google Glass where it was more if these are applications you have to go that route.

[0:25:53.5] SC: Smart consumer. Almost like the Snap Glasses, right? They try to make a consumer thing when they miss the opportunity to enable or develop their ecosystems to Lawrence's point.

[0:26:05.7] LC: They've got the Alexa device. They now have the dash buttons, real simple, real affordable, and now the DeepLens. That's pretty powerful combination.

[0:26:17.6] SC: Do you know the difference between the IoT one click buttons and the dash buttons? Dash buttons they've had for a while now, years, right?

[0:26:27.8] DM: : : At least two or three years, yeah.

[0:26:30.3] SC: This time they announce these IoT one click buttons that I haven't figured out what the difference is.

[0:26:38.4] DM: I believe they're an evolution of the dash buttons, and you can actually hack dash buttons to do other things from what I understand. I've not done it, but they're almost the same thing, but I think not quite. I also believe they streamline the experience of programming the IoT buttons to be able to make them, again, more developer friendly versus the dash, which is consumer. I think that's really it though. I don't think there's a dramatic differences.

[0:27:07.1] SC: Okay. I may be thinking of something. There was the consumer dash buttons and maybe there was like some limited addition developer version of that, because you could — Or maybe it was a hack thing that —

[0:27:21.7] LC: I don't believe it's released yet publicly. Yeah, I heard the same time.

[0:27:25.1] DM: It was a giveaway. They gave away these IoT I believe last year. Yeah.

[0:27:30.9] SC: Maybe that was just like the prelude to this IoT one click thing.

[0:27:34.5] DM: I think so, which is still interesting and it still gives you a good pathway. I think that's one thing that they're trying to do, is enable lots of different ways of leveraging IoT, which is the right approach. I mean, especially Amazon's — Amazon released AWS. Their entire growth strategy is around enabling the ecosystem and expanding it, and that's what they keep doing. They empower developers and they create all of these componentized things to make it easier to build more things, and then they continue that cycle. The ecosystem grows, and they get more customers and it's a virtuous cycle.

[0:28:14.9] SC: So there were a ton of IoT related announcement. Lawrence, you're our IoT guy. What do you think? Well, you're in IoT guy now too. I guess, at G Digital. What struck you as interesting on the IoT side of things?

[0:28:29.5] LC: Let's see. What was there — Wednesday morning I believe.

[0:28:34.5] DM: They had quite a few IoT announcements. They have a lot of IoT announcements around managing IoT devices and interacting with large numbers of them and having control and such over IoT devices or consider large numbers of them.

[0:28:50.3] SC: It's like fleet management or IoT stuff.

[0:28:52.1] DM: That's exactly right.

[0:28:53.8] SC: I think the ones that were like closest related to the AI thing where the — There was an IoT analytics offering that they announced, and the Greengrass ML inference, which I think is just the productized version of the DeepLens. Actually, like what DeepLens is doing is I think a products — Yeah, I think that's the generic kind of productized version of what the DeepLens is doing where the developer experience the envision developer experiences, develop using SageMaker or something else, kind of one click push your model after it's been trained to not just DeepLens but any Greengrass device and then do inference on the edge. That one is in preview now, so you have to fill out a form to get access to it.

[0:29:47.4] DM: Which I'm curious how long it stays in preview, how quickly they can evolve that. There's a lot of value in being able to run at the edge, collect the IoT data, perform

analytics and do things like machine learning inference. The number of different industrial applications is pretty high. So I can see that. I'm curious what other applications we'll see and what the demos next year will be like. That's where the kind of proverbial rubber will meet the road at.

[0:30:19.6] SC: At Perimeter, you're doing a lot or —Of do you see much applications for that kind of thing, the edge? Kind of the intersection of IoT in machine learning and AI and running stuff at the edge and all that?

[0:30:33.6] LC: Yeah, basically the common use case would be predictive analytics, right? Predictive maintenance, so just trying to optimize an asset, its life and maintenance, so where in our platform we've got a machine learning component that ties directly under the AWS ML service, and so we'll generate, again, models, train the models and then allow the inferences to really trigger an action that we're going to take in the IoT platform. So that use case is fairly common.

[0:31:07.8] SC: I guess it sounds like what's new to some of these is that edge element of it. Have you been doing that part for a while as well or is that evolving?

[0:31:16.6] LC: Yeah, that's fairly new. You're referring to just the recognition, the video, image capabilities.

[0:31:24.4] SC: When I think of or when I've heard like the IoT at edge, the idea I guess is that you've got whatever plant, using the term. You've got some bank of sensors at either a physical facility or within a geographic region and you want to do things like predictive maintenance or other analytics against them, but you don't want to pull all that data centrally back to the cloud. You want to push some of that processing more locally, so you deploy these edge devices.

Greengrass was like a software stack for these edge devices that allowed you to basically use the same API calls that you would use and cloud-based Lambda on the edge. It's like a programming model for these edge devices, and then what they announced this week is this ML inference thing, which is in addition to being able to run these Lambda models or these Lambda

functions, you can also deploy machine learning models from SageMaker and other things, presumably other things, on to the Greengrass devices themselves.

[]0:32:39.9 LC: Yeah, I feel like we're still in early days of seeing that being deployed, but it'll be interesting to see how that grows over the next few years. Are you seeing, Dave, in your role more that type of application?

[0:32:53.8] DM: We're seeing more of a requirement to be able to do that for different types of applications where either the data is too large to use the cloud, or there are compliance regulatory or governance issues that would prevent it from being sent to the cloud, so it needs to stay and run locally. That could be in something like healthcare or it could be something that's large-scale industrial.

We have an application today for a customer that in a single year, a single application out of an industrial machine generates 600 petabytes of data. I don't want to send 600 petabytes of data up to the cloud. Is it possible? Absolutely, it's possible. Why would I send that level of data to the cloud? I'd rather apply the data locally, do some processing and send the essence to the cloud ,or if I did want to send it to the cloud, I would still want to send intelligent decision-making back down to the edge to be able to make those decisions. That needs to be in a reasonably compact footprint, because it might be on the industrial floor or might be somewhere else where I can't have lots and lots of gear taking up space, consuming power, using resources or at risk that it's going to be damaged.

It's something we're seeing, but I still think that's 4 to 5 years out before we see that kind of gaining the momentum of being commonplace, where it's being rolled out everywhere. So I would agree, it's early days for that. Not early days for machine learning and production, but out at the edge, people are still trying to fill their way on how all these things fit together.

[0:34:45.6] LC: Let's see if we can come up with some use cases. I can think of maybe an Airbnb example since everyone loves to build and take advantage of that industry. So maybe a video camera stream at the door, your guests, picture of them in advance that have made the booking. They're going to arrive and perhaps the device, the camera can lock the doors based on the capture of the doorway.

[0:35:12.7] DM: Yeah. I know Amazon has this service, the security service that was allowing for delivery people to walk up and it would unlock the door for them to put the delivery inside and then shut the door. I know they're fixing it and all of that, because it had a security issue. Still, the possibilities of having something like that, as you're saying for Airbnb, that would be fantastic. You could eliminate the need to even give guests a key. That would be very handy in my mind.

[0:35:43.6] SC: What's interesting about that example is I think, at least for me personally, it really illustrates the power of what the cloud is bringing to all of these. We'll use AWS as an example, because we're here, but Google has their own ecosystem of similar things. Microsoft has their own ecosystem of similar things.

With any of these ecosystems, I can pretty easily imagine — Like let's take the case of AWS, likeyou're your DeepLens out at your door. Filming video, someone presses your dash button or your IoT one click, which is your doorbell, right? that sends an IoT request that gets pushed down your DeepLens to turn on, do a face recognition, and you match that against your Airbnb guest profile, even do an on-device inference, do another IoT request that unlocks your door. Of course, you can manually override all of these stuff. You can have a dash button by your desk to let them in if you want, or you can get a regular camera and stream that video out to recognition video, which we haven't talked about yet, but it's also something they announced today, and do similar facial recognition.

You could even do — Actually, I don't remember if they do like emotion, like, "Does this person look scary or not. Should I let them into my house?"

[0:37:15.4] DM: Are they angry? Sentiment analysis, right.

[0:37:20.0] SC: Even at this relatively early stage of the game, it becomes easy to see how you can put all these pieces together to build pretty interesting applications quickly.

[0:37:30.4] DM: I liken it to the whole idea, I think that we would all love to have something like Jarvis from Ironman, that kind of thing. The components are getting there. We're still a ways off.

I have no illusions that anytime soon we're going to see this amazing Jarvis, but the components that you see from the movie, if you go back to, I think, it's 2008, they're all starting to happen. Maybe not a flying suit that does all these amazing things, but the idea of Jarvis —

[0:37:58.7] SC: But Elon is working on that.

[0:38:00.1] DM: Well, but the idea that Jarvis is this assistant for Tony Stark and Ironman and that he can do these things. He'll say so and so is at the front door. Should I let them in? You can see those types of things happening and you could see that that kind of digital assistant, I'll call it, carrying on to the car and you being able to do all these things for your car. So you're driving your car and you find out that someone's at your door, but it's able to know that you're actually headed home right now and they're saying, "Do you want me to let the guest in to your home, because I know it's your Aunt Sally. Do you want to let Aunt Sally in while you're on your way home or not?" By the way, I didn't have to look at my phone, Aunt Sally didn't have to call me, I didn't have to do any of those things. I simply hear it and respond while I'm driving. I can totally see that happening in, say, 5 to 10 years easily with these components that Amazon and the other companies frankly, weather it'd be Microsoft, Azure or GCP. I see the components there. I see it as — It's within reach. It's not, "Oh! That science fiction a hundred years from now." It's getting really close.

[0:39:11.0] SC: Some of those higher-level components that AWS announced this week are, just mentioned, Rekognition video. So Rekognition is there. Rekognition with a K. Is that another acquisition?

[0:39:26.3] DM: I don't know.

[0:39:27.6] SC: I don't believe so. I met with — I don't remember if he was a GM. I think it was a GM of that business. Amazons has got this really interesting process where they call it the working backwards process, and they start with what is basically the press release for the service that they want to announce and work backwards from there, and when they get to the end of a product development cycle, they go back to that document and determine whether they actually met the promise of this press release.

I spoke with an individual who authored this press release. I believe it was —They could've acquired some pieces, but I think it was internally developed. Rekognition was announce, I think, last year at Reinvent, and that was image-based object detection. Send it some images, it'll tag those with glass, bottle, whatever, beach ball.

So they announced, in fact last week. They had so many announcements at Reinvent. They started announcing things like two weeks before and they may continue. I think I heard someone say they'll be some announcements after.

[0:40:44.3] DM: They're doing — My understanding is, today they are doing, I think, 4 to 5 an hour, every, on the hour, and there will be announcements — From what I've heard as well, there will be announcements into next week, which is just the sheer number of services. I think the services, it was like 3,600+ services are now available. At some point, no matter who you are, you will not be able to keep track of all of the services available, which makes you wonder if you keep looking at the AWS site. How are they going to make it so you can find the services the you want to use? It just becomes a problem.

[0:41:23.9] SC: It's an interesting issue — We'll put the recognition thing on the stack for second, but like when I think about Alexa, likeI've got — I don't know, how many of them at home. I don't use any of them, and they keep telling me that they are great and that there are like 1,600 skills or 16,000 skills. I forget what the large number was, but like there's no easy way to find them. Like you go through — I'm not going to search these 16,000 skills in an app, let alone like via voice.

[0:42:00.5] DM: It would be great if you could say, "Alexa, what skills do you have around time, or what skills do you have around —" and it would say, "I can do these."

[0:42:10.2] SC: Or personalization, "Alexa, I've been buying shit from you for about 10 year —" How long has Amazon been around? Like 20 years, whatever? "What skills do I need? You know half the things that exist in my house."

[0:42:24.0] DM: That's right, and when I buy in a weekly basis, to tell me what I need. I agree with that. I use my Alexa primarily for exercising. I set timers with Alexa and I have it play music for me or read the news while I exercise.

[0:42:37.2] SC: Wow! That's a good idea.

[0:42:38.7] SC: And when you're exercising, you don't want to go touch your phone or your tablet or you what. You don't want to deal with all of that data. That is like an ideal example of wanting to be hands-free.

[0:42:49.0] SC: That's perfect. So I've tried Alexa in the bedroom as the alarm clock and it's an interesting use case, but it kind of fails as an alarm clock, because you can check the time without waking up your spouse, which is kind of a problem, right? I've tried it in the office, but I'm sitting in front of a computer and it's easier to just do whatever I want to do on a computer, but the exercise room is interesting.

[0:43:15.2] DM: Exercise and kitchen. Those are the two where you really don't want a computer involved. I've used it in the kitchen as well. Those are kind of the two ideal places that I found so far where it's just hands down way easier to use Alexa than really anything else.

[0:43:34.5] SC: They announce — Did you mention Alexa for Business?

[0:43:37.7] LC: That was announced this morning. That's right. There's a business edition of Alexa that's been rolled out. That'll be interesting. I think that's another great use cases in the office, on the conference table connecting to meetings, calls.

[0:43:54.6] DM: I agree. I I've always had this dream of a vision for Alexa and I'm sure someone's going to do it, but I would like to be sitting at a conference table having a discussion and be able to have Alexa walk me through a process of narrowing down and making a decision. I think that would be fantastic.

Another thing would be interesting with be —

[0:44:16.3] SC: Dave, it sounds like you guys are all over the map on this one. I recommend the Ben Franklin process. Get a piece of paper and draw a line down the middle and write the pros and cons.

[0:44:28.3] DM: Maybe not exactly like that, but may be presenting all of the possibilities and then providing something like a map that's output of all the things that were discussed, or ideally a worldly map after a strategic discussion. That would be fantastic.

[0:44:46.3] DM: That would be amazing.

[0:44:47.4] DM: Or Alexa being able to act as a moderator or a mediator. That would be fantastic. Those should be things, do I think these are going to be out in six months? No, and I'm not saying that all, but I think those should be fantastic, highly, highly, highly common things that happen in conference rooms every single day across every industry. That would be incredibly fast, and it seems like it wouldn't be that far away.

[0:45:13.0] SC: Another interesting example. I've talked to a couple of companies now that are building platforms for doing information augmentation based on like transient listening. The scenario here might be you can say, "Alexa, start listening and help us out." It turns on the computer screen and it's just listening to your conversation, and as you talk about things, it's doing entity recognition, identifying the important stuff may be based on all of the documents it's scanned in your environment. You mention — Well, we talked about that in the report last year that was issued blah-blah-blah, and it throws that up on the screen.

[0:45:55.9] DM: I actually like that. I can think of uses where just talking about like a public company and going, "Oh! What was on their latest quarterly report?" and Alexa goes, "Okay. I want the latest quarterly report for Acme Co." It goes up, automatically looks it up and displays on the screen or everyone to see and you don't have one person typing at the keyboard and going, "Oh, well. I have their quarterly report up here." "That's great. Now, can you email it to me?" Then you email it to me. Now, everybody's on their computer and they're opening up the report. Instead, it's just displayed and the section that you're talking about is highlighted. That would be fantastic.

[0:46:32.6] LC: That's certainly the natural evolution of where Alexa and voice recognition is moving. You got to believe that, right?

[0:46:41.5] SC: That's the right point, right? Evolution. We're not there yet.

[0:46:44.3] LC: Oh! We are so far from that. You got to think, just based on where how Amazon began, just the idea of buying a book online. They made that every day normal activity now, e-commerce, and so they're doing the same thing with voice. No doubt they're providing these devices. It sounds pretty cumbersome and silly and awkward at home in the kitchen when you're talking to your Alexa device, but soon I think 10 or 10 years or less, it becomes a normal thing, and business, we're going to see people or managers and Linebergers demand for voice interaction to perform their work.

Right now, at one of our projects, we're deploying a platform called ThingLogix foundry, and the one use case in an agricultural setting is — And I believe this is a cattle ranch or farm setting where you got gloves on, trying to package the meat to the butcher, and just the idea of having to take your gloves off and record with a pen and paper, because you're going to count each part in the volume and weight. Having to do that and take off their gloves and put it back on is just a pain. So the ability to just speak to a device to log that information for you and then send the order —

[0:48:00.6] DM: Probably double the efficiency at a minimum.

[0:48:02.5] LC. Yeah.

[0:48:03.2] SC: Oh, yeah. You can easily see that.

[0:48:06.0] LC: I think that's slow, but we got to get through this psychology, this human mindset of, "That's silly. Why would I speak to a machine to do my work?"

[0:48:17.2] SC: That's the magic of making these things like super easily accessible and letting everyone get one. I think the price went down to as low $29 bucks for like Black Friday and all that stuff.

[0:48:30.9] DM: I believe you're right. I see it as not only do we do we see this marching along, do we see the sophistication and the services going up. I can see going into stores. A while back, they had the Amazon Go, which was the store where you could go and in and then you sense their fusion to be able to go in and you buy things just by putting in the card or taking that —

[0:48:51.6] SC: Not a while back. They had it. A while back they announced it.

[0:48:54.2] DM: Yes, they announced it. There was a store that was actually an Amazon Go store and it's still there in Seattle. Recently in Seattle —

[0:49:02.3] SC: You can actually go to one?

[0:49:04.1] DM: Employees could go and supposedly it's supposed to be open. Yes, real store.

[0:49:07.2] SC: Oh, really? I didn't realize that.

[0:49:09.0] DM: There's also at least one, an Amazon physical bookstore. I've been there and purchased things from an Amazon physical bookstore.

[0:49:16.9] SC: Is that in New York?

[0:49:18.1] DM: No. It's in Seattle. It's Belleview actually. I thought about it, the way it works, you go in. It's geared towards making you want to become a prime member, because you get discounts on the items in the store by being a prime member, but then when you check out, you simply pull up your Amazon account on your AWS app on your iPhone, you set it to camera mode and you scan a 3D barcode and it presents a 3D barcode on your phone that you scan at that register and it pulls up all your information. It gives all your account and it says, "Do you want to charge it to your normal card for prime?" You can just say yes, and it will email you a receipt and you leave.

I was thinking the only next step would be to use sensor fusion for me to have a photo of myself tied to my prime account and when I walk in it recognizes me. I take my stuff and I walk out of the store and it just charges my prime account and I get the email receipt and —

[0:50:19.9] SC: There are so many ways to do that with a sensor fusion. You can do the video thing that you — Apple's demonstrated that you can do it with the 3D point cloud thing with the iPhone X. You can do facial recognition of a camera with video. You could — Amazon shopping app is on my phone. It could access location services. I've trained my Alexa with my voice to differentiate between the people in house that are using it, like, "Sam, do you want to make this purchase?" "Yes, I do." It knows that it's probably me and I'm in the right location.

[0:50:55.5] DM: Now, Sam do you want to share that you made that purchase with your wife?

[0:51:00.1] SC: Exactly.

[0:51:01.0] DM: Maybe you were both going to go and buy something and you can say, "Oh, share this purchase with my wife so she knows that I bought milk and she doesn't need to pick up milk on the way home," or whatever it happens to be. There's value in that.

[0:51:12.8] SC: Yeah. So just for sake of completeness, API services. We keep coming back to recognition, but there are some others, right? So they announce Translate. They announced Translate, Transcribe and Comprehend. Comprehend is kind of interesting I think. Like you can put a document corpus up on S3 and call an API and it will do entity extraction and topic modeling and a bunch of interesting NLP stuff. Lots of questions, right? How well does it work is the first one, but the idea that you can just do that with presumably a huge corpus of documents and just have one click, all of that stuff. The example they gave was, for example, financial news articles, financial articles. It can identify all the brands that are mentioned. They can do sentiment analysis. They can identify places, people, and there are a bunch of other categories of stuff. That's pretty cool.

[0:52:14.2] DM: I can imagine being able to say, "Alexa, what's the current sentiment with Brexit, or pick your controversial topic." "Well, on Facebook it's this. On Twitter, it's this. Across the average news media, it's this, and the confidence rating is 72%."

[0:52:33.1] SC: The Russian bots seem to think that —

[0:52:35.9] DM: Exactly. I can see being able to ask questions like that and actually have a reasonable answer in the near future.

[0:52:47.5] SC: Translate is another interesting one, like it kind of depends on how well it works, I guess.

[0:52:53.1] DM: That's what I'm curious about. I know that translation, language to language translation it turns out is an astronomically difficult problem, and having been incredibly poor at all languages, I would argue, including English, and then learning of other languages and all of the challenges that you get. I went to China and the difficulty in translating, for example, technology terms into Mandarin, there are no words, so they will substitute other words that don't make sense if you run them through Google Translate, for example. It comes out as like the soap star fish and you're like, "What is soap star fish? I was talking about cloud computing. How does that relate?"

I see problems with that, and there are problems especially if you try to convert from one language to another and then you take that conversion and try and convert it again in Translation. Forget it. It will be so far off from what you expected.

[0:53:52.7] SC: Were you telling me about the caption video thing.

[0:53:54.9] DM: No. No. No.

[0:53:56.1] SC: Somebody was just telling me about this earlier today or yesterday. Somebody did a — I forget what it was. There's some project where they took some video, and I don't know if they automatically generated captions from it or they — I think they like auto — Yeah, they auto did speech to text on what it said, and then they like acted out in the video what the thing said it said, and then they ran it again against —

[0:54:31.1] DM: Against what the actual original content was?

[0:54:33.2] SC: No. It's like they did two layers of like running it through this either text-to-speech or pulling off captions or something. I don't know. I'll find it and put it in the show notes, but it sounds like something that would be hilarious to take a look at.

[0:54:46.9] DM: I would love to see that.

[0:54:48.2] SC: Yeah. There's Translate. I think, for me here, from what I've seen and granted they just announce this, but I think of Google is like the company to be. Google's done some amazing stuff for translation. I bought the Pixel Buds. I return then. Once I realized that, actually, the Pixel Buds is just a button to activate the app —

[0:55:11.3] DM: [inaudible 0:55:10.8].

[0:55:12.8] SC: Yeah. Not only that. Like it's way easier to do the two-person real-time translate, which is amazing when it works, but it's much easier to do it just on your phone without the stupid buds. That was the cool thing that suckered me into $160 Bluetooth headphones.

[0:55:29.6] DM: It sounded like a universal translator from Starfish. That's what everyone wanted. Yeah.

[0:55:33.9] SC: Right. Yeah. I should have known better, but, hey, return policies.

[0:55:40.0] DM: With DeepLens, you think about massive computer power and machine learning and such on a portable device. Not that far away from them.

[0:55:50.2] SC: Yeah. The other thing about — I think Google does a better job, like publishing their models and algorithms on a research blog than Amazon, and I feel better about that than Translate, which is literally a black box without a lot of input into the way they're thinking about it, or kind of contribution back into the community.

[0:56:12.9] DM: I think you're right. I think that's something that Amazon has traditionally struggled with. That was like the announcement that they made, and I think it was last week,

about providing consulting services around machine learning and having expertise and being able to help you do machine learning by providing this consultation, which if SageMaker is so amazingly easy, why do you need consultants to help you in machine learning. You might ask that question.

The question that I post on Twitter that remains unanswered; who owns the IP if you come in as Amazon and come in and do consulting and to help me develop an algorithm or you work with my domain experts? Who owns that IP? Does that stay as my IP? Is it jointly owned IP? How does that work? That remains unanswered, and I'm curious about that, because we all know Amazon loves to replicate things that they find that run on their platform and such, that there's no question about that. It's happened a thousand times, plus now.

[0:57:15.7] SC: You could argue that who owns the IP is the last decade's question, and this decade's question or the future decade's to come question is who owns the data. Do I have to license my data to you?

[0:57:29.1] DM: That's right.

[0:57:30.3] SC: Are you allowing other customers to benefit somehow from my data?

[0:57:34.4] DM: Well, it's my data and it's my machine learning model to solve my domain-specific problem, which is likely key to my business. Giving you access to my data, which is at the heart of my business, and the algorithmic processes that I used to solve my business problems, I wouldn't do it. No way I would do that. Otherwise, what's stopping your competitor from gaining the exact same insight you have that really differentiates your business from your competitors.

[0:58:08.6] SC: Or I didn't say it, but what's stopping Amazon from competing with you? It's not like they've ever done that before.

[0:58:13.3] DM: Well, true, but for example with GE, I'm doubtful that Amazon's going to get into making jet engines or maintaining nuclear power plants anytime soon. It's highly doubtful. Impossible? Nope, I won't say that. It is possible. Just I doubt it.

[0:58:30.3] SC: Right. I guess the — Did I mention all of them? The Transcription? I'm kind of personally interested in the Transcription one as a podcaster, because I'm going to try it. Like take — And maybe compare like all the different ones, because Google has something similar, Microsoft. I think Watson's got one. The results of my attempts at using these kinds of services have been variable, let's say. It's not there yet. What was kind of interesting about this one, two features, that they announced as coming soon. They're not here yet. Multiple speakers. It's kind of important on a podcast like this. Identifying and tagging the text from the different speakers. I haven't come across any of the other services that do that well in an automated way, but also custom vocabularies. Huge for this kind of podcast. If I can train it or tell it about CNNs and RNNs gradient descent, that could potentially increase the quality of translations for a podcast like this significantly.

[0:59:35.9] DM: It could also increase the quality of translations from language to language, for example.

[0:59:41.4] SC: I don't think they mentioned custom vocabularies in the translation product.

[0:59:44.9] DM: But I'm saying it wouldn't be a far leap if they get it right for transcription. How hard would it be to then do translation? Translation, if they could do real time translation when you're mentioning the Google side, I was thinking imagine being able to get five or six international speakers together and have a podcast and each of them speaks a different language, yet the interaction could be smooth without needing a team of translators or making people have to be able to be bi, tri or multilingual.

That would be pretty exciting. That would open up a lot of new doors that and eliminate barriers that we face today and being able to share more information between each other when language is a barrier.

[1:00:30.5] SC: Even more simply than that. This podcast has listeners all over the world, but English is a potentially huge barrier to entry, right? What if without me doing the interviews and us doing this interview in multiple languages, right? Folks can access that with pretty high quality in specialized context in their native language.

[1:00:54.1] DM: That would be phenomenal.

[1:00:55.0] SC: That would be amazing.

[1:00:55.8] DM: Absolutely agree.

[1:00:57.0] SC: So lots of cool stuff happening around AI and the cloud. Any final words, thoughts, anything?

[1:01:06.5] LC: Have you guys seen the [inaudible 1:01:07.6] announcement, the 3D mixed reality? Any thoughts on that?

[1:01:11.9] DM: I have not. That's one of the announcements I haven't seen.

[1:01:14.6] LC: That came out Sunday night I believe. So it kind of flew under the radar, but I believe there was a session. I didn't get a chance to attend. I was wondering if you have any insights.

[1:01:23.2] DM: I just saw the pictures.

[1:01:24.8] SC: I don't know enough about that space to like contextualize how interesting it is. There are two pieces of it that kind of caught me as interesting. One is like they've got this like VR developer app kind of thing. I don't know. It seems like there — I'm imagining that tons of people are doing that kind of stuff. This will have cloud hoax, which is kind of interesting. I don't know if it's backed by a service, like the game service and the physics engines and that kind of stuff, maybe, but they also have this thing that is kind of interesting, but kind of hokey. Like you can create — You can build out these virtual worlds n this app, but you can also create these virtual agents and you can give them like — You can like design them from a physical characteristic perspective, like skin color, hair type and hair color and whatever, and you can — There's an API that allows these virtual agents to like interact in this virtual world.

I didn't see any specific mention of integration with Lex, for example, which is their chat bot platform, but you've got to imagine that those are all plugged together. And so they're building this Second Life S kind of virtual world with intelligent chat bots in it that have like humanoid features.

[1:02:53.4] DM: Yeah. That's something that I'm going to personally pass on for a while. I think I prefer real life for that, conversing with real people in such, versus going into the virtual reality.

[1:03:09.3] SC: I mentioned virtual training, like corporate training as an example. You can do a training session. Have your people come in. There's a virtual greeter that can get them to their training. I don't know. As I said, it's kind of hokey. I don't really get it, but —

[1:03:25.0] DM: Well, corporate training is hard to make kind of a good experience.

[1:03:32.2] SC: One way or the other.

[1:03:34.6] DM: Yeah. We're going to do compliance training. How many people are like, "Oh, yeah! Compliance training. I can't wait to do that," said nobody, but I think it will get there one day. I think augmented reality will happen. I just think we're still pushing it and I still think it's early looking at all the different devices I've seen. I still haven't seen something where I'm like, "Okay. I have to have that. That's going to be the future." Certainly not a gigantic headset that I'm wearing. Nothing like that. That's not going to happen.

[1:04:05.4] SC: Part of those is just because we're geezers.

[1:04:10.4] DM: I don't know. It looks kind of silly and clunky and that usually becomes the barrier for people using it. That was one of the barriers for Google Glass. People are walking around and it just didn't look — It looked odd. Even in the Bay Area, you'd walk around and you'd see somebody wearing Google Glass and you're like —

[1:04:27.8] SC: You're in when they patch it into your nerve bundle.

[1:04:29.8] DM: Yeah, that's right. Jack me in like the Matrix where you just plug it right in. Then I'm in.

[1:04:35.5] SC: Yeah. Any final thoughts from you?

[1:04:38.0] DM: I thought it was a great show and I'm looking forward to seeing what happens next year and I'm also looking forward to seeing what the competition does, kind of is there kind of next level things? It's fun to watch the space evolve.

[1:04:50.0] SC: Yeah, absolutely, and it's worth following that up. I mean, there's definitely kind of this continual one-upsmanship here, like SageMaker which we talked about, a great example. Like everyone else that had it. Amazon didn't have it. It's not kind of Amazon way typical experience. They like to have things more API-oriented, but they did it, and they did some interesting things with it. So it'll be interesting to see.

We didn't talk about with Recognition, and I'm like we're going really long here. With Recognition, like one of the things that — Everyone's head. Well, not everyone. Actually, Google announced. I don't know if others have had it, but Google announced, for example, at the last Google Next, I think it was the first video object detection. Now, Amazon has this little bit of this kind of one-upsmanship.

The thing that's kind of supposed to be interesting with recognition is that typically the way that video object detection is done is it's done on a frame by frame basis, and what Amazon is saying that they are doing this like contextually, like temporarily, they're looking at a time span of video in there. They're not only able to identify objects in a video, but also actions, like there's a cup, there's a person. The person is drinking. It will be interesting to see. Like I like to kind of play with that and see how it —

[1:06:15.5] DM: If that's the case, that is a revolutionary thing to be able to make that leap for a machine's understanding that this object is being used by this object in this way. That's big.

[1:06:30.5] SC: A lot of questions there, but it is potentially huge. Another great example of this constant leapfrogging, and so I'm looking forward to the same things, just seeing how it all continues to evolve.

Well, Dave McCrory, what's your Twitter handle? How can folks connect with you?

[1:06:48.0] DM: It's my last name. It's @mccrory on Twitter.

[1:06:53.6] SC: Lawrence, are you on Twitter.

[1:06:54.3] LC: I don't hang out there, but I do hang out on Instagram. Just lawrencejohn_.

[1:06:59.6] SC: Okay. Underscore at the end, like you said?

[1:07:02.2] LC: AT the very end. Yup.

[1:07:02.7] SC: Okay. Cool. Awesome. Well, thanks guys. Great discussion. Next time maybe.

[1:07:08.0] LC: Absolutely. Thanks for having us.

[1:07:08.3] DM: Definitely. Thanks, Sam.

[1:07:09.6] SC: Awesome.

[END OF INTERVIEW]

[1:07:14.2] SC: All right, everyone. That's ours go for today. Thanks so much for listening and for your continued feedback and support. For more information on Dave Lawrence or any of the topics covered in this episode, head on over to twimlai.com/talk/83. To follow along with the AWS Reinvent Series, visit twimlai.com/reinvent.

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