Rashmi Mohan: This is ACM ByteCast, a podcast series from the Association for Computing Machinery, the world's largest education and scientific computing society. We talk to researchers, practitioners, and innovators who are at the intersection of computing research and practice. They share their experiences, the lessons they've learned, and their visions for the future of computing. I am your host, Rashmi Mohan.

The best way to predict the future is to create it. While our next guest is a groundbreaking technologist, serial entrepreneur, investor, and celebrated author, and has been creating the future for many decades, Alvin Wang Graylin is the global VP of corporate development for HTC and has previously served as the China president at HTC.

He has founded, built and successfully exited from four startups in the mobile world and is usually found at the cutting edge of all things technology. He's the president of the VR Venture Capital Alliance, vice chair of the Industry of VR Alliance, and now the chairman of the Virtual World Society, following his words with real action. He was also recently inducted into the XR Hall of Fame.

He's a distinguished professor at Beihang University and a recent author of the very well-received book, *Our Next Reality*. We are so thrilled to have an esteemed technologist on the show today. Alvin, welcome to ACM ByteCast.

Alvin Wang Gray...: Well, thanks for inviting me, Rashmi. I'm looking forward to our conversation.

Rashmi Mohan: Likewise, likewise. Alvin, I'd love to start with a simple question that I ask all my guests. If you could, please introduce yourself and talk about what you currently do and maybe give us some insight into what drew you into this field of technology and computer science.

Alvin Wang Gray...: Sure. As you kind of just said, I'm doing quite a few different things, both in terms of industry, as well as corporate, as well as more for cross-industry organizations. My focus really, right now, is to see how we can make technology something that does good for humanity and for society versus purely for profitability. As you probably mentioned earlier, I've been involved in studying and developing product and services and building software the better part of three decades.

I guess, what really got me started was when I first moved over from China to the United States, and my father sat my brother and I down and said, "Hey, we brought you over from China so that you can come to America with the best education in the world and have an opportunity to go make a difference." Essentially, he's saying the purpose of a human is really to leave the world better than when you came or before you came, and you need to find what it is that you can do to maximize that goodness.

I gravitated towards software and technology and tech, in general, just because when I first got here, one of the first things I did was, with the money that my brother and I earned delivering papers and working side jobs, is that we bought ourselves a computer. And from that computer, we started to do programming and get online and go on BBSs. This was back in 1980, '81, so it was like Commodore 64. And then later on, we had a Amiga, and then the, later on, Atari 400.

So, just really got gravitated to the computing and tech space and online medium because really allows an individual, with no other tools except his computer, to start creating things and to be able to see, fairly immediately, the impact of your work. For a young person to have that level of access, I think I felt very fortunate to have been given that opportunity by moving to a country like the US.

Rashmi Mohan: It's amazing, Alvin, that you were able to enter the field. I mean that I think it's particularly impressive that you and your brother were earning money and then sort of providing for your own interests. It's also amazing that your father had the vision to give you that freedom of expression and to tell you about... I think it's such a powerful thing for a lot of us to know, young or old, that we all have a gift that we can give, and leaving the world a better place than where we found it is so critical.

As you were, I'm guessing, very self-taught and learned a lot of computing on your own, did you always think that that's what you would study in college? Was that just a natural progression?

Alvin Wang Gray...: Well, I was doing essentially tech, yeah, pretty much since about nine or 10 until college. In fact, in college, I was building and selling computers and doing custom software and networks for small businesses and the university to pay for part of the college. It was something that I was pretty good at and something I enjoyed.

But to be honest, I was actually deciding between going into EE or going into aeronautics because I was in Seattle, and Boeing is based here, so aeronautical engineering was also an area that I was considering. The funny thing is when I was deciding between going to IBM for an internship to work on what became the PowerPC chip or going to Boeing and working on the B-1 bomber, and talking to some of the folks at Boeing, and they said, "Oh, if you come here, you'll be in a room where there's no windows, and you'll never see the sunlight during the whole time you're here. And you can't tell anybody about anything that you've ever done, even after you leave."

After hearing that, I was like, "I think I would rather work on something where I can actually see the sun and also be able to have conversations outside with my colleagues and friends and be able to enjoy understanding things and discussing things." So, I moved over towards the EE side, which also brought me later on to

Intel. But at the same time, I was also working at the Human Interface Technology Lab at the University of Washington, which was the first VR-focused research lab outside of the military, and headed by Tom Furness, who was actually just the former chairman of the Virtual World Society. I just took over for him a couple of months ago, so it's kind of going full circle as see the cycle of life, I guess.

Rashmi Mohan: That's incredible [inaudible 00:06:32], such a long association. It sounds like Tom Furness was one of your mentors when you joined the Human Interface Technology Lab. I think that was at University of Washington, if I'm not mistaken.

Alvin Wang Gray...: Yes, yes, exactly.

Rashmi Mohan: Right. Right.

Alvin Wang Gray...: Yeah. I mean, I think it's important for any young person now to have mentors that care about you and really can give you useful and unbiased advice. So, we should all try to seek those out because just a few people in your life can really change the trajectory.

Rashmi Mohan: Absolutely. Yeah, absolutely, including the one that told you about the windows also moved you in a different direction, even if it wasn't towards them. I'm also curious, Alvin, the field when you entered it, just in general, VR was super nascent when you started any serious work on it. That's amazing because you have a green field for discovery, but I'm sure there's probably a lot of challenges also that you may have encountered because it's an area that nobody has really explored seriously before.

Can you talk about both? What did you find exciting? What did you learn through that experience, as well as what were some challenges?

Alvin Wang Gray...: Yeah, I mean, I think going to any industry... And I've had the luck of being at the beginning of multiple technology revolutions over the last four decades, but the VR space, when I got in there, it was really the early days, and the devices we were working on were hundreds of thousands of dollars. They were definitely not consumer devices, and you had [inaudible 00:08:01] wired, and there was two and a half kilograms on your head, so more than five pounds of these devices.

Whereas, today you can get them for a couple hundred grams or some new... the eyeglasses or XR glasses can be under 100 grams. So, the weight, the comfort, the resolution, everything has just dramatically gotten better, and the best part is also probably several hundred times cheaper than it used to be, as well. So, it's definitely a lot more accessible.

And one of the other, I guess, challenges of in addition to comfort is also just the software, because the processing wasn't there, you're more likely to be nauseous. So, you had to get your VR feet, as they call it. The more you use it, the more you get used to it. But I think that's on par for any new technology. You really, whenever you're getting into the early days, you have to deal with the deficiencies or immaturities of a new technology.

I was also very early in the internet space where when I joined Intel was when the first browser came, and to see that entire industry come up. And when I went to China, I actually helped to create the consumer PC business there, and seeing people start having PCs at homes, where at the time in China there was only business PCs that was two to 3,000 US dollars, when the average income of a [inaudible 00:09:27] was something like two or $300 a year. So, this is kind of 10Xed your yearly salary just to buy a computer.

So, I was able to help create the various things that fill in the various things that was missing in the industry in terms of lower cost devices, lower cost channels, as well as localized content to help fill the growth in that business and the growth in that use case. By the time I left, we went from zero to about 300 in chips being sold into the consumer PC space, so just three or four years later.

And then later on, I was able to be part of the entire mobile revolution as well, where when I went back the second time to China, I started the first mobile search engine in China. At that time, there was no mobile internet, so we were doing text messages to do conversational search. So, like what GPT search is today, we were doing back in 2005.

So, almost 20 years ago, we were allowing people to send a message, send a question and have a response directly versus a link, because this was before they had WAP or apps or mobile internet or smartphones really. So, to see that grow, and then to have seen then the adoption of 3G, and seeing apps coming into mobile phones, and then getting into that side of the business.

And then over the last nine years, seeing that the growth of the XR business from essentially something that was disappeared for about 15 years to coming back onto the scene, and being able to restart something that I had been thinking about for multiple decades, to get back into that industry and play a role. I feel just very fortunate to have been in all these right places at the right time.

Rashmi Mohan: Yet, there's so many things in there that I want to talk about, Alvin. First thing being you've had multiple stints, and from what I hear, going back and forth to China was, how do you spot those opportunities? Was China a natural choice because that was home, because that's where you came from? That's maybe my first question, and I have follow-up questions as we progress.

Alvin Wang Gray...: Yeah. I mean, I guess I was lucky in the sense of when I went to Intel, the first time I went back to China was to help found the China office for Intel back in 1994, so exactly 30 years ago. And the fact that I spoke Chinese and was from headquarters and had an interest, they made me that offer to go there. So, in a way, it happened to me more than I chose it.

But the fact that I was in that position, it also gave me an ability to execute a lot higher level of things than I would have normally at my age. I was 23 and managing a business of multiple hundreds of millions of dollars and hiring dozens of people or more, or and actually later on computer people who I was managing and driving and sending direction for, all of whom were older than me, were better educated. And the only reason was I was lucky enough to be a Chinese speaker who was coming from headquarters, who had that interest and was there at the right time.

So, sometimes things happen because you're lucky, but then if you can connect to those opportunities and really show your ability to execute and your ability to analyze a situation and bring value, people will continue to trust you to do more and bigger things.

Rashmi Mohan: Absolutely. I think that's a very valid point that you bring up, which is ability to execute, I mean, opportunities, of course. One is to be able to spot that opportunity to be able to make the most of it, the responsibilities that you're given. Of course, it's a super young age to be able to have that level of responsibility over a business, but it's amazing that you were able to capitalize on that and learn and contribute positively.

While you were in China, I know you mentioned that you were also a serial entrepreneur. I know you were in mobile search and advertising. Again, I mean, it seems like a pattern, again. Brand new area, mobile technology was probably just burgeoning in the world and in China at that time. What was your experience of building in a brand new technology area? Were there learnings from both your previous experiences as well as your education that you felt were like a continual thread that you could apply and build on this new world of mobile technology?

Alvin Wang Gray...: Yeah, absolutely. We're all really a product of our prior experiences, okay. So, part of when I was actually at the University of Washington, I was studying natural language processing and working on neural networks in AI back then. And later on, at MIT, I also did a lot of symbolic-related AI. That type of experience played a big role in terms of helping me come up with the right solution set to enable us to actually provide workable solutions, given the limited processing that we had and the difficult complexity.

In fact, with Chinese, it's actually a more complex language to work with because there are no spaces between words, so there's a lot of different ways that you could cut a word to mean different things. So, creating the right

context to create proper natural language is probably more difficult than it is in the States, and there's a lot more words to work with. That experience was definitely, from a technical perspective, helpful.

The other thing was really just the experience of having done a startup after MIT in Boston and working through the difficulties of trying to sell to large companies, trying to get the big portals and e-commerce companies to work with us. When I went to China, I had to do the same thing, but to state-owned enterprises, to large carriers. So, I was able to, after we built our solutions, sell [inaudible 00:15:20] Chinese carriers and have them implement our search solution in their data centers and have our staff, often within their premises, to get these services up and running. That kind of higher experience definitely helped to fill and make me prepared to take that on.

But again, when you're working in a brand new space, there's always new difficulties that you don't think of. It's really, I think, finding good partners and good teammates that will fill in for things that are missing on your side because there's no way a single founder is able to have the total solution.

Rashmi Mohan: Yeah, absolutely. I mean, I know I was listening to some of your older interviews, and I know that you had a really, really successful set of partnerships. I know you were a partner at the Olympics. You partnered with China Telecom.

Alvin Wang Gray...: Yeah, the Olympics was something I'm actually quite proud of because at the time when the 2008 Olympics came around, everybody wanted to be a partner. And they were paying tens of millions of [inaudible 00:16:22] a logo and be able to use it. But for us to actually have done it completely organically where we said, "We think we can help you make the service and make it multilingual, make it natural language, make it work on any phone," and they didn't believe us.

But I had my team work for six months dedicated to that project, and we won the bid and was able to be the official mobile search provider for the Beijing Olympics, which is a real proud moment for us. Even though we didn't really get any money for it, but the sense of application of being able to serve your country and to serve such a important entity as the Olympics was something that was worth it for us to put that effort into.

Rashmi Mohan: Absolutely. And just the experience of working at that scale at such a global world stage, it is phenomenal, and obviously it stuck out. When I was listening, I was so impressed, and I was like, "Wow, that's such an amazing achievement for a young startup company."

One question I had, Alvin, about the companies that you built, I know it seemed like you were building for the hyperlocal market. You were building for the Chinese market. Did you take these products into different international

markets? And what was that experience like, like building in China, bringing it maybe west or wherever else that you took it?

Alvin Wang Gray...: Yeah, so for the service things that I did in China, actually, they were pretty much for the Chinese market because they was very local language, local market. The good thing is China is actually a large enough market where you can do that. Probably an only another place you can do that is in the US. These are essentially the two largest indigenous markets that you could operate in.

To be honest, I think Chinese companies, particularly software companies in general, have had a really tough time getting products to be accepted outside of China. I was in the period where really there was no Chinese apps or services or even websites that was popular outside of China.

Now, over the last few years, we have things like TikTok, and that came out of China, but really that may be one of the very few that was able to cross borders and be able to have that impact. Not just things like the more appliances and digital equipment and so forth, those have been very popular out of China for a very long time, but in terms of the software side. I think that the cultural and language barriers and the customs and expectations and user experiences of different cultures has made it a little bit more difficult for China.

But I don't think that that's going to be an issue longer term, although now the bigger problem is probably more geopolitical barriers that are being put up to limit the success. I think recently they've just announced that they're going to have a ban of TikTok that will start in January 1st. These are the kind of things that we would like not to see.

I'm actually not a big fan of social networks that are not bringing more innate value, and I think TikTok is probably one of the ones where you can spend a lot of time but not really learn much, so I'm not a big fan of it. But I think the fact that we are operating the way we are right now in the US where you have essentially a ban of particularly good reason, considering that they've really followed all of the policies and expectations of the local law. So, for America to be positioning itself as a democratic place of freedom and free speech, that's a little bit hypocritical.

Rashmi Mohan: Oh, fair enough, fair enough. And I think your point about TikTok is well taken by me. I know my teenagers will probably object or protest, but yeah, no, I hear you.

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What was also interesting, Alvin, is around this time, when you were in China and you were building and working very deeply in this space of building these

companies, you went back to HTC or you forayed into the VR space again. How did you see that emerging interest? I'm guessing they approached you because you had expertise in this area, but what do you think saw that resurgence?

Alvin Wang Gray...: It was a coincidence in the sense of I had recently sold my company, and then I was helping a friend start up a venture capital firm in Taiwan. And at the same time, I then got contacted by a friend who was the special assistant for Jack Ma, so he's the chairman for Alibaba.

Apparently Jack Ma was talking to the chairman of HTC, and they had mentioned that they were looking for somebody to head up their VR business and if he had any candidates. And my friend who was in the room, I guess, said, "Oh, I think I know somebody that might be a good fit." And somehow that connection got made, and I was able to go in with Cher. Sometimes good things happen just by luck, and I think I've been the recipient of multiple lucky breaks over my career.

Rashmi Mohan: I mean, I think it's also an area that you were one of the pioneers in, so, certainly, I think it was luck on both sides. I'm sure they were super lucky to have you as they were bringing up their VR division.

What did you think in terms of the market itself at that time, Alvin? Did you see it grow at the pace that you expected? Was it something that was more like a visionary thought from HTC, saying, "Hey, I think this market is going to grow. Let's start to invest in it"? Because it was still pretty early when you went in there. I don't think it had taken over. The interest hadn't taken over the world as it has today.

Alvin Wang Gray...: Yeah. It was fairly early, and it was a relatively early product because when I tested, it was still the early prototypes. But it is already significantly better than what's been on the market for the last 10 years in the sense of it was... HTC was a company that had first room-scale VR where you can walk around a room and essentially experience a holodeck-type experience. Whereas, at the same time, when Oculus, who was the other player in the market that was later bought by Meta or Facebook, they had ones where you were essentially sitting down in front of a camera, and you can move around, but it was essentially a sit-down type experience.

So, I was actually quite impressed from what I saw with HTC, and that did heighten my interest. But at the same time, when I was speaking with Cher after the demo, she's like, "Oh, what do you think? Does this excite you?" And I was like, "Oh, this is really exciting, but it's actually not that different than what I saw 20 years ago when I first experienced this thing."

Because when we had those several hundred thousand dollar devices, it already had the ability to do six DOFS or six degrees of freedom being able to move around. It had contracting. It had full body tracking. So, I've been able to

experience it definitely at a much lower resolution and lower processing, a lower fidelity, but it really was more of a linear type of a progress from where I was. But definitely, to me, it was possible.

And even with the early ones I saw in the early '90s, I could see where it was coming. And I had told myself, "Hey, within 10 years, everybody is going to be using this. This is going to be amazing." Three decades later where I think we're getting close to some broader adoption, but we're probably still a few years away from having this becoming fully mainstream.

And when I saw it again in 2015, I was thinking, "Okay, now I think this second resurgence is probably we're ready to take this more mainstream." I would have expected it by now to have gone even further than it is, even though it has gone into tens of the millions of users now, but we're still far, far away from the billions of users that we see on cellphones. So, we're still two orders of magnitude away from where we need to be.

Rashmi Mohan: That's very interesting, Alvin. What do you think is holding us back? I mean, when you took on the role at HTC, what was your goal in terms of what metrics were you tracking to see the success of this program or the product?

Alvin Wang Gray...: Yeah. I mean, I was looking essentially at trying to match the growth that we saw with the iPhone. You look at the iPhone, the first few years grew very slowly. I mean, not very, but let's say a few million units, but by the third, fourth or fifth year, it started to really ramp up into the tens and then the hundreds of millions by the fourth year. In some ways, I was internally forecasting that, "Okay, we should be able to get into that order of magnitude, and at least into the tens of millions of units, and then probably within five years, in the over a hundred million units."

So, I think it definitely has not lived up to that expectation I had for myself, although, I think, internally, there was a mix of expectations. Because I don't think the devices and hardware were as ready for mainstream as I had thought it was because it still had wires that connected. It still required high-end PCs to dock it the first few years. Only after the third year did we start working and [inaudible 00:25:44] on these standalone devices.

And now, we're getting to a point where I think we are really, now, a few years away, like three to five years away from having the hundreds of millions of devices out there. Because I think we need to move from having headsets, which are giant boxes on your head, to glasses form factors. And within the next couple of years, you'll find that there will be probably over a dozen vendors from around the world that would be providing glasses-type form factors that has displays, that has AI built in, has fairly long use time.

Compared to the set of Google Glass that I had first used back probably more than 10 years ago, those devices lasted 40 minutes, and it was out battery. And

it was one eye and was really thick, and a super nerd. Now you have glasses that look like glasses that people can't even tell, unless they really look closely, that these things have cameras or mics or they're [inaudible 00:26:42] than what you would expect.

And I think the social acceptability is definitely one of the things that held it back in the past. Now, I think that, currently, that what's holding it back is actually the lack of content that makes you want to use it every day. What we find is that for a lot of XR devices, the first month or two, it's being used very heavily, but after that it is dramatically slows down because a lot of people run out of the content that really excites them.

The good news is now, with what's happening with generative AI and all of these AI tools are coming out where we're first going from prompt to pictures and then prompt to video, and now we have prompt to 3D worlds or prompt to 3D objects. And then you have AI avatars that are fully synchronized with voices that you can then generate to sound like anything. You can essentially put NPCs that are almost feeling they are alive into these virtual worlds and have it all be generated [inaudible 00:27:41] time and almost for free.

When you have that, we get around the limitation that we have in terms of content that resonates with you and actually to come back, and we will have reasons to put it on every day. And the more you put on these devices, the more use cases you have, the more data you are generating that makes you want to stay longer because now it is more useful to you than ever before. I think that positive reinforcing loop is about to happen, and when it does, then we will start to see the ramps that I was hoping for and expecting eight, nine years ago.

Rashmi Mohan: Yeah, I think that's fascinating, Alvin. I mean, I think what you're talking about is also, how do you build that engagement? I know when the internet first came out, people were thinking a lot about engagement metrics, and how do you keep people on your web page and apply them with the right set of ads and the content. The time spent was a big metric that we would track.

Do you feel like we are at that inflection point now of greater adoption because we've now learned to understand the domains in which this is particularly valuable? Because I know you also spent some amount of time thinking about applying VR in the field of education. Was that just one of the areas that you were exploring? I thought it was fascinating when I heard you talk about that, and I'm just wondering if you thought that the technology naturally lends itself well in that domain, and now we're expanding way beyond that so that it's applicable to so many different areas of our life?

Alvin Wang Gray...: Yeah, I think education is one of the, I think, most positive use cases of this technology in addition to things, let's say, like medical use case or collaboration. Gaming is what a lot of people know XR for today because where Meta is

pushing with their on-your-face gaming console type of a positioning for their product, although I don't think that's necessarily the most productive or useful use case.

The reason that I really lean towards education is because we, as a species, have evolved in a 3D space, and our brains adapt best and learn best when we actually are in a 3D environment when we can not only see something, but we can feel it, we can walk around in it, and we can let our whole body be involved in it so we can have full-body learning. That allows you to learn faster, to remember more and to be able to reach all of it better.

I think that's the possibility where we can essentially let the next generation of learners have the ability to not just watch a movie about history, but to actually travel back into time, not just be able to see a document about atoms, but to actually make yourselves into the size of an atom and see how they interact with each other. That kind of visceral learning is something that you can't help but learn, you can't help but get excited about.

So, education definitely is an area I look forward to more use cases. It have been a tough area for businesses to be successful in because is a highly regulated business or an industry. And I think there's a lot... It's that the school, in general, have been relatively slow-moving in terms of their decision-making and their adoption. We even see that today with AI language models where a lot of schools and a lot of teachers are afraid of it. And they're afraid of students using it because they think of it as cheating.

I just feel like that's such a wasted opportunity because this technology is something that can allow kids to have access to essentially a personalized tutor that will be available 24/7 and be able to teach them at the pace that they need to be learning at and to be able to personalize the content to them. It should not be seen as a threat to schools if school's objectives was really to teach. It's only a threat to schools if school's objective is to make money from teaching.

So I think that the education industry is really needs to be disrupted a little bit and probably will be disrupted quite a bit over the next few years, and I think for the better. And hopefully the progressive teachers who are part of that structure will enable it to happen where you're bringing in the AI to support learning instead of keeping it out as a way to preserve jobs.

Rashmi Mohan: I think it's amazing that you bring such a positive spin to the use of AI, as well, Alvin, because I think a lot of us, also, you tend to read a lot of media, et cetera. There's a lot of fear, like you say, about adoption, and what does this mean for the way humans have been operating for centuries?

It naturally leads me towards your book, Our Next reality. You talk a lot about the metaverse and just your overall... I think your dialogue in the book is really

highlighting the positive outcomes of us being engaged for us embracing this technology with open arms.

I'm just wondering if you could maybe give us just a little bit of your perspective on why do you think we are at this pivotal point of adoption right now? What has changed? I know you spoke a little bit about the availability of content, but what is your perspective on why we, as progressive humans, should really be adopting or embracing this technology now?

Alvin Wang Gray...: Oh, embracing AI technology or immersive technology, immersive media?

Rashmi Mohan: I would say immersive. Yeah, immersive technology, and AI as well, I would say. And I'd love to hear your perspective on both because I think that there's a little bit of caution and worry on both fronts.

Alvin Wang Gray...: It's natural for people to fear change and to fear things that they don't understand fully. And the realities that both AI and XR are technologies that is complicated to understand it and to explain, and particularly I think XR in the sense of, if you haven't tried it, it's very difficult to use words to describe it to you because it's such a visceral medium, and there hasn't been enough devices out there to let enough people buy it firsthand.

Now, I guess the importance of why XR is going to play a greater role in our future is that I really think that the AI and XR are actually going to be two sides of the same coin in the terms these are two technologies that are both maturing at the same time, and they're both highly reliant on each other. Almost anything in XR and the metaverse would not be possible without AI. Everything from eye tracking to voice recognition, hand tracking, to rendering 3D objects and scanning a physical world, to talking NPCs, all of these would not be possible without AI.

And the same is a lot of people don't realize the next generation of AI would not be possible without XR. Because for AI to get to the next level, it has to have real-world understanding. And right now, there aren't enough physical sensors for these AI data to understand the real world. So, a lot of its training for the 3D world is actually done in virtual simulations. It's like a matrix for AI where we put them into these virtual worlds, and this is how robots are now training each other. This is how autonomous cars are training how to avoid accidents and to handle different edge cases in the world.

We need that type of systems to be around. In fact, if you look at all the new teleoperated robots now, all the humanoid robots, they're all trained using TeleOp systems where a human is wearing a headset, doing something, and that the cameras and the sensors are able to capture what the human is doing. That information then informs the robot how to do something and to be able to repeat it at a professional level. So, that type of tool is mandatory for us to get to that next level of AI advancement.

Now, the other thing that a lot of people maybe don't want to understand or maybe are afraid to see is there's going to be massive job displacements that will come from the maturity of AI, starting first in the white-collar world. And then later on, as these humanoid robots become more and more pervasive, even the blue-collared service work will start to be displaced, as well.

What would these people need to do to retrain themselves? I think XR will play a significant role in terms of being able to retrain the humans into new skill sets that allow them to be productive in society. The other thing is there's also going to be a lot of mental stress that will happen from job displacement because so many of us, right now, to rate our personal identity and link it to our jobs.

Sometimes when you meet somebody, the first thing you say is, "Oh, I'm Rashmi and I work at so-and-so company," or, "I do so-and-so work," or what's my so-and-so title? So, we're so identified with our jobs as who we are. And if sometime in the near future, a lot of people, some large portion, 10, 20, 30, 40% of the population is no longer working in these jobs that they used to be in, how will they have a sense of identity, a sense of belonging or a sense of value to society?

Because where immersive technology can play a major role, particularly if we can actually establish that metaverse infrastructure where we can allow the global trade of service and labor and cognitive knowledge around the world, if we can allow for people to be able to do travel, virtual cultural learning, virtual services, virtual child care, whatever, where you can create virtual worlds, and then use that as a way to have an outlet for your energy, or virtual art, or virtual music, or you can provide a virtual service to a physical person or company somewhere else in the world in the world through a 3D cross-border platform.

That's why I'm a big advocate of us starting to think ahead before all of these displacements happen, to start building that infrastructure that we need to enable essentially a parallel tier of digital or virtual commerce to happen. And this also allows for easy and natural redistribution of wealth between the haves and have-nots in the world and the rich and the developing countries in the world. Because at the end of the day, it doesn't really matter where you sit or who your parents were, if you can provide a service that's valuable somewhere else, and somebody else is wanting to pay you and compensate you for that service. This allows that global workforce to be much more accessible than it is even today.

Rashmi Mohan: Yeah, I think you bring up so many good points, Alvin. I mean, one thing I think is not maybe spoken about as much is how the immersive technologies and AI is actually going to be great to upskill. We hear a lot about potential job losses, but we don't really hear much about what we could do to upskill using these technologies and how it would be so much easier to be able to seek knowledge, learn and be able to acquire new skills.

The other point that you also bring up about equalizing, which is, I think, the next area that I was going to go into is, how do we ensure that this is actually something that is not only limited to certain geographies or certain economic stratas, but is really actually equitable across the globe so that people have access to this technology, and the communities that need it most, in terms of upskilling, are able to access it?

The other thing I think is also critical is while we are talking a lot about the fact that there's all of these amazing uses of AI, but there's certainly some guardrails. Or like you said, how do we ensure that people are thinking about how we can encourage this adoption, but within these guardrails to allow for this to be a positive experience for most of the world? Who do you think is looking at this from more like an uber level across the globe? Are there organizations? Are there policies that are being put in place?

Alvin Wang Gray...: There are definitely a number of industry organizations that are trying to create more standardizations across countries and across vendors. There are some regulations, some policymakers that are probably more domestic or national level. I've seen more international level AI regulation, but very little international level XR- or metaverse-related policy discussions.

I think a lot of people have been... A lot of the ideas and thoughts around immersive tech was actually drowned out a little bit the last few years with the rapid rise of AI, and everybody's attention have now focused on AI. I think what a lot of people don't realize is that the issues that AI will bring to the world in terms of the job loss, the lack of progress, maybe even the lack of understanding alignment, the interpretability can be solved when we have a proper global metaverse system.

So, one of the things with AI that people are afraid of is AI is going to go rogue, and it's going to kill us all, and it's going to become evil and domineering and et cetera. The reality is actually we could probably take these early AI models, put them into these virtual worlds and see how do they behave when they live in a world of a billion virtual beings? Do they act aggressively or are they more benign? Are they more compassionate? And to run it for a million years or a billion years in virtual time so that we don't have these issues where people say, "Oh, well, it's just pretending that it's nice until you give it all the power. Then it's going to become evil."

And you hear a lot of fear out there about where technology could go, but I know a lot of ways that I feel like we're anthropitizing it based on what we've seen humans doing, but there's really no evidence and no research that shows that more advanced AIs is going to be somehow more malicious than less advanced AI. In fact, I think that the bigger danger that we need to be thinking about is really more around the misuse by humans, both that there is 100% certainty that there are bad actor humans in the world, and when they get access to special capabilities, they will misuse it.

And we were talking about cybersecurity earlier and before this chat. If you're dealing with hackers and ransomware makers and terrorists, they're going to be using this technology to their advantage because it is a very... What is that? Asymmetric tool in the sense of the person who has it, if you know this hole first, if you see a vulnerability before other people, you're able to take advantage. And that asymmetric capabilities allows a very small group of people to have a very large influence on the system, whether if you want to hack into a system, or you want to hack into a bank, or you want to turn off the power grid, et cetera.

So, there's a lot of things that same type of asymmetric nature will be possible in the AI-centric world when we have very advanced AIs available, especially as they become more and more easily accessible, as well as easily processed. Because now, a lot them are being optimized, so they don't necessarily need to run on giant data centers. At least with data centers, it's sort of monitor what's happening. But when you start able to run it at the edge, those kind of security possibilities go away. So, there's definitely a lot of potential downsides and the greater need for the guardrails that we had talked about because the data issues is really where we need to spend more time focusing on.

Rashmi Mohan: Absolutely. What would your advice be to young technologists, folks who are in computer science who want to get into this field? What would be good areas of research or work that they should be focusing on to actually make a significant impact?

Alvin Wang Gray...: The pace of change that we're seeing, essentially, if you're not already an AI scientist, it probably too late for you to start to get into that field and to make an impact because there are already hundreds of labs and probably hundreds of thousands of people who are working in this field trying to advance it. And at the pace of change that we're seeing, within the next one to five years, there's a very high probability that we will get to AGI. And then likely within months or years of that, we will get to AMSI.

I guess, I would be less focused in telling young people, who are just starting out their career or starting out their studies in computer science, to say, "Okay, now you should go be an AI scientist or a researcher." I would say, "Look at what the AI systems have today and find an area where you are passionate about, whether it's for healthcare, or whether it's for education, or whether it's for better food or helping the climate, or whatever." The value will come more from the application of this technology than it will come from the development of this technology by the time that they start to enter the workforce.

And honestly, I feel like a lot of the people who are in these industries today, they don't have enough technical basis to properly apply what's out there. So, this may actually give young people a greater voice and a greater influence in whatever industry that they go into by applying what's coming out of the labs into the real world. Because what we actually find right now, even with what we

see, the advances in capabilities that we see in things like the GPT models or the anthropic models where their actual use case in the real world is still relatively limited.

It's something that will not be the case within two or three years where almost every senior leader I'm talking to is trying to find ways to apply it. So, if you can think about how you can apply it to solve real-world problems, whether it is cognitive problems, or data analysis problems, or decision-making problems, or even robotic problems to solve physical issues, I think all of those would be amazing use cases.

I would say not to do as much of what you can in the weaponization side. I know there are people in defense industry that are very heavily focused and trying to apply this technology to creating better weapons and better ways to harm your opponents, but I think we need to be careful about what type of signals we are sending to these AIs and how we're training them because the AI is a reflection of what you tell it to do. If you're telling it to find the best way to kill somebody versus finding the best way to solve the climate problem, or their food problem, or their health problem, it will do its best to do those things. I would rather we have more of its capabilities and energies and more of our creativity and innovation put into the positive use cases.

Rashmi Mohan: Very well said, Alvin. I think that's very encouraging and also such a positive direction in which to motivate the youngsters of the world to start thinking about the applications of this technology, to embrace it, to learn more about it and apply it to the problems that they're most passionate about. Thank you so much for your thought-provoking work and for taking the time to speak with us at ACM ByteCast.

Alvin Wang Gray...: Well, thank you for inviting me. I enjoyed our chat and happy to chat again if you ever would like to do that.

Rashmi Mohan: Absolutely. Thank you, Alvin.

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