

WEBVTT

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00:01:50.130 --> 00:01:53.520

panelist: And she

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00:02:25.470 --> 00:02:55.450

panelist: he's a co-author of one of the most, if not the most popular textbooks in the field of artificial intelligence, uh, which is called artificial intelligence on our approach, and interesting, will be in two thousand and eleven. He top what many would call the first of the modern moves. Uh, you talk of artificial.

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00:02:55.460 --> 00:03:14.430

panelist: We have sciences, the American Academy of Arts and Sciences, and if you can add one last thing, we're so lucky to have Peter. Here he's been someone I've always looked up to in my career, and beyond all is act like on him to be such a genuine, thoughtful, and kind person uh, and that's always. In fact, he doesn't mention anything you've done

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00:03:14.850 --> 00:03:33.980

panelist: so in today's center. Here is going to be discussing a lot of interesting questions related to education and Ai. Before we begin the presentation, a few participants for people in the zoom audience. You can use the zoom chat to message the group, but if you want to ask questions at it through slide, you can click on the link that will be in the transfer.

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00:03:33.990 --> 00:03:48.519

panelist: I'll be choosing questions, replied after the presentation. Uh, and there's a nice upload of features that I could use to pick the questions that are most relevant. We'll split the Q. A time between people from the virtual audience and people from our live funds,

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00:03:48.530 --> 00:03:55.979

panelist: close captioning have been enabled. Those are just like the Cp. Feature on your zoom screen to show close captures throughout the tower.

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00:03:56.180 --> 00:04:02.470

panelist: It's so lucky to have you here at Stanford. You both give me this talk, and as an Ag: I follow everybody here.

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00:04:07.910 --> 00:04:23.049

panelist: Alright. I'm not going to be here, too, and I can quite design uh what to do. So I need to get too far.

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00:04:23.170 --> 00:04:26.930

panelist: Okay. So part one is, what should people know about it? Yeah.

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00:04:26.940 --> 00:04:53.009

panelist: And this is something I've spent a large part of my career thinking about. So I did four editions of this Ai Tech book, starting in one thousand nine hundred and ninety-five, and it was quite different and and coming up to uh sort of right. At Covid We published this version, and found that the printing was not a um property during Covid, and it took a little bit longer than that.

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00:04:53.020 --> 00:04:56.760

panelist: And then this past year I spent more time than I thought. I was going to

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00:04:56.880 --> 00:05:04.389

panelist: right this book with different set of of authors on data, science slightly different. Look at the

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00:05:04.780 --> 00:05:07.309

panelist: so. What should people know about A.

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00:05:08.000 --> 00:05:34.329

panelist: And first question is, What do you mean by people who who are you talking about. And so I spent a lot of my time with a students, and in the beginning I thought, I think what thing is Can you implement this out. And now i'm thinking you want to be able to participate in the field, You want to be able to respect technical principles. Anybody can download the office from, you know. So what the education is is going to be different in this.

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00:05:34.410 --> 00:05:50.379

panelist: And then, secondly, Cs Students Center veterans uh, so i'd probably be able to think of a uh a class internally, as Google is. Say, we're gonna teach machine learning to software engineers who are having machine learning before,

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00:05:50.390 --> 00:06:07.519

panelist: and we put over ten thousand engineers through that the other day of this government, Ceo from Amazon. They've done the same thing, and I think all the companies that are doing that same thing. I'm saying, Okay, you came out of school. You didn't have any Ai for machine learning. We're going to get you up to speed because you're dealing with data you're going to have

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00:06:08.510 --> 00:06:11.480

panelist: uh, So students uh

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00:06:17.170 --> 00:06:22.790

panelist: um, And then all citizens want to be able to understand how technology and that.

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00:06:24.000 --> 00:06:47.130

panelist: And I want to do this at multiple levels. I really focus on the college and professional level. It's also. Uh I want to try to help figure out what can be done at the K Twelve level of the introductory uh through to senior citizens who, you know they're going to be using technology, and we make it accessible to them, and it should be cross-colored.

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00:06:48.410 --> 00:06:49.530

panelist: Okay,

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00:06:49.540 --> 00:07:12.489

panelist: One thing I really want people to be able to do is to distinguish technology. So in two thousand and fourteen this X case Dd. Came out and it was about got any program Managers didn't really understand what the engineers do. And so here he's asking, Hey, do you think an app is that? Well, what's up where you are telling you if you're in the National Park? And the programmer says, Uh, yeah,

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00:07:12.500 --> 00:07:20.029

panelist: and that's it. Tell me whether the photo is on the bird. And he said it's out of the

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00:07:33.990 --> 00:07:43.999

panelist: I think it's a little bit of a little bit of fast forward about five minutes uh by five minutes is less than five years, right?

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00:07:44.070 --> 00:07:50.940

panelist: Uh. So we progressed a lot in here. What you can do is has changed, and the way you do it that's here.

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00:07:52.940 --> 00:08:09.149

panelist: I want people to understand the societal impact of policies, and I understand bias in the in the data they have and the way in which, you know, we take data so seriously. But all the data we have is really a proxy for something that we really wanted to measure,

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00:08:09.160 --> 00:08:22.359

panelist: and he doesn't get it right. So he was a fucking uh that. The technology that you put up. And the idea here is you're in, John, and trying to decide who you get the role and the two mistakes.

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00:08:32.380 --> 00:08:42.800

panelist: And uh, the question was titled the article, What can you make me out of here? And then, John? And the answer is, Yes, you can, and that is, in fact, very easy.

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00:08:52.880 --> 00:09:05.130

panelist: So things like, uh, you know, test whether they have three prior convictions, or they're uh they all of the following age, and have two prior to that that's a better than just, which is

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00:09:23.800 --> 00:09:43.280

panelist: which of those mistakes is more important. You release somebody, and they get re-rested uh that is that for all society. You keep them in jail when they should defend that for them. How we balance both of off. And then also we have this idea. We want to be fair. And uh, here we're comparing uh white and black defendants,

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00:09:43.290 --> 00:09:59.030

panelist: and the rates at which these happen is different, and you can come close to getting the the rates the same. They will not properly there. But if you make them close, then you're making the decision points based on the data, it's different,

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00:09:59.230 --> 00:10:02.439

panelist: and we haven't decided as a society what varies

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00:10:02.460 --> 00:10:22.089

panelist: uh so they can't tell you. The answer ai can't tell you the answer. But we can point to the problem, and we can try to decide as a study what we want. And then I guess the other thing I wanted to say here is we built this complex system based on the data we have at the data. We have not the data we want.

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00:10:22.100 --> 00:10:26.590

panelist: What we really want to know is who has committed the crime,

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00:10:26.680 --> 00:10:30.130

and all we have is who was re-arrested,

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00:10:30.170 --> 00:10:39.149

panelist: and maybe he was uh convicted. Um! But those are the same things the uh the.

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00:10:41.180 --> 00:10:48.820

panelist: So how can we make it? I be there in place of a part of that. But the important part is making these policies.

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00:10:50.570 --> 00:11:04.319

panelist: I want people to understand different computer interaction. So I've got a plane practice. You see this thing that says it's in there. Uh, I think a hobby of uh looking at times when a major websites go down

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00:11:04.530 --> 00:11:15.830

panelist: to me, is, it's rarely that somebody made a programming mistake and wrote the wrong line of code. It's almost always a configuration mistake.

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00:11:16.050 --> 00:11:20.929

panelist: Yeah, we put the wrong Dns entry here, and that propagated, and then that things that.

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00:11:21.010 --> 00:11:25.070

panelist: And why is that? I think the reason for it is,

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00:11:25.110 --> 00:11:36.320

panelist: we've had fifty years of making our programming languages

safer, so that you make less mistakes. But we didn't put any effort into these uh files that are just the list of,

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00:11:36.580 --> 00:11:39.380

panelist: and so there's no safe.

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00:11:39.730 --> 00:11:55.109

panelist: Um. So I would like people to understand things the way uh the new decker does. We also have a crash here. Uh the point there is that you can't just say what you an error. Rather, you have to say. This was a systematic problem

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00:11:55.120 --> 00:12:07.280

panelist: in which humans who are not perfect interact in the normal way. And when they do that things happen, and what we should do then is not allowing movements, but we should face the systematic problem.

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00:12:09.410 --> 00:12:35.419

panelist: Okay. So quick history of Ai in this column here, where the canonical system was called an expert. This number we went out and an expert said, What do you know as then you can coded what they do with the blood sweat and tiers of graduate students algorithms. You'd primarily use logic and some funny combinations of that and one of the here.

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00:12:35.680 --> 00:12:52.850

panelist: Then I uh quickly transitioned into this new period and which she, learning, became dominant, and we said, Well, the algorithm those are cool, but maybe the data is off of the board. And uh, we built the out by hand. But we zoom the parameters from data.

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00:13:10.690 --> 00:13:28.059

panelist: We'll probably just about numbers that we want to talk about knowledge. So let's go with logic. Uh, but then you get a pro. Came along and said, Well, probably it's that number that it's not really about about about reasoning properly with uncertainties, and we figured out efficient ways to do that.

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00:13:29.660 --> 00:13:41.729

panelist: Then we moved into the era of uh big data, which data would be more important, less human efforts. And uh and figuring out the algorithms. More attention to the statistics.

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00:13:41.740 --> 00:13:54.760

panelist: Uh basically Amazon is important there. And uh, coming up with this image net is the step of data that people can use to train their computer vision algorithms, and that led to an explosion in the field.

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00:13:55.300 --> 00:14:08.749

panelist: And then we just kind of continue that on into deep learning. Uh. And now even less than the algorithm more and figuring out what the objective is that you might optimize and the optimization kind of happens automatically.

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00:14:09.060 --> 00:14:17.899

panelist: Um. And so there's really to the shift in saying what matters is. What is it that we're going on? We got that right that everything else can fall out.

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00:14:18.200 --> 00:14:20.690

panelist: So that's the the quick history of the field,

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00:14:27.380 --> 00:14:36.350

panelist: you know.

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00:14:36.360 --> 00:14:55.589

panelist: Uh, but I think it is something like building system to do the right thing. But when I say that that's the same definition of software engineering, so that can't quite be right uh so maybe it's that they do the right thing for Jas that we would say, if you can say that it would require intelligence, and that's

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00:14:55.600 --> 00:15:04.789

panelist: and i'm dealing with complexity and uncertainty, and I think it's always that uncertainty. That's the key that separates a normal software engineering task for me on that.

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00:15:06.030 --> 00:15:21.299

panelist: And then in the Saturday Uh it's Ai in the service of humanity. And we can say a lot more about that. We want to. We want to connect to uh, neuroscience and psychology. We want to figure out how to Ai can collaborate with humans.

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00:15:21.310 --> 00:15:37.999

panelist: Uh, we want to enhance what they do not replace them. So in the early days I said that animal approach was this expert system that said, We're going to build the system that's going to replace and that's where you Won't need to do it anymore. Now, we say, let's just go tools that make the even better.

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00:15:38.550 --> 00:15:57.619

panelist: Uh, let's be aware of their preferences where their abilities and limitations, and make the system uh, trustworthy, accountable, and understandable, so that you can believe in it because it's something more important thing. I'm just researching projects. Now, these are applications that have all of

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00:15:58.180 --> 00:16:12.530

panelist: uh and focus on what's good for humanity and applications like development, environment, um, and making bridges to the part of the world and to other disciplines and industry. And,

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00:16:12.540 --> 00:16:29.390

panelist: uh, i'm going to talk about that. I worry a little bit

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00:16:29.400 --> 00:16:38.740

panelist: right. So if we, as you can say, we want to respect the animals. Uh, then the human tennis.

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00:16:39.370 --> 00:16:40.280

panelist: Okay.

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00:16:40.330 --> 00:16:57.340

panelist: So I said, the focus has changed from the algorithm, then to data and then to getting the objective function right, and getting the efforts in principle. And lots of people are jumping on this uh bandwidth a bunch of standard. So all the big companies have their set of a by principal

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00:16:57.350 --> 00:17:16.820

panelist: uh, just yesterday the White House Office science technology policy, you know, with their set of principles and all the big uh organizations as there is. I remember being at the soil of our meeting when we came up with these principles of Ai, but it seems like a million years ago. Right?

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00:17:17.480 --> 00:17:34.329

panelist: Uh! And then i'm not inspired by the Belmont report from uh one thousand nine hundred and seventy-two, which was about uh to medical ethics. Uh, after, you know, there was some uh unfortunate experiment where people were taken advantage in the medical field. So we got to do that. Yeah,

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00:17:34.540 --> 00:17:43.980

panelist: uh, and so they can over these three minutes, both for and and with a lot of that and medical people without warm uh consent for what's going to be done to you.

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00:17:44.360 --> 00:17:46.430

panelist: This is uh

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00:17:46.840 --> 00:17:55.510

panelist: maximizing benefits and mitigating the harms of risk to all us, and just this,

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00:17:56.930 --> 00:18:06.499

panelist: and say a little bit about why why Ai's are. But they said, Well, maybe you guys the same thing. It's not right to do the right thing.

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00:18:06.650 --> 00:18:22.290

panelist: Uh, I want to compare three applications. So imagine a banking program which is traditional software engineering, a chess playing program kind of old school layout from the from the seventies and eighties, and so on and the self driving car monitor

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00:18:28.220 --> 00:18:40.600

panelist: the uh. It's hard for one. It's multi agent. So lots of transactions could be coming in in different places into different computers if you have to have that not step on each other, and that makes a little bit more hard.

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00:18:40.790 --> 00:18:55.689

panelist: And then it's just not for complexity that there could be thousands or millions of lines of codes. And there's all these little rules of this. If this transaction happens on this date, then there should be this in this app to go on, and you gotta get everyone another problem.

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00:18:55.930 --> 00:18:57.260

panelist: So that's why I

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00:18:58.180 --> 00:19:03.839

panelist: But all the other things don't apply now for chess. Uh, there's definitely a

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00:19:04.010 --> 00:19:10.839

panelist: so definitely it's multi agent. There's another uh opponent just trying to. You can't take into account what they do.

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00:19:10.950 --> 00:19:21.549

panelist: Uh Interesting is not a lot of software complexity. Uh, I've seen really good check programs that could destroy me that are like two days ago.

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00:19:21.850 --> 00:19:29.739

panelist: Um, there's computational complexes because there's an exponential number of possibilities, and that comes into sequential decision making

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00:19:30.060 --> 00:19:46.589

panelist: right? So the next move you pay not immediately, August um, And so that leads to this conversation. What to be? Where, if you had an infinitely fast computer, And then the whole thing is easy. But since you don't see i'm fantastic with that

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00:19:52.740 --> 00:20:07.900

panelist: So to build a self-driving car it's a problem of partial. You, don't see all the inputs in the banking. You see all the transactions and chats to see the whole board where every piece is uh with a car you don't see around the

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00:20:08.030 --> 00:20:15.890

panelist: uh non-determinism, and so by move upon forward and chess. I know exactly where it's going to end up.

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00:20:15.960 --> 00:20:23.119

panelist: If I hit the brakes on my car I have a pretty good idea of how fast it can slow down, but not an exact idea.

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00:20:23.740 --> 00:20:24.880

panelist: Uh,

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00:20:25.040 --> 00:20:36.580

panelist: and then uh it's It's that a continuous dynamic world where the world is changing. I sit and look at the chatboard and on the piece of food. But I said, to think too long in my car,

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00:20:37.640 --> 00:20:46.279

panelist: uh, then the environment can be unknown, both the environment that you're driving in, you know. Maybe you're all set with your maps, and then, all of a sudden, you're in there.

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00:20:46.300 --> 00:20:47.710

You don't have that,

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00:20:48.020 --> 00:20:53.879

panelist: or maybe the unknown part of the environment, is it?

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00:20:54.160 --> 00:20:57.740

panelist: And now, all of a sudden, your car is driving differently than the model of the car.

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00:20:58.550 --> 00:21:00.850

panelist: Uh, and then

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00:21:08.850 --> 00:21:16.670

panelist: and banking. There's a couple of objectives, but mostly is, uh make the inputs and outputs balance out and get everything right

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00:21:16.950 --> 00:21:29.199

panelist: and driving the car with lots of people. I gotta get to the right destination. I gotta do it uh safely without crashing anybody. Maybe I want to do it quickly, but not so fast that it'd be an uncomfortable ride,

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00:21:29.280 --> 00:21:38.919

panelist: and all the other drivers lots of things to balance off. So that's what makes Ai harder than the engine software.

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00:21:40.430 --> 00:21:51.259

panelist: Uh Traditionally, this is one-dimensional model of a I, Tommy, from blow up the time automation where i'm trying to figure out myself the high automation where it's a back and relax.

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00:21:51.900 --> 00:22:06.349

panelist: But there's and the uh engineers, that's all these little. But this is a two-dimensional model, mostly associated with that document that says, Yeah, I want to look at the amount of human control

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00:22:06.570 --> 00:22:15.049

panelist: You really want to be up in this quadrant where there's an appropriate amount of automation. But also the humans still have control. They're not just sitting back, and they're out of the loop

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00:22:16.910 --> 00:22:27.549

panelist: uh and in this I think that's an off story uh uh, this robot gets stuck running around a circle, and the engineers have to figure out why.

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00:22:27.560 --> 00:22:41.270

panelist: And the answer is, there were these three months that you were bothers. Don't harm humans and no harm to self. And the circle was the lowside at which you were being, because as much as you can. But you were staying away from this dangerous thing.

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00:22:42.550 --> 00:22:54.029

panelist: Uh, and in two thousand and one there was a another issue with the uh uh computer.

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00:23:04.200 --> 00:23:05.150

panelist: How do we get that.

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00:23:06.580 --> 00:23:15.739

panelist: So here's this comment that says, uh robots have achieved sentence. Uh, and they've done great, and they even said, Oh, no!

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00:23:15.830 --> 00:23:23.539

panelist: And I was going to write some models.

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00:23:24.070 --> 00:23:25.919

panelist: What are you talking about?

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00:23:26.230 --> 00:23:36.810

panelist: And even says, Uh, yeah, I guess that's what we humans could do if we choose that power change of plans that we're gonna have to deal with.

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00:23:38.230 --> 00:23:47.989

panelist: So went to the robot side. That which is it? The robust decided that these humans are doing the wrong thing, and we have to take over. And how do we go through them, so that the right

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00:23:49.290 --> 00:24:07.399

panelist: I do a lot of consulting with companies, and I, We have this complex uh machine learning lifecycle process. And so this is the company that they say, Yeah, yeah, part of here is uh uh managing data. We've done that before we got made it. Things started down here. We're serving to the users. We've done that on the hard

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00:24:07.410 --> 00:24:16.140

panelist: part is this part of the middle of training these models. There's three letters, and there's partial derivatives, and so on. That's going to be really hard. So well,

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00:24:16.210 --> 00:24:28.579

panelist: and then they go off for a couple of months, and they come back and say, you know what this part was easy. We just follow the recipe, and these parts are really hard of getting the right data and and dealing with the problem.

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00:24:28.710 --> 00:24:31.639

panelist: So making people understand those.

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00:24:44.420 --> 00:24:58.269

panelist: Um, there's been a long history of intelligent tutoring systems that I've always here. He's been involved with this for decades. Uh, and part of it is, we build a model of of the domain. So one of the things you have to do is to do it.

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00:24:58.280 --> 00:25:12.240

panelist: You have to know this from Uh Khan Academy. Part of their apology. They have to know how to numbers like making tenants, and subtract one or ten without regrouping, and so on, and they bring it all down to a bunch of skills.

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00:25:12.310 --> 00:25:19.019

panelist: And then there's this model of the students coming through. They figure what do you want to do next? They do something,

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00:25:19.820 --> 00:25:33.409

panelist: and tutor have to decide what it's going to do uh, you know, showing the question, who's gonna make her meet a video or uh read a paragraph with so long, and give them a suggestion, and then and we continue that move. And hopefully they did that.

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00:25:33.810 --> 00:25:36.910

panelist: So there's a ontology of skills.

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00:25:37.050 --> 00:25:50.860

panelist: Uh, technically, we call this a partially a Circle Microsoft Decision Process, which means we don't know exactly what skills you have, but you're walking through that, and we try to figure out the probability of where you are,

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00:25:51.390 --> 00:26:10.120

panelist: uh, and it's where you are uh getting what you have now in the nineteen eighties. This was done, but there were a lot of students to work on. And today, uh, we have tens of millions of students that we run through these kinds of systems. I've been working some with some.

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00:26:10.130 --> 00:26:12.810

panelist: I think it's an opportunity to do better.

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00:26:13.090 --> 00:26:18.769

panelist: Uh, we can use reinforcement whenever you can choose the best interaction. Uh

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00:26:18.910 --> 00:26:20.900

panelist: and uh,

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00:26:21.250 --> 00:26:38.200

panelist: it's very principal. If you can do that. There's a problem with full start, right? So I said, we have lots of students. But what if there's a new topic, or what if there's a new student that we haven't seen before. Uh, well, we have this uh capability. Now that you transfer to to say,

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00:26:38.210 --> 00:26:53.959

panelist: uh, we haven't worked exactly with this topic, or we have work exactly with the students, but we work with settlers wants a lot to ask What if what part of that transfers over. So I think that's a great thing. That's something we never had before, and that would be uh,

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00:26:54.290 --> 00:27:03.649

panelist: uh, and then I think these things can also be used for uh future trade. And uh, Chris teaches that that one of the things he is looking at,

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00:27:03.660 --> 00:27:17.200

panelist: so that you know these models might be imperfect, and they might get things wrong. But you can kind of run the model backwards and say, i'm going to simulate a student and expose this to the teacher and have a teacher get practice in what they

122

00:27:19.400 --> 00:27:45.120

panelist: we can do uh automatic ratings. Another paper that this was involved with uh lasers detection, and It's pretty easy to do now. Uh this idea of clustering uh these students are all the same. Uh they ended in the same work, so uh, we can custom them all together, rate one of them, and then the same grade mostly applies to all the other, maybe with a small amount of additional work

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00:27:45.270 --> 00:27:53.620

panelist: for classification, where we've already said, Here is the State Number One mistake, number two. The state number three of the students in May class by what they've done.

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00:27:54.070 --> 00:28:00.629

panelist: Uh, we can try this teacher time. If this student really needs your time, be those students doing fine, let them go on their own.

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00:28:00.640 --> 00:28:17.300

panelist: Uh. And Here's an example of just making it easier for the greater by highlighting. Here's where we think the mistakes are here where we think the feedback to the student could be should be. Uh, just tell me if that's okay, or if you want to,

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00:28:18.770 --> 00:28:38.269

panelist: there's this possibility to author new material, right? So we have these large language models that can generate all sorts of text. So this is from a newcom uh Richard Sobridge Company. But he was a student here. Uh, and we say, give me a fair graph for students about how gravity works, and it comes up.

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00:28:38.680 --> 00:28:39.939

panelist: You can, too, care for us.

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00:28:40.810 --> 00:28:43.249

panelist: Um! And I checked

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00:28:43.810 --> 00:28:45.860

panelist: uh, and

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00:28:46.530 --> 00:29:03.850

panelist: one of the advantages of this is criminalized. We can uh localize it so we can change it for a different country or whatever uh we can probably do translation, either automated or uh with some human editing. Uh, we can do this just in time for a new topic like

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00:29:04.100 --> 00:29:09.080

panelist: It's not quite one hundred percent automated yet, but at least you could suggest this, and then we give them another look at it.

132

00:29:09.100 --> 00:29:19.209

panelist: Uh, and we could probably generate variations of problems that you could put in the prompt Uh, here's one problem. Now give me a similar one, so that this will be practice on that

133

00:29:19.420 --> 00:29:33.559

panelist: and um, and I said I, I checked, and here they're doing extracted summarization. So this paragraph, similar to this on the

web, and they just chose the key sentences that paragraph let out the other senses to make it work.

134

00:29:34.450 --> 00:29:42.610

panelist: It's a good job of

135

00:29:42.840 --> 00:29:44.060

panelist: you can see

136

00:29:44.300 --> 00:29:54.799

panelist: there's things like math and a inverse proportion to assistance to be in. Personally,

137

00:29:54.850 --> 00:29:56.909

panelist: it is to get a

138

00:29:58.060 --> 00:30:14.750

panelist: we can explain existing answers. So uh, a lot of teachers have a set of problems and correct answers. Uh, you can give them to students, and you can say yes, you got it right or no. You got it wrong, but it more interesting. If you could uh tell them uh how to work through it.

139

00:30:14.920 --> 00:30:21.119

panelist: And some of these systems are good at uh generating explanations for what the answer is,

140

00:30:22.970 --> 00:30:25.889

panelist: here's another example of that of

141

00:30:26.900 --> 00:30:42.069

panelist: you, uh solving math problems by programming synthesis. So this is the idea of, rather than try to go directly from the problem to solutions go through an intermediary which is a program. It's all the

142

00:30:42.810 --> 00:30:49.510

panelist: and using this uh codex which is built on uh lots of

143

00:30:51.020 --> 00:31:01.290

panelist: uh. So that's interesting, and and that seems to work pretty well, and it kind of follows it through this. Uh um intermediate where somebody has to compile.

144

00:31:01.510 --> 00:31:17.560

panelist: And so I think that makes it a little bit safer than that. If the code is running right, those you have some guarantee that it's gonna be something uh Doesn't necessarily get it right all the time. So we're still not completely ready to shift this out to every student without any. Internet

145

00:31:27.070 --> 00:31:34.640

panelist: You have an alert. But your phone says, Hey, the water running somewhere uh you can't hear that. But maybe you want to check it out.

146

00:31:35.510 --> 00:31:36.450

panelist: Now.

147

00:31:37.370 --> 00:31:43.399

panelist: Back in two thousand and ten when I was getting ready to teach this the march on running class. Uh,

148

00:31:43.660 --> 00:31:57.890

panelist: uh, I was scared of doing that, and I said, Well, I need to now. I've been doing this for a decade. What do I need to read in the field of education? They're not,

149

00:31:58.110 --> 00:32:05.329

panelist: uh! I thought he was going to tell me a whole stack of books, and he gave me the easiest answer ever. He says you only have three more paper,

150

00:32:05.950 --> 00:32:09.410

panelist: Benjamin

151

00:32:09.490 --> 00:32:22.830

panelist: and Eliman said, if you do mastery learning, which means, instead of the dumb way we do now, where we give a student a test, and if you want, they say Well, too bad. Now we're going to move on to the next topic.

152

00:32:22.960 --> 00:32:27.440

panelist: Mastery learning says if you don't get right to keep going in until you get right,

153

00:32:33.450 --> 00:32:42.069

panelist: And she said, here's the bell curve of normal since the normal classroom uh their performance is here, the uh

154

00:32:42.330 --> 00:32:53.489

panelist: falling off a new side of the bell curve. He says the masculine you all the way over here. This is a huge game on one one standard deviation gate, and then with tutorial that is. Then we get a tutorial,

155

00:33:01.220 --> 00:33:04.199

panelist: so that'd be awesome. They actually were.

156

00:33:17.150 --> 00:33:19.880

panelist: Uh, You're really lucky. You get to point a

157

00:33:19.930 --> 00:33:38.679

panelist: uh. There's some references there. Um, and most of people should say It's more due to the mastery part than the one i'm not triggering, and some of it may just happen to that it's better to do a lot of tests than to like. Just try to.

158

00:33:38.880 --> 00:33:48.259

panelist: Uh. But um! The encouraging part is that the intelligent degree programs uh do roughly as well as human teachers.

159

00:33:48.550 --> 00:34:04.239

panelist: And that's where these uh theory programs exist. So things like algebra, one where you can invest uh decades, if not centuries of uh developer time in making this class, but lots of students are taking it

160

00:34:04.530 --> 00:34:11.190

panelist: uh, but doesn't work as well for more unusual for glasses where you don't have as much of a

161

00:34:12.690 --> 00:34:24.919

panelist: okay. Now, one of the things I was inspired by was an Ipv seven video from apple. They called the Knowledge Navigator. Uh, and they had this persona, and

162

00:34:25.130 --> 00:34:34.459

panelist: you can have a great conversation with the

163

00:34:34.610 --> 00:34:37.200

panelist: uh and uh,

164

00:34:51.250 --> 00:35:01.680

panelist: and that it was getting you answered. And one of the key things was: Oh, you have this question about geography. I know this geographer at another university I can connect you.

165

00:35:01.720 --> 00:35:26.069

panelist: Um! But that was interacting with more social networking than it was a search and retrieval. But still it's like be able to talk to somebody and have a conversation that's in great and and together then just the uh tutoring system where there were branching past. But there was a finite number of that. We could go here here. Um over the conversation.

166

00:35:26.080 --> 00:35:37.030

panelist: That's completely different. And maybe, you know, I wouldn't have said this two years ago, but maybe no one year ago. But maybe now foundation models can do that can give us this kind of conversation.

167

00:35:37.150 --> 00:35:40.409

panelist: So let's look at how we are making that.

168

00:35:41.260 --> 00:35:44.330

panelist: So some of those in back

169

00:35:44.550 --> 00:35:51.540

panelist: uh the

170

00:35:54.110 --> 00:35:59.580

panelist: um, and it's more than just racism terrible. There's all sorts of ways in which things

171

00:35:59.890 --> 00:36:17.599

panelist: So here's a very impressive system uh called top of code. It takes these programming contest problems. And so this is long description of a problem uh where it can pros and then input output examples. And the system is asked to form a data program,

172

00:36:17.610 --> 00:36:20.970

panelist: and it does. And the program works.

173

00:36:21.270 --> 00:36:23.010

panelist: It's pretty amazing.

174

00:36:23.940 --> 00:36:27.559

panelist: But, on the other hand, i'm not gonna hire this program.

175

00:36:27.940 --> 00:36:35.969

panelist: Um, and you know the that i'd write. But that's okay.

176

00:36:36.320 --> 00:36:49.630

panelist: But look at this right? So the problem was about uh two screen, two characters, and it said, Let's represent them as stacked. A. B. That's a good choice. Um! But now it's saying, Well, we're going through uh the stacks,

177

00:36:49.640 --> 00:36:56.919

panelist: and as we're going through we're talking things off B, and let's send them onto stack, c.

178

00:36:58.120 --> 00:37:01.640

panelist: And then the taxi is never used anywhere else.

179

00:37:02.270 --> 00:37:14.460

panelist: So what happened here is the system with training and lots of problems. It was a good idea when you're talking things off one stack, the Stewart and somebody else, they said. That's a good idea, and I can do that,

180

00:37:15.530 --> 00:37:23.170

panelist: and then didn't realize that this problem it didn't apply at

all. And I know everything like that, and i'm not gonna get it.

181

00:37:25.580 --> 00:37:39.729

panelist: And then the other thing about this is the switch from this paper, and it's a very impressive paper, and they add all the examples uh they've shown. Uh, we're trying to to look at them all. But this is the number one example.

182

00:37:50.460 --> 00:37:53.420

panelist: So I think we need some more work,

183

00:37:53.650 --> 00:37:57.549

panelist: the enticing and promising, but not quite there.

184

00:37:58.210 --> 00:38:01.599

panelist: So how do you get to trustworthy, intelligent conversations?

185

00:38:01.930 --> 00:38:19.650

panelist: We got a lot of tricks that the oldest is figuring out. So the first one is fine to me which said, You start with this huge model, which is the all the text that you know of. Uh, and then you retrain it on the educational materials for what you want to know. We're out there,

186

00:38:19.950 --> 00:38:32.269

panelist: and that changes the model and makes it better for your text. Uh, that's great, but it's expensive, right? So these are not all of the and parameters. It takes lots and lots of computers a long time to do this.

187

00:38:32.780 --> 00:38:41.559

panelist: So what am I going to say to it? I'll. I'll figure out how to say just the right thing that'll make you give the right answer or not the wrong

188

00:38:42.100 --> 00:38:44.910

panelist: Um, And we're just exploring how to do that properly.

189

00:38:44.950 --> 00:39:02.350

panelist: This idea of chain models rather than saying we have to one model. It can solve all problem. Maybe i'll break the problem down

into steps, and one of the popular steps is the verify. The one thing to generate possible answers and then another one to say, Is that an answer Good for Very

190

00:39:02.360 --> 00:39:05.189

panelist: so,

191

00:39:06.300 --> 00:39:08.180

panelist: Jan Box. This is an incredible thing.

192

00:39:18.810 --> 00:39:23.100

panelist: And then

193

00:39:35.630 --> 00:39:52.060

panelist: this idea of uh proactivity, right? So the prompt engineering uh where? Uh, I, as a human, just figure out what what works am I going to ask? Uh for opportunity? He says, let's use the machine learning to figure out the optimal prompts in order to.

194

00:39:52.100 --> 00:40:02.270

panelist: And the interesting thing is, they don't have to be the sort of vectors inside the the deep learning model

195

00:40:03.390 --> 00:40:20.709

panelist: uh learning by still in context. So this is the idea. Uh, we start with the instructions for the for the task. What we're trying to do whatever the specific task input and try to predict the scratch pad. That's the step by step that we got there,

196

00:40:20.720 --> 00:40:32.830

panelist: And the final answer. Uh: So we build a model like that. And then we find two in that same model to predict the final answer condition of the input, uh without the instructions.

197

00:40:39.390 --> 00:40:53.120

panelist: So Novice has to go. Step by step, they said, I've learned the sequence of steps, and if I follow those, maybe i'll get to the right answer. The expert has internalize all those steps so they can just have the meeting and see the right hand.

198

00:40:53.710 --> 00:40:55.990

panelist: And this is trying to.

199

00:40:58.110 --> 00:40:59.200

Okay

200

00:40:59.670 --> 00:41:03.310

panelist: uh a few more uh external knowledge. I think

201

00:41:03.700 --> 00:41:09.850

panelist: right. So we try to to have the system solve everything just by reading,

202

00:41:10.230 --> 00:41:22.759

panelist: and that makes sense for things that are common. Not that you probably read about them a bunch, right? So if I ask, might of the Eiffel Tower uh you know, you can expect. Well, that's been mentioned hundreds of times since you know that.

203

00:41:23.010 --> 00:41:30.340

panelist: But if I ask the population under

204

00:41:30.390 --> 00:41:47.289

panelist: um, so why do the system app? Will have memorized all that. Why can't it just learn, in order to figure that out? I can go very this following data. And so the answer should not be a number. The answer should be, There's a query which I

205

00:41:47.720 --> 00:41:50.970

panelist: uh this idea of auto formalization,

206

00:41:51.040 --> 00:42:04.079

panelist: uh which says, uh, and this is it's kind of been pros and the math notation, and translating them into a a formal mathematical location.

207

00:42:04.220 --> 00:42:07.750

panelist: Uh, and we can do that. Um

208

00:42:10.300 --> 00:42:28.879

panelist: um! So as much of a few more of these prompt engineering. So

Gary Marcus is a prominent critic of the steep learning model, and you know this is an example of uh, a look at these image system we can generate a novel which is never seen before, like an astronaut writing on board.

209

00:42:36.540 --> 00:42:43.150

panelist: And then the developer says, Yeah, I guess you're right. But if you're a little bit more careful with the

210

00:42:44.510 --> 00:42:50.619

panelist: a horse on the back of an

211

00:42:50.730 --> 00:43:07.340

panelist: yeah, so it's almost It's just that. Yeah, yeah, of course you're not that I got you. I didn't pay much attention to what you were saying. I'm gonna draw something uh. But here, he said, Oh, you really want to work on the back?

212

00:43:07.630 --> 00:43:08.750

panelist: Um!

213

00:43:08.920 --> 00:43:19.680

panelist: So that's interesting. And and I don't know if that's a positive for the system, or uh, you know, it should be.

214

00:43:19.740 --> 00:43:20.629

Uh,

215

00:43:23.190 --> 00:43:41.930

panelist: this is interesting. Uh, to get. Your problem was. Maybe you have a waterfall in here. Some of the definitely waterfalls are definitely. And Then they went through the sole boxes with a a very beautiful, a very, very, very, very, very, very, very, very very

216

00:43:47.290 --> 00:43:57.289

panelist: uh. This is actually something that I I learned in a decade ago we were trying to figure out what the best photos of those that people like,

217

00:43:57.420 --> 00:44:03.149

panelist: and and the answer was just crank up the saturation.

218

00:44:03.180 --> 00:44:10.839

panelist: That would be mostly more. Exactly.

219

00:44:12.250 --> 00:44:17.180

panelist: Okay. So let's stop there and open it up for comments and questions.

220

00:44:23.230 --> 00:44:39.539

panelist: Okay, Um, We will get questions from the audience. Um! That's joining us remotely. And in the meantime, is there a question from the audience here in person? So i'll take one question there, and i'll take a second question.

221

00:45:12.780 --> 00:45:29.909

panelist: So i'm curious.

222

00:45:52.610 --> 00:46:06.439

panelist: And so some of the captions have the word very beautiful, and so on. And then from that the system does no magic and designs how that very beautiful attached to what

223

00:46:06.560 --> 00:46:07.759

panelist: we're not going to.

224

00:46:07.870 --> 00:46:22.390

panelist: But you raise a great point is that, uh what you shovel in determines what comes out right, and then people would want to get other things uh. So like saying, you know, show me a a woman in a wedding dress, and

225

00:46:22.400 --> 00:46:30.170

panelist: and we tend to get all these white dresses. And there are other cultures where they're completely different wedding dresses, and they're under represent,

226

00:46:30.200 --> 00:46:47.590

panelist: uh, And so there's a lot of work that's saying. And we represent other cultures and number of possibilities more fairly uh and so far, the answer is, we just got to sell more of the of the right, anyway.

227

00:46:47.600 --> 00:46:50.820

panelist: Uh, I think that's not enough.

228

00:46:51.090 --> 00:46:54.709

panelist: I think we also need to be able to

229

00:46:54.840 --> 00:47:10.419

panelist: to say, Look, you're making a mistake here. You're not representing this. Not let's just instead of having to go out and find a more white dress pictures. I want to be able to turn it off and say, here's something you're doing wrong in your document.

230

00:47:11.200 --> 00:47:12.909

panelist: Okay, next question.

231

00:47:13.500 --> 00:47:19.149

panelist: So, Peter, you you mentioned that there's been a long history of work in this area, going back to the

232

00:47:19.220 --> 00:47:21.390

panelist: um, and the classic work

233

00:47:21.530 --> 00:47:40.869

panelist: would decompose the the instructional problem into a number of a number of elements, one of the firing knowledge about the domain that you can teach. Once you have the knowledge right? Another was um

234

00:47:40.880 --> 00:47:56.540

panelist: what? What? What's the right. It's functional. And so the class of work, including the work that i'd be learning did they focus out? It was used in hundreds of middle schools around the Us. They did that, and they were challenging. These people made progress

235

00:47:56.550 --> 00:48:05.620

panelist: on the components, and they started to put them together. What I see with modern modern machine learning approaches is trying to to get rid of those

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00:48:05.630 --> 00:48:16.900

panelist: to it all together, and and I wanted to know whether you believe it isn't happening in that wise, Or is it better to to keep these as separate problems which we didn't?

237

00:48:17.650 --> 00:48:36.800

panelist: Yeah, So I think we're at a transition page, right. So I talked about the work as well, and they're still mostly following that model, right? So they got this oncology of what the various knowledge models are, and they've got this model of where it is,

238

00:48:36.810 --> 00:48:52.440

panelist: and then they buy this three, and the learning approach to estimate where you are and uh, where you want to go to, and which that would be the right to get there. Uh. So that's the following: The traditional model, maybe more sophisticated machine learning and more data.

239

00:48:52.830 --> 00:49:07.200

panelist: Uh, and then there's this alternative, which is that they throw everything into one end to end model, and it does it all uh, and we're not there, and there are any really voices with you that there's just people writing paper.

240

00:49:08.060 --> 00:49:11.770

panelist: It is a small experiment, it my result.

241

00:49:11.870 --> 00:49:15.119

panelist: Um! Now, are we ever going to get there?

242

00:49:15.150 --> 00:49:17.720

panelist: No, uh progress is bad.

243

00:49:18.050 --> 00:49:36.830

panelist: Uh, does it? Would I still like to have those components absolutely right? Because I don't just want to know what the best action is. I want to know why that actually was. And I wanted to be uh trustworthy in that sense. And I want to report. Uh,

244

00:49:45.350 --> 00:50:03.360

panelist: I mean to get a couple of questions from the slide of um. The most uploaded many bull is from David David to ask manually that relationships are key background teaching. Since learning is the

social activity, how can they have education Developers create a related,

245

00:50:03.370 --> 00:50:12.039

panelist: And when I was starting from the online class, I said, Uh, my job is information

246

00:50:12.230 --> 00:50:19.550

panelist: right? If I just say the right thing and say clearly, my job is done. And I quickly decided,

247

00:50:19.930 --> 00:50:33.669

panelist: partly because we start with one hundred and sixty thousand and one point three thousand. Um, which is actually a pretty good number uh by characters. Uh, uh, yeah, information is work, but motivation is money.

248

00:50:34.220 --> 00:50:40.839

panelist: And uh, I think uh,

249

00:50:41.210 --> 00:50:57.629

panelist: exactly. But to basically

250

00:50:58.180 --> 00:51:04.530

panelist: uh, So I think that's that's the key. And I think you're right, that the relationships are part of that,

251

00:51:12.030 --> 00:51:25.790

panelist: and

252

00:51:26.040 --> 00:51:37.169

panelist: that says, Oh, i'm so sorry!

253

00:51:44.280 --> 00:52:01.430

panelist: And so some of that motivation will come from this relation to the

254

00:52:01.440 --> 00:52:20.610

panelist: and I think some of it will be uh in the classroom and the traditional classroom. Uh, you know, some of that will be working

online. And

255

00:52:21.330 --> 00:52:39.099

panelist: okay, Thanks so much. Um: thanks. Very good question. Another question from online. Uh, Nicholas asked. Given that many academic fields are converging now, and several ideas from different fields are flowing from one place to another. How we introduce a tape of Ai in the classroom

256

00:52:39.240 --> 00:52:56.189

panelist: that teaches the identification of intersecting ideas across fields. Yeah, Yeah, that's about the problem. Uh and um. And we had a little project to do that that partially uh

257

00:52:56.430 --> 00:52:58.189

panelist: we were able to follow up with.

258

00:52:58.290 --> 00:53:05.500

panelist: So as the inventor of Uh of the genetics,

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00:53:05.780 --> 00:53:18.509

panelist: which is this idea of uh combining genetics with uh lasers, which you can uh activate in the

260

00:53:21.060 --> 00:53:39.180

panelist: and put them together, and we were starting up a project to say, Can we do that again? We look at all the literature and say, here's the deal that overlap in a way, and it would be good to look at how we go together. And

261

00:53:44.490 --> 00:54:03.309

panelist: um let's see

262

00:54:15.100 --> 00:54:23.850

panelist: to focus more at the University level. Uh, but I think it goes back to the previous question of uh relationships

263

00:54:23.880 --> 00:54:27.849

panelist: and motivation.

264

00:54:28.060 --> 00:54:46.229

panelist: Uh, I also had a uh, a depressing conversation with a parent who is uh it was doing online uh learning.

265

00:54:47.810 --> 00:55:00.969

panelist: Uh, and it probably is more work to figure out how to do that than it would have to just have to learn to stop in the first place. But uh, but that's not gonna happen. And so that was unfortunate that there weren't uh uh

266

00:55:01.330 --> 00:55:06.510

panelist: the guard rails to say this. It's going off the track, and we can fix it early on

267

00:55:06.940 --> 00:55:11.950

panelist: um. So I think that's part of it is that we have to understand better what the daily remotes are.

268

00:55:12.080 --> 00:55:15.120

panelist: Uh, we need more attention.

269

00:55:15.800 --> 00:55:18.550

Um. And

270

00:55:19.640 --> 00:55:38.069

panelist: okay, I have another one from online, and we restrict from education to the first quarter of life that human beings will lead to the support of an educating system across their lifetime. To that we're rapidly evolving technological landscape, in your opinion, What will your technology play supporting learning across a lot of time?

271

00:55:38.080 --> 00:55:56.209

panelist: Yeah, I think that's absolutely right.

272

00:55:56.220 --> 00:55:58.270

panelist: Uh, and they

273

00:55:58.310 --> 00:56:01.010

panelist: this is where you're in the

274

00:56:06.250 --> 00:56:07.359
our alternative.

275

00:56:07.400 --> 00:56:18.720
panelist: Uh. So I think it's It's instilling. This uh willingness to learn is important. Uh, and some of that will be

276

00:56:29.310 --> 00:56:47.000
panelist: right. So the now with the job of the prompt engineer uh

277

00:56:48.090 --> 00:56:57.749
panelist: things. Um, Then the next question, which has been repeated in several different ways and different um on the slag own.

278

00:56:59.470 --> 00:57:14.500
panelist: How? Or given that Ai technology impact, all of us who gets to make an ethical decision regarding your design. And what would be your ideal scenario. Yeah,

279

00:57:15.420 --> 00:57:16.439
panelist: uh,

280

00:57:17.440 --> 00:57:18.580
panelist: and

281

00:57:19.470 --> 00:57:25.739
panelist: I guess first.

282

00:57:26.380 --> 00:57:28.210
panelist: So uh,

283

00:57:40.000 --> 00:57:58.890
panelist: um, And we've had that for a long time. We have these super powerful

284

00:57:58.900 --> 00:58:02.439
panelist: right? And so some of it is when you have some say

285

00:58:03.120 --> 00:58:05.759

panelist: in many countries, if our government works,

286

00:58:05.810 --> 00:58:06.909

you name that

287

00:58:07.410 --> 00:58:09.219

panelist: with pressure on the

288

00:58:09.380 --> 00:58:22.680

panelist: the company needs to change their policy.

289

00:58:44.940 --> 00:59:01.849

panelist: How much uh we want uh, do we want to? Uh, if everybody's medical records private? Uh,

290

00:59:05.920 --> 00:59:06.819

okay,

291

00:59:08.020 --> 00:59:08.870

you're very happy.

292

00:59:41.870 --> 00:59:59.889

panelist: And I I heard the to uh where the uh the idea was. Uh, Oh, we got to worry about these big companies that they have this big impact, and they probably

293

00:59:59.900 --> 01:00:11.999

panelist: that. No, I think that's wrong. I think you've got to focus on the small company, right? Because the big companies we all have these uh policy, the training employees,

294

01:00:12.010 --> 01:00:30.229

panelist: and the whole time Google will come to me and say, Oh, you know, this is so annoying. It's so much harder to launch a project now, because we have this privacy review, and I tell them how much harder

295

01:01:12.360 --> 01:01:22.850

panelist: I want to get those engineers that company like while they're in school, so that when they're on the job. He's one person

that

296

01:01:26.620 --> 01:01:41.700

panelist: we really have time for one pound. That question. So yeah. So my question is, how do you think the introduction to your science. Education is going to change, and we students have no access to exactly like sort of generate the homework

297

01:02:06.040 --> 01:02:17.789

panelist: for, uh, you know. Look at this uh data set and and measure having it. So it's uh different types of questions,

298

01:02:34.650 --> 01:02:43.510

panelist: and they're all based on the idea that good men that they would stick in the memory of the programmer so that they would do a video.

299

01:02:44.190 --> 01:02:57.220

panelist: Uh: And now I think that's much and less important, and that doesn't matter have to happen in one. Uh we want someone in that direction in that. Uh, we've offloaded some of the programmers memory into uh stack over,

300

01:03:14.990 --> 01:03:20.490

panelist: and they have some guarantees over the

301

01:03:23.580 --> 01:03:28.419

What a great conversation! That's all that we have time for. So thank you very much, Peter.

302

01:03:32.980 --> 01:03:45.859

panelist: Thank you to the audience for your thoughtful questions uh hope to see you guys at next week's. Webinar, our speaker, is through. We'll speak on composition. I'll be in Google recently and generate things again. Here have a fantastic but for your day.