

SDS PODCAST EPISODE 223: DATA SCIENCE TRENDS FOR 2019 (WITH HADELIN)



- Kirill: This is episode number 223 Data Science Trends for 2019. Welcome to the SuperDataScience Podcast. My name is Kirill Eremenko, Data Science Coach and Lifestyle Entrepreneur, and each week we bring you inspiring people and ideas to help you build your successful career in Data Science. Thanks for being here today and now let's make the complex simple.
- Kirill: Welcome back to the SuperDataScience Podcast ladies and gentlemen, super excited to have you back on the show and Happy New Year. By the time you're listening to this, it is already 2019. It is a super exciting time to be alive and to be in the space of technology and data science. Very, very cool that we're all in this together.
- Kirill: In this episode Hadelin and I got together to discuss the Artificial Intelligence, Data Science, Machine Learning, Deep Learning and other technology trends for the coming year, for 2019. So be prepared, this is going to be quite a long episode. In fact, we actually recorded this as a webinar. So if you were on the webinar, then a huge shout out to you, and maybe it's not a bad idea to listen to this stuff again to refresh it in your memory and to really solidify it. If you weren't on the webinar, this is your chance to jump into the AI and technology trends.
- Kirill: We had hundreds of people on the webinar actually from all different countries in the world. You'll actually hear me at the start reading out the list of countries where people are coming from. And we had some great interactions and good questions, good points from the attendees.

- Kirill: And the way we structured this podcast/webinar ... By the way, you can watch it in video. So if you have a chance to watch this in video you are welcome to do so. Head on over to superdatascience.com/223. That's superdatascience.com/223, and you'll find the youtube video there, it's already been seen. At the time of this recording, it's already been seen by 4,600 people, or it has 4,600 views. So by lots of people, by hundreds of people.
- Kirill: If you want to watch the video or if you want to listen to podcast, feel free to continue here. Totally cool as well. Just be prepared that it does go on for quite a bit. It's almost two hours long.
- Kirill: The way we structured this webinar/podcast is, at the start and we reviewed our trends, our predictions for 2018. So a year ago, we took this exactly same approach that we sat down and made predictions about 2018. This webinar's starts off with our review of those predictions, and you will find out what accuracy rate we actually got. We had eight predictions, so you'll find out how many of them came true.
- Kirill: And then we moved on to the 2019 predictions. That happens around 45 minutes into the webinar, so if you want to jump straight ahead to that, if you don't really care about how our predictions were in 2018 that's totally cool. Just head on over to about 45 minutes into this podcast/video, you'll find that part there. Then basically then we move on to the predictions for 2019. Once again, we make eight predictions for 2019. We start off with the highest impact prediction that we



see in the coming year. So you're going to have a lot of fun right away learning about what is to come or what our view for 2019 is, and what you can prepare for in the future.

Kirill: This podcast is designed not just to talk about cool predictions that are coming up, or things that are going to happen in 2019, this is actually to help you structure your career, design your own path through technology and what you want to be working on because you want to stay relevant, stay current and be focusing on things that are booming that are flourishing rather than things that are slowly fading away and decaying, dying off.

Kirill: So there we go. This is our technology, AI, Data Science, Machine Learning, Deep Learning predictions for 2019. Can't wait to share this podcast with you. So without further ado, I bring to you this webinar, this podcast with our predictions and my dear friend and business partner, Hadelin de Ponteves. Let's get started.

Kirill: Oh boy, so many people. India, Sweden, USA, Chile, Melbourne, Australia. Hello to Australia. Columbia [inaudible 00:05:26] Canada, India, Tunisia. India, wow so many people. Romania, Greece, Tunisia, India, Tunisia, Costa Rica. Okay, we're going to continue from here.

Hadelin: We are connected with the world, that's amazing.

Kirill: Yeah. Brazil, Algeria. Oh my God, so many. Malaysia. Oh wow, India. Have we had anyone from Africa yet I wonder. China, San Diego, San Jose, Colombia,

Mexico, Singapore, Brazil, Taiwan. Oh, I can just keep reading forever. Seattle, Japan, Australia, Houston, Texas, Taiwan. Thank you everybody. Bulgaria. Thank you everybody for coming, this is so cool.

Kirill: Very, very exciting to have everybody on board. So today we're talking about trends for 2019. The way we're going to structure this is we're going to look at, we did a webinar like this last year with some predictions for 2018. So we're going to actually look at the predictions that we made and we're going to go through them and see which ones came true, which ones didn't. So you guys can be excited for us that we made some correct predictions. Or be like, boo you made a bad prediction, something like that. And then after that we'll look at predictions for 2019. So we have something to work with next year.

Kirill: Yeah. Excited Hadelin?

Hadelin: Yeah, super excited. And super excited to be all connected together with the world. That's really amazing.

Kirill: Actually mentioned a really cool thing that is important to point out at the start. What's the purpose of making all these predictions? Anybody can make predictions and anybody ... A lot of people make and just for fun. Like ooh what are the trends going to be? It's like data science and data and technology is very hype and it's also really disruptive in the world right now. So people just want to know what's going to happen.

- Kirill: But our purpose here, and you will see this reflected in the predictions that we've picked, our purpose here is actually to help you guys understand where to direct your careers in the next year. What to look out for. Because the thing is that, again, regardless of what part or stage of career you're in, whether you're a beginner, advance, you own a business, whatever it is, the case, certain things in technology and Data Science and analytics, they will die out, and certain things will pop up. You want to be flexible and adaptive to make sure that you're studying the right things, you're looking into the right technologies, you're looking into the right trends so that you can get to make the most of your career. Because it would be really unfortunate to be just learning something that doesn't have a future, for example. On the other hand, it'd be really cool to learn something that is about to explode and be on the right track.
- Kirill: All right, so let's do this. Some of the predictions that we made last year. The prediction number one we talked about was, AI is the new electricity. So we said that more and more businesses will be adopting AI. That this trend is not going to stop. That in 2018, you will see more happening in the space of Artificial Intelligence than ever before. So let's see what happened actually in 2018 about Artificial Intelligence.
- Kirill: So here's some interesting stats. To start off with, the majority of all organizations, 58%, foresee modifications of their business models due to Artificial Intelligence within five years. So 58% of organizations see that their actual business models will be modified

with Artificial Intelligence. Overall, 91% ... And by the way, all of the links, we're not going to go into like the sources and stuff. All of the links in the show notes, you'll be able to get on SuperDataScience in the URL for the seminar, which we'll share and then give it to you towards the end, you can get all the links there.

Kirill:

Overall 91% of survey respondents is expected new business value from AI implementations in the coming five years. So some kind of business, not just changing the business model, but some kind of business value is expected by 91% of respondents. Basically even those who are quite passive about Artificial Intelligence, they expect to experience AI based benefits indirectly ... 81% of them expect to experience AI based benefit. And I know it's a mouthful, but basically 91% of businesses see Artificial Intelligence somehow impacting their business in next five years. And majority of all organizations, 58% actually see AI modifying their business model. What are the thoughts of that Hadelin?

Hadelin:

I think we were right about this prediction. And actually, that's why we started building a business on that, helping companies transitioning into AI. So these figures, first of all, are highly positive. We can see really the trends are increasing in AI. We can see that indeed the trust is more and more present in companies and businesses. People in companies and managers, even executives are more and more convinced that AI can disrupt their industry, and bring a lot of added values. We can see that in even the non AI based company starting to build AI teams and AI

departments or even AI boroughs inside the company to really disrupt and transition into AI so then they can not miss the opportunity.

Hadelin: So yes, this is really convincing. This is really promising and this will keep continuing in the AI 2019 trend will still confirm that the AI will be an increasing one. So I'm really happy about these figures because we're basically spending all our time working on Artificial Intelligence. And so, we are really happy that we can help you transition as willing to AI.

Hadelin: Following on what you said at first, why is it important to talk about trends and why is it important to make predictions? Well, that's because for me, the most fundamental reason is that, whether you are building a business, or whether you are planning your career and developing your career, the most important thing to have is a vision. A vision of the time to come. The vision of what strategies you must adopt. And that's why if you make the right predictions, if you can foresee what's going to happen, well, this will be well aligned with your vision and you will definitely have leveraged that in order to make better moves for your future. So it's really, really important for me to make prediction and if they're the right ones well even better.

Kirill: Totally agree, I totally agree. I also wanted to mention to our listeners, some of you might know that Hadelin and I have our own ... We just actually started this year in since 2018. We follow our own predictions about trends, and in 2018 we started our own consulting company in the space of Artificial Intelligence. It's called [Bluelife.ai](http://www.bluelife.ai), which you can find

at bluelife.ai. We just started it, and right away, so much interest. People started asking us about projects. Within a year we've already talked to clients and we started working on some projects. Specifically we've talked to clients about energy, the energy market. We've talked to about the mining industry. We've talked about retail organization about how Artificial Intelligence can be used in retail.

Kirill: There is extreme amount of interest from businesses in this space of Artificial Intelligence, so it's something that we are actually experiencing for ourselves. So I think we can sum up this first prediction that it was a correct prediction. So far, one out of one.

Hadelin: And also I'd like to add something very important. Not only companies are adopting AI, but also governments, right? Politics. Because people in politics are starting to invest in AI for their whole country. And that's a pretty good hint that AI is doing well. That people, general people are starting to believe in AI and what it can do to make the world a better place.

Kirill: Totally. Totally, purpose. Very important. Okay, next one. Blockchain. A prediction we made that look out for blockchain, it's a very, very important trend. As we said we follow our own predictions. Whether they're right or wrong, we believe in them and that's why you saw us launch a Kickstarter campaign for blockchain, which raised north of \$100,000 with thousands of backers. Then the course was released. It's a massive course. I think it's like 14 hours of content, you can learn Ethereum and everything.

- Kirill: We really invested heavily into this topic in terms of our self-education. However, what we saw in 2018 was, now towards the end of 2018, we can see that the interest in blockchain actually dropped compared to December 2017 when there was like the peak of the interest. Interest in blockchain dropped 65% over the past 12 months. And the main reason for this probably from our thinking is that, the hype around Bitcoin had a negative dynamic, and it dropped actually 80%. So blockchain dropped about 65% in interest, Bitcoin dropped about 80% in interest since December last year. Massive drop and, what are your thoughts Hadelin on that?
- Hadelin: Indeed, indeed. Bitcoin went from its all time high of \$20,000 down to \$3,000 up to recently. So a massive drop. There is no words to describe that massive significant drop. But yes, I am totally convinced that the hype in blockchain was on a significant downtrend, due directly to the bitcoin downturn hype. Because most people associated blockchain with cryptocurrencies at first. So the Bitcoin is the king of cryptocurrencies, as long as bitcoin is dropping down, the rest of the cryptocurrencies are dropping down as well, and therefore the blockchain hype drops down too.
- Hadelin: I think it's true to say that it is very linked to Bitcoin. However, I'm still believing in blockchain. Remember we predicted that blockchain was going to be a high, but we also said a lot of times, and even in our course that blockchain was a real huge Wild West. I think it is still the Wild West actually. There is this famous curve

that in the Wild West you have first a big hype going up, then a big hype going down, and then it's going back up again once the Wild West is calming down. Once the storm has calm down.

Hadelin: So I think right now we're still in the Wild West. If we don't think about cryptocurrencies when we think of blockchain, but all the amazing applications it can have for companies, then I think it's still going up. We still have a lot of our startups in blockchain developing. We still have a lot of opportunities that we can do for companies, which have nothing to do with the cryptocurrency.

Hadelin: But for example, the best example of blockchain is IoT [inaudible 00:17:52] which to me will become one of the top trends in 2019, and the best IoT systems are the ones handled by blockchain today, and also Artificial Intelligence of course.

Hadelin: Of course, if we think about cryptocurrencies yes, blockchain is in a bad downtrend. But if we think of the more general scope of blockchain, I think it's not there. It's not an [inaudible 00:18:16]. I think it's in a good progress.

Kirill: I agree, totally agree. Somebody in the chat ... By the way guys, let's make this interactive. Because I am watching your chat right now and if you post some questions ... Post your thoughts. When we're mentioning a trend, post your thoughts about it. You agree, disagree, what do you think? And I'll have a look through them and I'll read the most interesting ones. Somebody said that indeed blockchain is not

just bitcoin, but a lot of people don't see that. Don't understand that.

Kirill: So in my view, blockchain ... There's this thing called the Gartner Hype Cycle, and blockchain is going through a Gartner Hype Cycle. It's like, it goes up, it's got a peak, and then it goes down, and it kind of like plateaus, and then slowly starts growing. So blockchain and Bitcoin, well mostly blockchain, we're talking about blockchain is going through that hype part, it's dropped down. It's normal to see such a draw. Then it'll slowly come back out of there. So blockchain is not going anywhere. It's still a cool thing to invest your time into and learn. Very interesting topic. Not that hard to code, but very, very powerful.

Kirill: But at the same time, yes, indeed, this prediction for 2018 definitely failed. So I think we all have to admit that that was not the best prediction.

Hadelin: True.

Kirill: All right, let's keep it going. So the next one we talked about was ... So far we have one out of two. The next one we had was security. We highly recommended people to look into security because that uses data. Very, very data driven topic, especially like IT security, information security, data security.

Kirill: So what happened in 2018, what did we see? Well, first things first, we saw the GDPR come out, right? Was it called Global or General Data Privacy Regulation in Europe? I think that's what it stands for. GDPR in Europe, massive impact. Lots of companies had to adopt new ways. Like our businesses, we had to

assign data officers, data regulation officers within the business.

Kirill: If you're dealing with European clients, you have to have a data officer, somebody who is going to be looking after the ethicacy of the business in terms of data, how it treats data, all the regulations of all. Massive changes. A lot of companies had to adapt to their operations to these new policies. And that's all because governments are becoming more ques-

Kirill: By the way, GDPR was the first change in data regulations in Europe in the past 20 years. Massive, right? Like a big thing. On top of that, what else did we see? We saw that hacks are continuing to happen. The city of Atlanta was locked down for a ransomware. I think the demand at \$50,000 or something like that, and they refused to pay. The databases of some of the government operations, public services of Atlanta were locked down and they had to start pulling it all apart, and they investigated it, and they spent millions of dollars just fixing the situation.

Kirill: Another one was recent, just a couple of months ago, couple weeks ago, that Marriott attack for 500 million accounts were hacked, including first name, last name, stays at the Marriott hotels and passport details. Credit card details for some of those that were affected. 500 million, half a billion affected. I think it's like accounts or transactions, but like a massive amount of data was stolen.

Kirill: So all in all, lots of things are going on in this space. And what we saw in general is a increase of, where

was that number, interest in cybersecurity rose by 61% in 2018. It's very interesting. If you type in cybersecurity into Google trends, you'll see an exponential curve building up. 61% compared to last year. So massive growth. Hadelin what are your thoughts on that? Why do you think cybersecurity is becoming such a popular topic?

Hadelin: First all the figures and examples you gave are pretty alarming. It's totally obvious that there is a need for a much stronger IT security systems. The good thing about that is that it's a great thing for the AI. Because AI has a huge role to play in cyber security. I know the masters programs in IT security because I have some friends who did it, and they actually placed AI at the heart of the programs to handle them better.

Hadelin: So it impacts Artificial Intelligence. It also impacts blockchain again because there had been some breach in blockchain systems, and even I think some of the cryptocurrencies were hacked. So there were breaches everywhere in data, blockchains, and I think the savior of all this is Artificial Intelligence.

Hadelin: Because indeed in our courses for example, we did a few case studies or examples of how we can leverage AI to build some security systems [inaudible 00:23:46] made a fraud detector for example. Well that's a classic example of how AI can help. But now with all the decentralized systems combined to Artificial Intelligence systems, which makes an IoT system, that will play a huge role in IT security. And indeed the programs are increasing, the companies are increasing their need for IT security systems, and AI will play a

better and better role in that. So definitely your prediction that was correct, and that is in the uptrend continuing for 2019.

Kirill: Nice. That's really cool. And I wanted to ask our audience, who has heard about at least, apart from this webinar, who has heard about at least one cyberattack in this year in 2018? If you haven't, say no, if you have, say yes. Let's all have a look and see how many people are saying or thinking ... Have heard stuff, haven't heard stuff about Artificial Intelligence. I mean, sorry cybersecurity. I'm already jumping forward ahead, far ahead.

Kirill: All right, let's have a look. We can see [inaudible 00:25:05] multiple attacks. So like it's obvious, whoever's looking at the chat, you can see that like 90%? What do you say Hadelin?

Hadelin: Yeah 90% of yes.

Kirill: 90% would say yes. So yeah, it's crazy. So there we go. That's what's happening in the world in the whole space of cybersecurity. Very, very powerful a topic. So far I would say that that was a successful prediction. That was like number three. So, so far we have two out of three. Very good. Very good. Let's see if we can get better than that.

Kirill: Okay. Deep Learning as a mainstream. Hadelin you're the expert on this. What are your thoughts? How has Deep Learning evolved in 2018? Do you think that was a correct prediction?

- Hadelin: About 2018, sure there has been some development, but I have a huge announcement for 2019. But that has to do with 2018. We will all find the motivation in 2018 to this new era that is coming in at 2019. So we're talking about is that the biggest question everyone has ever had about Deep Learning is how do I find the right architecture of the neural network to do my application? Whether it is to classify some images, whether it is to do some uptakes or recognition in some videos, or whether it is to apply the Deep Learning for medicine. Well, there is much degrees of freedom when building the architecture of the neural network that it is the biggest challenge in Deep Learning. Figuring out that architecture.
- Hadelin: The biggest progress, the biggest state of the art breakthrough that is appearing right now in Deep Learning is the answer to that question. What is the best architecture for my specific application? And this is a new field in Artificial Intelligence and Deep Learning as well, called, Deep Neuro Evolution. And it is the technique that allows us to answer that question, what is going to be the best number of layers in the neural network? What is going to be the best number of neurons in the hidden layers of a neural network that will provide me with the highest accuracy for my specific application?
- Hadelin: So this is amazing for the field of Deep Learning and Deep Reinforcement Learning and Artificial Intelligence, because for many years people have been asking the same question. Really, do I need to be an artist to figure out the best architecture? No. Right

now the technique, the ultimate technique is coming to answer that question. So that's pretty amazing. But sorry, yes, I talked about 2019.

Kirill: Yeah and we'll talk more about 2019 coming up. In general, we've seen Google invest a lot of time. So if you go to Google publications database, you will see that they published about 565 research papers in 2018 and approximately just short of 400 of those publications are to do with the space of Deep Learning or some kind of Machine Learning. And most of the Machine Learning, the research that they do is towards the Deep Learning from what I understand, I might be wrong there. But, anyway, you can have a look at them. Google research paper then a lot of them are tailored to Deep Learning, natural language processing, image recognition. We saw self-driving cars take on more and more markets and slowly getting used in more and more states in the US. Although some restrictions for now, but all of that is also Deep Learning. All of that is enabled by Deep Learning.

Kirill: Another really exciting thing is that a new TensorFlow is coming out. Any comments on that? That's definitely like a statement that Deep Learning is here and it's here to stay. Hadelin do you have any comments about the new TensorFlow?

Hadelin: Yes of course, TensorFlow 2.0 is coming and everyone is really really excited about that. And besides, TensorFlow has made a lot of progress this year in 2018. I have to admit that I had a preference first for PyTorch, because PyTorch was the first who introduced the dynamic graphs, which allows some

much faster computations of the gradients during the training than TensorFlow. But now TensorFlow has made some progress with that.

Hadelin: TensorFlow is working with graphs now and we have some amazing training efficiency. So actually the last AI Course that we made is with TensorFlow because I was really convinced that it was great for what we built. Besides, we built the most powerful AI model that exists today.

Hadelin: So yes, a great thing about TensorFlow. TensorFlow 2.0 is coming and actually as soon as it is coming, we plan to make a course on that. But still, I would like to say that PyTorch on the side is absolutely amazing as well. It's really now depending on which AI platform you prefer, which one you are most comfortable with, but in terms of techniques, now they're both equally the same.

Hadelin: And now Keras is really amazing as well, built on TensorFlow. Actually I still recommend to start with Keras at first, when you start with Deep Learning, and then if you want to get it into the real complicated stuff and make some more manual models, well TensorFlow is an amazing tool.

Kirill: Awesome. Thank you. You can see that people are saying Deep Learning is the future indeed. That's where we're going. Okay, so that's good. So how many we've got? One, two, three, four. So it's three out of four.

Kirill: Number five was a persistent growth of the Hadoop market. We talked more about like big data so that

people should look into big data and how everything is going in there. And the reality of what we saw is big data wasn't as popular this year. It actually kind of like dropped off. Here are some stats. According to Wise Guy Reports, global Hadoop analytics market cap, in 2016 was \$5.2 billion. So in 2016 was \$7 billion, 2017 was \$8.1 billion, and in 2018, it's estimated to be \$7.7 billion.

Kirill: So as you can see, it kind of dropped off. Market is expected to return to growth in about 2020. Very interesting. I was thinking about this. We already have more and more data in the world. More and more companies need data. If you look for Google trends for Hadoop, for a Spark, either Spark 2.0, Apache Spark and so on, you kind of see like a peak and then it kind of trickles off a little bit.

Kirill: So interesting situation. What do you think Hadelin? Why do you think this interest in big data, big data tools, it's kind of like dropped off a little this year?

Hadelin: Yes indeed. It was really surprising, I wasn't actually sure the real reason behind the drop. But I think it's because, since systems are becoming more and more automated and there are more and more cloud platform solutions which you can use to handle your data just like that, without having any things to do.

Hadelin: Let's not forget we have older cloud solutions. We have AWS, we have Paper Space, we have Microsoft Azure, we have Google Cloud platforms and also the IBM cloud solution. So with all this, it's actually normal I think that there is a downward trend in systems like

Hadoop which were the way we did things before when we implemented the big data system with our own hands. Right now we'd rather use automated systems, which are now very well to handle big data and actually that's what we did in our company.

Hadelin: So really, I think it has to do with the cloud platforms. But maybe I'm wrong.

Kirill: Okay, gotcha. It's an interesting thought that ... Maybe to extend a bit what you were saying, maybe the way we were using big data previously was kind of limited to the tools we had and predominantly when big data came around, Deep Learning wasn't as prevalent as it is now. And it was mostly like Machine Learning tools and people were like, I think it was kind of limited. And so basically this whole prediction that by 2020 and this trend will pick up, maybe now we're going to develop the tools a bit more. And then we'll see, oh, okay, now we actually do need, we see a bigger purpose for big data. Again, a better purpose, more powerful purpose. Let's get back into this.

Kirill: I think eventually big data is going to ... It's here, right? It's just like it's slowed down the trend, but it's still there. But I think it's going to be necessary for companies anyway because we're not going to run away from this data any time soon.

Kirill: Okay, so we have one, two, three, four, five. So that one was probably a failed prediction. A bit early, right? It will happen later on. So out of five we have three. Three out of five. Let's see if this can improve.

- Kirill: Another trend we identified was Augmented Reality. So what happened in the space of augmented reality in 2018? So augmented reality, we're not at the end of the year yet, so this report was made a bit earlier, somewhere in the middle of 2018, but it's already based on the data that available. It was predicted that in 2018, augmented reality, virtual reality products and services would reach \$27 billion. That is a 92% increase year over year.
- Kirill: Now, even if this is not 100% accurate, it can be some margin of error there because we're not at the end of the year yet and the prediction was made earlier. Still even if it's a 92%, even if it is an 80% increase, that's a massive increase of the spending on augmented reality and virtual reality products and services. Massive, massive trend. We see lots of companies slowly getting into that space, of finding ways that they can implement those technologies and augment their services, or create new services and products with those tools. What are your thoughts on the AR/VR trends Hadelin?
- Hadelin: Definitely increasing trends in 2018, not only in the fun business, it was a lot used in video games and games in general. But also as you said, there're several industries. Medicine leveraged that. Real estate leveraged that. There are many applications we can find on augmented reality, and yes, for me there is absolutely no doubt that it is an increasing trend. It has been an increasing trend for 2018 and is going to continue in 2019, that's for sure.

- Hadelin: According to my estimation going to reach a couple of hundreds of billions dollars markets in 2019.
- Kirill: Great. So that's six trends that we talked about. Four out of six. I think that one was a successful trend and those who listened to this prediction and got into that space I think are getting some great benefits from that.
- Kirill: Next trend we talked about, it's a very interesting one, digital twins. So digital twins, what is that all about? Digital twins, just as a reminder is when, you have a real physical object, like an airplane or I don't know, like a big piece of mining equipment. And then you have a twin, like a copy of that object in a simulated environment. So it's like a simulation, but the simulation is actually attached, it's actually linked to a real life object like let's say a plate.
- Kirill: And then, you take the data from the real object, you pass it on to the twin, and then you monitor the twin and you try and understand when will it require maintenance, how will it perform in certain circumstances, what are the drawbacks, benefits, how can you improve it and so on. Instead of doing all those tests on the real object, which is sometimes impossible. If the plane is constantly flying, you do need to maintain it. But if it's in the air, how you're going to maintain it? How are you going to try and run an analysis? Well, you have the digital twin for that.
- Kirill: And so our prediction was that digital twins are going to be an important trend in 2018. This is what we saw: 48% of organizations that are implementing Internet of things are already using or plan to use digital twins in

2018. In addition, the number of participating organization using digital twins will triple by 2022. That's a report by Gartner. The global market for digital twins is expected to grow 38% annually to reach \$16 billion by 2023. That's a report by Deloitte. So massive trend, what are your thoughts Hadelin?

Hadelin: Yeah massive trend, also massive trend in the science fiction world because more and more people are starting to spread the idea that we might be digital twins ourselves in a simulated environments. So of course the science fiction, our imagination can imagine great ideas. Digital twins are becoming a trend and it's fascinating. It's fascinating how people can then use them today to gain a lot of value in their business. So I think it will continue to grow.

Hadelin: Digital twins by the way, are applied in some amazing application industry such as, you mentioned the digital planes. Also in a simulated environment where you can build some avatars of yourself and have your characters in a video game.

Hadelin: So we can find as for augmented reality and virtual reality some applications of digital twins in both the fun world and industry world, the business world. So this is all good hence to say that it is becoming in an up-trend.

Kirill: Do you think people should look into building careers in that space? It looks like it's going to explode in the next couple of years.

Hadelin: Yes. I think people should start considering it. Not only because it will explode, and also because it is

fascinating. I mean, I would love to work my career on that. It's a futuristic subject. It's a highly focused on technologies. It will leverage several technologies that exist today. So yes, I would only recommend, but of course I would keep on the side a security option in case it takes time to develop. But I think it's already starting to be in good position.

Kirill: Speaking of exciting, Leonard told me that Formula 1 use digital twins. That they usually have three drivers, two are racing and one is predominantly focusing on testing stuff out. And the way they test is, they don't actually test with the real car, they test in the dynamic, what are they called, aero tubes where the air is pushed against the car, or in those digital twin environment. So it was pretty cool, Formula 1 racing. [crosstalk 00:41:45] stuff.

Hadelin: [inaudible 00:41:48] twins.

Kirill: Okay. We're going to move on to the next trend. So I think that was a successful prediction. So far we have one, two, three, four, five, six, seven, five out of seven. One more. Self-serve analytics. This is, we're moving into a world where people and organizations are empowering employees to more and more have access to analytics themselves rather than waiting for a report from the data scientist or a requesting some information, they can just go in and look at that and educate themselves on the information they're looking for and make decisions based on that.

Kirill: One thing that we found here is that, in 2018, self-serve analytics remained one of the three most

important trends in the business intelligence world, along with data discovery, master data and data quality management. Sorry, data quality management and data discovery, and then it was self-serve analytics. So it was an important trend and made important trend. I think that's a report by BI-survey.com.

Kirill: The question is why is self-serve analytics such an important aspect of today's data driven world? What do you think Hadelin?

Hadelin: To me, this is pretty obvious actually because anything that has to do with self is exactly the new thing today. Artificial Intelligence is nothing else then a self-system because it is self-learning. And so in business intelligence the new obvious added value will be the self-serve analytics as it says.

Hadelin: Basically what is it exactly? It's like a system that will optimize and automate the Business Intelligence [inaudible 00:43:54] within an industry or within a company. And that's why to me this is really the natural next step in Business Intelligence because, it combines Business Intelligence with Machine Learning, even Deep Learning and AI. So yes, this is a natural uptrend which will therefore for me continue in 2019.

Kirill: Totally agree. In my view, self-serve analytics is kind of like empowering people. Imagine when we drive cars, my favorite example of cars, we don't need to know how a car works inside, right? I don't know what the difference between a crank shaft and a cam shaft is,

really don't. And more frankly, I don't care. I just need to know which pedals to press to put the petrol in.

Kirill: Self-serve analytics is kind of like that in the sense that there are these super powerful tools like Deep Learning, Artificial Intelligence, Machine Learning, all of these super useful things that we can use. But some people never want to learn programming, never want to learn how to even visualize stuff in Tableau and things like that. But they want to be able to leverage the benefits of those tools. So that's where self-serve analytics comes in. It's like instead of chopping things up with a knife, here's a blender, go and blend it together. That's all you need to know. You don't need to know how it works inside. Of course, people are going to jump on top of that as long as you educate them. You give the right resources for them to learn how to use it.

Kirill: So that was a trend, and remains a trend. So in total, to sum up our predictions for 2018 there were eight trends that we talked about. AI being the new electricity to quote Andrew Ng, Blockchain security, Cybersecurity and Deep Learning, Hadoop, Augmented reality, Digital twins, Self-serve analytics. And so far we've got six out of eight. I think it's not a bad score, six out of eight, right? 75% accuracy rate.

Hadelin: Yeah. It's not to [inaudible 01:53:21] the prediction accuracy rate, but it's still pretty good I think. Yes. [crosstalk 00:46:07].

- Kirill: Very good. Okay. Moving on to the exciting stuff. It's been 45 minutes and we're now finally moving on to 2019. Exciting. Yeah.
- Hadelin: Yes. Good things are coming in 2019. I'm so excited about this new year. I'm really excited.
- Kirill: Yeah for sure. For sure man. Every time it gets better, right?
- Hadelin: It seems that they were going to be some answers in 2019.
- Kirill: Answers to what?
- Hadelin: Well, for example, Deep Learning. What is going to be the next breakthrough in Deep Learning? Well we know what it is and this is what I reveal in our new course. This is really a breakthrough in Deep Learning.
- Hadelin: What else is going to be? Well, IoT of course, Internet of Things. It's going to be the next big thing. And why is that? It's because it reflects the new power is we can find in technologies, which are hybrid systems. Technologies we're developing alone so far, now we're starting to combine them. We can combine an AI to a blockchain to integrate an IoT system. We can combine technologies in medicine to Artificial Intelligence to create a hybrid system that will cure some diseases. We build more and more hybrid systems that are becoming optimized by this Deep Learning evolution, branch of Deep Learning that I've mentioned and in improving in a significant way at the models.

- Hadelin: So that's something I'm really excited about and I look forward to implementing these models for diverse applications in industries. And I think this is what people should start to focus on right now when they are starting in AI.
- Kirill: And also look at case studies, not just learn them. But as you said, see how you can apply them in different industries. That's a powerful part.
- Kirill: So not so keep everybody waiting, we're going to dive straight into it and we're actually going to start with our biggest and most exciting announcement. We were thinking of leaving the best for last, but we know some of you might have to run and timing and stuff like that. So we're going to make the biggest prediction first.
- Hadelin: Yeah. Someone just asked the question on the chat.
- Kirill: Really? What did they ask?
- Hadelin: If you notice, look at one of the previous questions. I think this is what you're about to reveal. I'm not sure so [crosstalk 00:48:51]-
- Kirill: Yeah, yeah, yeah. Well, I'm not sure either.
- Hadelin: It was what I was thinking about.
- Kirill: Is that the question Hadelin? A new course from you guys. That question?
- Hadelin: That's the one.
- Kirill: Okay, all right. So we have a massive trend which is coming and Hadelin has been on top of it for the past

couple of months. You presented for the first time at DataScienceGo right about the strike?

Hadelin: That's right.

Kirill: Everybody was like, wow, nobody knew what was going to hit them. And that was October. So two months ago you presented. How long have you been monitoring this trend before we name it?

Hadelin: The new trend is a really recent one. It's a brand new thing. I discovered about this not more than one month before the DSGO.

Kirill: So about three months. It has been around for three months and you've been on top of it. Okay. Very cool. And it's funny, it's very interesting how you announce it at DataScienceGo, something that is a trend, and now we're slowly seeing it to actually start take shape in the world. You kind of feel it happening.

Kirill: All right. Without making everybody wait any longer, would you mind announcing what the big trend for 2019 is?

Hadelin: Okay. The big trend for 2019 is going to be the Hybrid Intelligent Systems optimized by Deep Neuroevolution.

Kirill: That's a mouthful. What does that? Give us a quick overview. What is that? What are Hybrid Intelligent System optimized by Neuroevolution?

Hadelin: Basically, so far we have been building AI models separately, single AI models. And we've tried to improve them. We've tried to improve them by adding some new features and adding some new techniques.

Improving the optimizers that will update the parameters at the most to figure out the best ones. Or adding some feature to the AI that can do something more than do some mathematics and remember and have a critic sense like it was the case.

Hadelin: But, the thing is that we've been trying to improve the single AI's by themselves. We've been improving slightly the performance. But the big breakthrough that appeared recently was not by adding a feature to an AI, but by building a team of the most powerful AI models. And therefore the new breakthrough in Artificial Intelligence that we have today is a Hybrid Intelligent System, meaning a team combining the most powerful AI models. And this is exactly what this brand new model in the AI ecosystem is. And it wasn't until recently, which is called the Full World Model.

Hadelin: And it is exactly a Hybrid Artificial Intelligence that combines several Deep Learning models. And mostly it combines several branches of Artificial Intelligence. It combines Deep Learning. It's combines also Deep Reinforcement Learning because you have AI model based on Deep Learning. And also of course it combines with the most powerful branch of Artificial Intelligence, which is Policy Gradient. Because one of the components of the AI full world model will be optimized by evolution strategies, which is the state-of-the-art model in policy grid in branch Artificial Intelligence, and it will basically figure out the best parameters for your model.

Hadelin: And so this is exactly what I mean by optimized by Deep Neuroevolution because Deep Neuroevolution is

the cherry on the cake that will tell you which parameters are the ideal ones for your model. And about that, well, this was so exciting to figure out this breakthrough that we couldn't help but for the past few weeks to work on that and build a course for this. So here we go. That's the big announcement. We are really seeing the course on this Hybrid Intelligent Systems optimized by the Deep Neuroevolution.

Hadelin:

It was so exciting to work on that because, not only we built a hybrid team of intelligent systems, but also, we built an Artificial Intelligence that has the ability to dream like [inaudible 00:53:40] the best solutions are found in our sleep, well, we added this new feature in the Artificial Intelligence, a feature that allows the Artificial Intelligence to sleep and dream so that it can recreate its observations of the environment, like in a dream. Like what humans do when we sleep. So that was so fascinating to implement, and that's also a big new feature in this new trend in the Hybrid Model.

Hadelin:

It was amazing to work on that, and it's going to keep continuing. It is going to the trend of Hybrid Intelligent Systems optimized by this new Evolution Strategy branch of Artificial Intelligence will be the next new trend and breakthrough in this ecosystem.

Kirill:

Now that is so, so exciting. Would you say that having multiple AI models working together is kind of like random forest, where you take the average? Or is it something more complex for the benefit of, it's never my benefit. How is it best to understand? How do they work? How did it manage to work together?

- Hadelin: No, no, no. It's much more complex than random forest because in a random forest, it's just basically a bunch of trees doing anything, predicting the same outcome and working on the same basis. But here in this new system, Hybrid Intelligent System, well you really have several components that are doing completely different things.
- Hadelin: For example, in this new model, the full world model, we will have one Deep Learning model that will take care of visualizing the inputs images, input frames. You will have one other model that will dream about the environment and recreate the environment inside a dream to learn inside it in a much better way. And this model is a variational autoencoder.
- Hadelin: Then you will have another model which is MTM, RNN, recurrent neural network, which will remember basically better its training so that it can play better actions to maximize the reward and increase the performance. Then you will have controller doing something totally different. A separate controller that will optimize the actions to play. And you will have again, totally different things doing totally different things. You'll have the optimizers based on evolution strategies that will figure out the best parameters technically of your different models inside the full world models.
- Hadelin: Really, it has nothing to do with random forest. It's like a very complex system of several AIs working together, but each having their own particular role. And that's the first time I've ever seen that in Artificial Intelligence. So the full world model is the really first

world AI model that is based on such an idea. And besides, it has this fascinating ability to have a model inside that can dream, and also can gain the performance inside the dream.

Hadelin: So really a big breakthrough in Artificial Intelligence I must say.

Kirill: Yeah, man that is crazy. We're already getting some questions from the chat, when is this going to go live? When are people going to be able to get their hands on this new course and learn all about the Hybrid AI model?

Hadelin: Well the answer to that question is in four hours.

Kirill: That was unexpected.

Hadelin: In four hours people will be able to get exactly what we've been talking about and actually I can see great question in the chat is, more like nervous system. Yes, exactly. This is a great question because with this model that is not only hybrid and able to dream, well we are getting closer to how humans we think and we make predictions. Because indeed this Deep Neuroevolution, new trend of AI is the one that can really optimize the new world systems, the neuro networks and the AI.

Hadelin: So it's a really good question. We're getting closer to human intelligence basically thanks to Deep Neuroevolution. Yes, that is fast. Really in four hours? Yes, it's going to be in four hours. But we've been working on this for two months. Basically since it appeared in the research paper, and I have to say, I

have never been that excited to work on an AI like that.

Hadelin: For the hybrid nature and because it can dream and that made me realize that indeed, it reflects very well the human intelligence. Because I myself in my experience was able to find the solutions to toughest problems right after waking up. Therefore, something happened during my sleep. And I think this is how the inventor of this model figured out this amazing and fascinating idea of putting an AI that can dream to gain some performance. And indeed when we see the results, well this is obvious that it really works. It really, really works.

Hadelin: And actually in this new course there is something very exciting that we'll do. We'll do a competition between human intelligence and Artificial Intelligence. Meaning that we will race a car and we will play the game, actually, we will be with our keyboards driving that car, and we will race it against the Artificial Intelligence. So this will be the first time in the course that we do an AI versus HI competition. And this is something pretty exciting in this course.

Kirill: Nice. Very cool. Very cool man. And speaking of sleeping, you haven't been sleeping much have you recently?

Hadelin: No. I've been so excited about this course that I haven't been sleeping at all the past few days, but the energy is still here. I think that sleeping is mostly about getting back the energy. The fascination and the excitement is so high with this course, the passion is

so high that it's impossible for me to sleep more than three hours per day. So yes, indeed, I haven't been sleeping much, but I'm sure that once the course is released and the demo is live I'll have the most amazing sleep of my life.

Kirill: That's awesome. Okay, well there you go guys. Make sure to check your inboxes or any other announcements we send out on social media in four hours from now to get your early access to the course. Hadelin told me there are some incredible bonuses attached to the early access.

Hadelin: Yes. The thing is, working on this AI took so much time, and I was waiting for the next info actually by the people in the community, who were the top people working on this. And so at the same time during the two months, I worked on the bonuses when I was waiting for something. Therefore the bonuses were prepared so much in advance, because usually we make the bonuses before the launch or after making the course, well this time was different. We've made the bonuses for two months or even three, and at the same time we're making the course. And therefore the bonuses at some point became like a whole separate course. [inaudible 01:01:26] huge that they're like a whole separate course.

Hadelin: So indeed with this new course, what is very, very special is the bonuses as well. Because there're so huge, the content is so huge, we made so much content on this that they're like a whole separate course. So basically let's put it this way, with the course you'll get of course the full world models. With

the course plus the bonuses, you'll get the TRP which is the state-of-the-art model in the Policy Gradient Branch, Trust Region Policy Optimization, which provides as well amazing results and also one amazing model that appeared very recently. [inaudible 01:02:04]-

Kirill: From Russia.

Hadelin: Yeah, in late October, beginning of November. This is a model called CatBoost. And why is that amazing? It's because it is the most powerful model providing the highest accuracy when your data set has categorical features and that's what the cat in catboost comes from. Categorical features. And today all the data sets have categorical features and in fact in our courses, everyone asks us about categorical features, how to better handle them.

Hadelin: Well, the thing about catboost is that not only it is the state-of-the-art machinery model that provides the highest accuracy, well also it's the one that handles the best of categorical features. So it is a must have in the two kits. The catboost model, because it is not only powerful but also super practical for the data sets we're working with today.

Hadelin: No, not catbooster, catboost, yeah catboost. Antonio, you got the right one. Catboost, it is of course based on the gradient boosting models, which are like the [inaudible 01:03:09] efficient one in neuro machinery.

Kirill: Awesome. There you go guys. Once again you heard Hadelin. Course coming out in four hours, make sure to jump on top of it and join us inside the class.

- Kirill: All right, let's move on to the next trend. So we spent quite a bit of time on Hybrid AI models, big trend for next year, biggest one, but what other trends do we have coming up in 2019?
- Kirill: An important one then I would like to point out is data literacy. What does that all about? Well, organizations... we're moving into a data driven / model driven world. Model driven is even beyond data driven. Is when you have a model running a business like Amazon or Google, where something like a recommender system. But in any case, whether it's data driven or model driven, we're moving into a data powered world where businesses need to make use of this asset that they have. This very powerful asset that they have data, which is usually the underutilized. Every business has it. It's just a matter of how are they capturing, storing and processing that data.
- Kirill: The businesses that do use their data, both the other things being equal will outsmart, outperform their competitors. Will have lower costs, higher efficiency. So businesses want to get onto the train.
- Kirill: One of the ways to do that is not to just only have a Data Science department, which is important, but actually to have data scientists across all the board of the organization in the sense that people who work in organizations, the employees, the staff of the organization are actually educated in the space of data and can derive some basic insights, or can use insights that others have derived and get benefits from data. That's where the concept of citizen data scientist comes about.

- Kirill: So here's an interesting statistic. More than 40% of Data Science tasks will be automated by 2020, resulting in increased productivity and broader usage of data and an analytics by citizen data scientists according to Gartner. So if tasks are going to be automated more than 40%, you want people to be able to use those results of those tasks.
- Kirill: Gartner also predicts that citizen data scientists will surpass data scientists in the amount of advanced analysis produced by 2019. That is pretty intense. What do you think, Hadelin?
- Hadelin: Yeah, that's really, really intense. I heard about this data literacy and also data legacy. You have to build a data legacy when being a data scientist, which comes again to the importance of having a vision, having a strategy, having a good prediction, some good predictions. So yes, data literacy should be one of the next buzz words in the Data Science ecosystem. And indeed these statistics are amazing. That more than 40% of data scientist tests will be automated by 2020. That will definitely increase the productivity, and it will definitely enlarge the opportunities in data systems.
- Hadelin: And again, remember that we were wrong about Hadoop and all these big data systems, but this data literacy and statistics, we'll definitely bring that up back in 2019 or the years to come. So yes, that's my view of data literacy. It's really good as we can talk about this.
- Kirill: Awesome. Definitely. That's something for data scientists and people listening to this podcast to think

about. How can you help your organization take advantage of this trend? Like actually get on top of it. How can you maybe run a course within your organization to help people improve their data literacy? Like I did that personally a couple of times in organizations where I helped people understand the insides or how to use the tools, the self-serve analytics and so on.

Kirill: So it's not just like a trend that we're throwing out there. All of these trends are for you to take advantage of. Whether it's to learn a new tool for herself, or to somehow enhance your career or help others or help the organization in general. Get on top of this trend.

Kirill: Okay. Our next big one is Cloud. Our favorite cloud, cloud, cloud. Hadelin, did we talk about this? That the cloud is actually underwater. How crazy is that? That's the cables that go between continents, the Internet cables, they're all underwater under the ocean. So when you think about it, the cloud is not like celestial, it's like underwater.

Hadelin: You scared me. I thought you meant metaphor, underwater. Like it's-

Kirill: No, no, no, no. Physically, physically under water.

Hadelin: Okay. I didn't know that. It's under water, yeah.

Kirill: There's a really cool map online of the Internet cables. Anyway, let's do a quick stat here. So worldwide public cloud services market is projected to grow 17.3% in 2019. From \$175.8 billion this year. \$175.8 billion this year to over 205. In fact \$206.2 billion next year.

That's a massive amount and a massive growth. What are your thoughts Hadelin? Why would you say that cloud is growing so fast? It's becoming such an important trend in this technological world?

Hadelin:

Well, it's really directly because of the need. Companies have higher and higher need for these cloud systems. At the same time, Amazon is doing so great on their offer. So it's the system of the offer and demand, offer and need. This comes very well together. The offer need demand across is right in the spot right now. So I think it is basically on a good momentum. There is more and more need for these cloud system and actually we're the first in need of it. We're using cloud systems ourselves today in our company to handle big data and to automate machinery and pipelines and AI pipelines. So really in the answer is obvious. It is because it is so practical in companies. Companies want to optimize their process, they want to gain efficiency and this is what these cloud systems allow them to do.

Hadelin:

For me, this really comes well with the major concerns and major goals that executives and the companies have today in their business process.

Kirill:

Okay. But why would you say that companies ... Like before, I remember when I was working in the industry back in 2000, when was this, 2014. There was a lot of fear, a lot of push back and apprehension from companies to move to the cloud. They were like, security is a risk and we don't want our data to be sitting or even processed in the cloud. What if somebody hacks it and so on.

Kirill: In fact I've witnessed companies, the cloud was already there, but I saw companies spend \$20 million, a specific company without naming the names, spent \$20 million on installing servers locally, no, upgrading their servers. They already had servers, they outgrew their servers. Instead of moving to the cloud, they upgraded their servers for ... They started talking to vendors about upgrading their servers for 20 million bucks. Whereas moving to a cloud would have been much cheaper and easier scalable. The benefit of this cloud is that it's so scalable.

Kirill: So what are your thoughts on that? More time has passed. And even though we have more cybersecurity attacks and threats and so on, more organizations are open minded about the cloud and are happy to go and explore this option and actually go with it. What do you think changed in the world the past couple of years?

Hadelin: I think I know what happened. Actually I have a worse example than the one you said. A few years ago, I knew a company that actually spent \$100 million in that kind of system where today they could use the cloud for a lot cheaper. Speaking of cheaper yes, the cloud systems are becoming cheaper and cheaper.

Hadelin: But what I wanted to say is that I think the reason for this suddenly working so well and developing so well for companies is that there were a few failures at the beginning, that's for sure. Like these companies investing a lot of money on their own system instead of using cloud. And then at some point, I think that what happened is that some companies adopted the cloud

and this turned to be a success and then came the domino effect. The neighbor company started to observe that the competitor started to gain some value thanks to the cloud. So with the domino effect, they started using the cloud as well. And then, here we go, more and more companies use the cloud. And with a snowball effect and success propagation, it is how we came today in the situation where nearly most of the companies are using the cloud.

Kirill: Gotcha. So it's more like competitive pressure. There's no choice. It's just so inefficient to have on premises that that's your new norm.

Kirill: That's an example of when something in that Gartner Hype Cycle that we talked about a little bit earlier, when something has passed the hype, has dropped off and now it's slowly getting to that, it has become the new norm. It's come to that plateau of stability where people have accepted it as not a hype anymore. Before cloud was a hype. Now cloud is not hype, cloud is the new norm. We do stuff in the cloud. Sometimes do things for courses for our businesses. We do things in the cloud. 'Cause that's the way things work.

Hadelin: Yes.

Kirill: Rohit posted a great question in the chat. Let me find it. Which cloud service is the leader in Artificial Intelligence? What are your thoughts on that Hadelin? We've used cloud quite a bit for our consulting services.

Hadelin: There is absolutely no doubt that the cloud service leader in the AI is AWS. No doubt. I have used all of

them. I have had actually good experience with all of them. The one I'm the most satisfied with, not only in terms of speed and also cost, but also what results it can bring is AWS. So I have nothing with AWS. I'm not making some advertising for them, but it's true that I have used all the cloud systems. Tried all of them. Not only for the courses were also for our business, and the one I'm most comfortable with and the most satisfied with is AWS.

Kirill: Awesome. That's very cool. I read a really interesting statistic. I'm reading a book now and there they said that for the Amazon business, I think it was in 2017, I should find those stats, the web services accounted for 120 or so, but more than 120% of their revenue, or profit. Yeah, 120% of their profit. And so basically, don't quote me on the exact numbers, but basically what that means is that the retail side of Amazon was still losing money. They're growing the scaling really fast, but in essence, they're losing money, but they're making up for it with their web services. And so hence they have to be good, right? They have to be some of the leaders.

Hadelin: No, they're doing a great job. Really. It's becoming better and better.

Kirill: Awesome. Okay, so that's three trends so far. So far we've talked about Hybrid AI models. Don't forget it's maybe like just under four hours left for your big announcement, for a big notification about that to come. Data literacy and data moving to the cloud.

- Kirill: All right, next big trend. One of your favorite ones Hadelin, we're going to talk about Internet of things. So, before we dive into it, let's have a look at some of the stats.
- Kirill: Internet of things spending is forecasted to experience a compound annual growth rate of 13.6% over the 2018 to 2022 period, and reach \$1.2 trillion. Not billion, 1.2 trillion with a T. T, trillion dollars by 2022.
- Kirill: The term global spending this year is expected to be, this amount to \$772 billion when Internet of things hardware will be largest technology category with valuation. So the Internet of things hardware will be the largest technology category with a valuation of 239 billion, followed by services software and connectivity. Bain predicts B2B Internet of things segments will generate more than \$300 billion annually by 2020, so this is just business to business Internet of things. Including about 85 billion in the industrial sector. What's this? Harley Davidson reduced its build to order cycle by a factor of 35 overall profitability by 3% to 4% by shifting production to a fully IoT enabled plant according to Cap Gemini.
- Kirill: So this is just an example, a case study that Harley Davidson increased their build to order cycle by a factor of 36 with the use of Internet of things.
- Kirill: Globally business to client B2C commerce is projected to invest \$25 billion into Internet of things systems, software and platforms within two years. Healthcare and processes industries are projected to invest 15 billion each into Internet of things.

- Kirill: So there are some stats. We can keep going, there's plenty more about what's happening in this space. Just to give you a feel that things are heating up in the space of internet of things. And now I'll pass over to you Hadelin. One of your favorite topics, just to get everybody up to speed, what is Internet of things? Let's start there.
- Hadelin: Well, the first thing I have to say is, based on what we've just talked about in this webinar is that, an internet of things system is nothing else than again, a Hybrid Intelligent System. Here we go.
- Hadelin: It is another Hybrid intelligent system. So it is really obvious that now everything is connected together. The dots are connecting. In AI, the new big trend is that Hybrid Intelligent Systems. The next big trend in 2018 in terms of technologies will be the Hybrid Intelligent System in the IoT.
- Hadelin: What is an IoT? What is the hybrid nature coming from in IoT? An IoT system is a system that will combine several technologies, starting with of course all the connected devices. Like the smart home for example, is an IoT system. Smart cars, the smart phones as well. Basically when you drive and you have your data connected you to your insurance to calculate at the end of the month, the probability of the cost, well, all that is again an IoT system.
- Hadelin: So it is a system that combines hardware devices, connects the device with technologies in form of softwares like Artificial Intelligence.

Hadelin: The next big IoT system that we're going to see and that's why we must not forget about blockchain is the combination of connected devices, hardware, then Artificial Intelligence, and then of course blockchain. These are going to be the best IoT systems combining today the best three technologies that we have today.

Hadelin: And so, we can imagine the crazy number of applications you can find in IoT systems that can be in the energy market. It can be in the health industry. It can be in the transport industry. I gave an example basically of an IoT system in the transport industry when it is connected to the insurance or when it is connected to other IoT systems all around you so that it can prevent more and more accidents from happening.

Hadelin: There are crazy the applications, that's why I'm not surprised about the figures here that it's going to reach the T, the trillion dollar market by 2022. So, because the applications are endless, they're endless applications of IoT. And besides it combines the most powerful technologies that we have today. It is in the right alignment with this new trend of the Hybrid Intelligent Systems. So to me, this is really the next thing to bet on, to invest on. And actually, if today I was, for example, a student in my last year of my studies, I would really, really start working hard on that. Because then when I finished for example, my engineering studies, the next big thing was about to be, Artificial Intelligence. So I highly invested in my work and energy on this, and that's how it all started for me.

- Hadelin: But today, AI of course is still developing crazy, but there's the new Hybrid Intelligent field coming. And of course IoT is going to be at the heart of this, and AT's going to be the fuel of IoT. So, it's really fascinating how all the dots are now connecting, not only intrinsically in the AI ecosystem, but also extrinsically when we look at the several technologies today that are combined together. So yeah, IoT, go for it. Definitely.
- Kirill: Hadelin, I loved your description and advice. Actually sitting I was also thinking that'd be really cool. If I was at the start of my career or thinking of how to direct record in Data Science, really powerful.
- Kirill: How can people actually study Internet of things? Studying AI I understand. Go and learn PyTorch or catboost or something like that. But what is Internet of things? We know what it is, but what is it in terms of what skills do I need to pick up? What courses do I need to take? What can I learn about Internet of things apart from just the actual just the broad general overview of the topic and what's happening in the space. How can I actually get some hands on knowledge in IoT? What do you think?
- Hadelin: You remember how getting into Data Science is a very challenging task, because it's not only about knowing statistics, it's also about knowing computer science, statistics, good mathematics, algebra, probabilities [inaudible 01:23:38]. There are a lot of things around Data Science that you have to get the skills on. Well, the bad news about IoT is that it's even worse than this. Because in order to tackle IoT, you will need

some solid skills in not only math, Data Science and Artificial Intelligence and blockchain as well, but also in all the hardware stuff. The hardware side of things.

Hadelin: Because indeed we hear IoT is about building some hardware systems as well. It's not only about software. The good thing about software is that you can just code the things. But in hardware you'll have to build some actual products, and you will need to know and not only all these, but you will need to know about embedded systems.

Hadelin: You will need to know about also Robotics, and Robotic programming like ROS. You know ROS, Robotic Operating Software, which can combine, for example, Raspberry Pi to your software in order to create an intelligent combination of software and hardware.

Hadelin: So it's really worth than Data Science in terms of what skills you need to get. But, the good news is that it's tomorrow that we will have a program about IoT system and how to become an IoT expert. So what I would recommend now is just to really identify different components of an IoT system, which I can already say today are, Artificial Intelligence, blockchain, Robotics and the connected devices. And therefore we can start by studying them separately, and at some point, using our engineering, we can combine them and start to learn how to create good IoT systems.

Hadelin: So really the answer to your question is first understanding, really understanding what are the

components separately and, then learn how to embed them into a hybrid, as we said, intelligence system.

Kirill: Amazing. That's some great advice. I want to add to that, that while it's hot and it's good that we are being very transparent here that indeed it is difficult to get some education in the space of IoT right now it's such a new field and you cannot just jump into it and go and take a course or something like that. None of that exists yet.

Kirill: What I would do, at the same time I'm thinking about it, I'm thinking like if this market is going to grow to \$1.2 trillion in the next couple of years, there's massive opportunities there. And how cool would it be? Just imagine, let's forget about how to get the publicity go to the result. Let's think in terms of results. How cool would it be to say that I am to have my on my CV or in my LinkedIn or just to be able to state that I'm an expert. I'm an IoT expert. I'm an expert on the Internet of things. If you can actually prove that, instantly you'll have millions of job opportunities. You'll have companies ripping you away with your hands and legs.

Kirill: And so the question, so now you have the results in mind. The question is, how do you get to that result? What's the pathway? It's not clear, but that's good in the sense that not many people will be able to take it until it clears up. So the people who do get through this thorny difficult journey now will reap all the benefits.

- Kirill: So how would I go about it? I would take exactly what Hadelin said and identify the different components of Internet of things, which are Artificial Intelligence, blockchain, connected devices. What else did you say?
- Hadelin: Connected devices, Robotics, blockchain, Artificial Intelligence and embedded system of course.
- Kirill: Embedded systems. I would also add sensors to that, because that's a good one. And I would start like, what Hadelin said, you can take it to the extreme and start actually building stuff using microchips and components, actually build something out. There's a lot of tutorials on YouTube. For instance, I saw one on how to make one suite ... If you have what are called blinds on your window, make those blinds open when you leave the room and make them close when you enter the room. So basically it is a sensor connected to your door ... Or actually no, there's a camera that is set up that has computer vision embedded with a raspberry pi device that is personal computer vision and that as soon as it sees movement, it causes the shutters on the blinds.
- Kirill: That's a very basic example. I would do a couple of those projects. That's an extreme case. You could do it simpler. You could buy some sensors and just connect them to your phone via Bluetooth. Or hook them up to your laptop, you do some Deep Learning on that and process images and stuff like that. Or, put them on your car and they'll process how many cats and dogs you are seeing and then what something's happening on your computer based on that.

Kirill: So do a couple of those on your own then go to a local supermarket, or a local store and tell them, hey guys, I can help you with Internet of things. I can embed sensors on your shelves to help you better identify customers that are interested in certain products so you can market to them. I would do a couple of those projects. And within a year I would do like three or four of those projects, and I would get such a good grasp on IoT that I would actually put that on my resume. I would say I'm an expert in IoT, and then I'd go to the local government and say, hey guys, this is what I can do for you. What projects do you have? And the governments have plenty.

Kirill: Actually heard of ... I think it was in Belgium. There's a city where they're building a system that's smart cars that have AI on board, are going to talk to the buildings. They're going to communicate with the buildings that driving by so that the buildings are going to tell them if there's another car around the corner.

Kirill: So basically when you get to a traffic light, your car already knows if there's another car coming, or if the road is clear and so they want to reduce the collisions like that. I know San Diego is building a smart city. That involves a lot of Internet of things.

Kirill: That is happening all over the place. And that's one of the easy markets like the low hanging fruit. If you're an expert in IoT, go to your local city, go to a government, they will have a project for you. That's what I would do.

Kirill: Yeah. Okay. So that's IoT, we've spent quite a bit of time on this. I think important topic to cover off. Let's move onto the next one. So this one will be interesting to get your thoughts on Hadelin, because it is actually related to Artificial Intelligence and it is the rise of explainable AI. Something new, something like an interesting thing that hasn't been around for long.

Kirill: People are getting more and more concerned with Artificial Intelligence. That it adds value, but it's a black box. That you don't know what's going on. With a Machine Learning algorithm, often you can actually look at the coefficients, you can just see what's happening. Like interpreter. Artificial Intelligence is very hard if not impossible to interpret at times. And so people are getting concerned with that. And so what we're kind of feeling is happening is this rise of explainable Artificial Intelligence. Where AI is built in a certain way that its findings and insights are designed that they can be explained and we can see what's actually going on. What do you think Hadelin? Why do we think this is going to be an important trend in the next year?

Hadelin: Well, it all has to do with control. In fact, if you remember in the DSGVO I talked about the three levels of control. And the first level of control indeed today we are a bit manipulated on the Internet by the data and some algorithms that can influence our decisions. So that was actually settled in the events that we had in 2018. And this is actually on a good way, it's actually making progress.

- Hadelin: But then the second level of control has to do with the black boxes. Because if AI continues to be a black box still well, very well, it can end up into the right hands, but it could also end up into the wrong hands. And in the wrong hands, if the black box take the black box, well, it would be very difficult to prevent the danger from spreading around the world. So I think that black box should not be continuing. I think that AI education should be spread as much as possible with the knowledge and understanding in AI should be spread as much as possible worldwide, so that we can prevent too much black box from happening in the future.
- Hadelin: And therefore that's why some of governments are already making a plan to introduce some Artificial Intelligence courses in schools already at a young level. It is in that perspective of preventing too much black box from happening.
- Hadelin: And also not only about control. It's true that most of the time people don't like black boxes. They like to understand what's inside the model. They like to understand where the results come from and how with some input we can get to the output. So I think that not only in terms of business, wherever you introduce a model to for example, your boss or manager or an executive, well, you should definitely not come with a black box but with a clear explanation of how the process works. And again, for that, the best way is to spread the knowledge about AI and talk about it to around you so that it becomes like a main stream to understand.

Kirill: Yep. You said it there man. That's pretty much why. I think this one is kind of like a risky bet for us in terms of making this prediction. It can go either way. But we got to stick to it and let's see how it works out in 2019 in terms of explainable AI. Would be exciting to be a part of that, to see how things go.

Kirill: All right, so that was explainable AI. The next trends that we are seeing is, an interesting one that I really like is Robotics Process Automation, RPA. So we had some guests on the podcast episodes 173 for those who are wondering, experts in Robotics Process Automation. This is an industry that is rapidly, rapidly changing the way we do a white collar work. A lot of things that we do are manual and can be automated. So for instance, you could create an RPA Robotics Process Automation script that automates how you receive an email, process it, save a file, then send that file to somebody else later on. Data entry, data manipulation, data checking, data processing, lots of things RPA can ... It's like the very low level of working with data. A lot of that stuff can be automated. So here are some stats.

Kirill: The global Robotic Process Automation, RPA market size is expected to reach \$3.1 billion by 2025 according to a study done by Grand View Research. The global market is estimated to expand at a compound annual growth rate of 31.1% during this period from now to 2025. Different organizations in different sectors are increasingly challenged by the growing market, the competition due to shift in technology and changing consumer preferences.

- Kirill: So that's that. As you can see, it's not massive yet. It's not in the trillions of dollars like we saw with Internet of things or cloud computing, but it's a really new space. It's a really new space and it's starting to disrupt businesses. It's really helping businesses save a lot of efficiency. We'll save a lot of costs and get a lot of efficiency. I personally think that RPA is, if you look for Robotics Process Automation on Glassdoor, it's got thousands of job offers right now. It's very new, so it's very easy to get into it and become like a subject matter expert, an expert in the space of RPA.
- Kirill: What are your thoughts on Robotics Process Automation Hadelin? It's not a massive market, not yet. It's still in the billions of dollars. But would you say that it is valuable for people to consider it?
- Hadelin: Absolutely. Again, the dots are connecting because RPA is actually one component of IoT, because RPA will allow you to build some good device and systems, good hardware. RPA is all about automating processes in big systems. So when you have the IoT system, which is a large process of things happening, well RPA will definitely bring its added value. Okay, it's not going to reach double digit billion dollar market, but it is an essential component of some more valued markets like IoT, which therefore will leverage it for sure.
- Kirill: Awesome. So yeah, there's something to look into, RPA, new exciting technology on the block. Okay. Next trend. So far we have Hybrid Models, data electricity, cloud computing, Internet of things, rise of explainable AI and RPA. So what does that make? One, two, three,

four, five, six. We're going to do two more trends, two more trends.

Kirill: The next trend is something that with all this rise of technology and all this rise of different Artificial Intelligence algorithms and RPA, and just all these things we're talking about. Internet of things, explainable AI and things like that, there is more and more room for people who are connecting insights to people who are making decisions. And that is the data scientists that participate in data storytelling. So the data scientists that can actually explain insights and findings in simple and understandable manner.

Kirill: What we're seeing is for one indication for how we can assess, really hard to assess a market like that. Data storytelling, is it growing, is it not growing? Something that we're seeing is the visualization market is growing. In order to explain insights, most of the time you need to visualize those insights. What we're seeing before our programming was a golden standard for years, but now with its libraries and ggplot2, but now we've got tools like Tableau has been around for ages as well. It's also grown substantially. If you look at the Gartner Magic Quadrant, you will see how Tableau is in the lead, but now tools like Power BI from Microsoft, ClickView and others are catching up with Tableau and like they're all very heavily investing in these tools.

Kirill: Also what you can see is Python, it has got its Plotly and Seaborn libraries are catching up very rapidly as well. Both R and Python have polls, competition to these tools that are provisionalization like Tableau with their own libraries, which allowed to build

interactive dashboards such as Shiny, in the case of R and Dash, in the case of Python to build BI solutions.

Kirill: So as we can see from this space, more and more energy and resources is being invested into the visualization and into the data storytelling market. When we were at DataScienceGo, a good number of our speakers, at least several speakers were talking about even if not directly but indirectly, there talk was related to data storytelling, how important that is.

Kirill: So we see that as a trend. We see that as something that's going to continue being super important, especially with the psychologist. Psychology is not actually to push out data storage and it's going to make data storytelling even more important. What are your comments on that Hadelin? What do you think as an Artificial Intelligence expert, what would you say about data storytelling?

Hadelin: I would say that it is really, really, really important. I would say that managing to leverage your story for whatever you want to do with Data Science is really, really efficient and helpful.

Hadelin: For example, when I started, the first steps with my story helped me reach the next step of the story. And then the next step of the story helped me reach the next step of the story. So each time I can see how ... We talked about connecting the dots, I can see how being really aware of my experience in Data Science, helped me to reach that next step in my story.

Hadelin: So I think that it was one of the top topics in the DataScienceGo and it also comes with what Ben Taylor

talked about building an AI Legacy for which having good storytelling can be very powerful also.

Kirill: That's cool to hear from ... You're a very technical person, you're in the space of Artificial Intelligence. Really cool to hear from you. People might be a bit concerned that like in the heavy, heavy AI, you don't really need that. In reality, you actually do. Some very, very powerful skill to have.

Kirill: Okay. So that's been seven trends and now we're going to move on to our eighth trend. And our eighth trend that we've identified is Natural Language Processing or NLP for short. So the NLP market size is estimated to grow from a \$7.63 billion which was in 2016 to 16.07 billion by 2021 which represents a compounded annual growth rate of 16.1%. The major forces driving the NLP market are increase in demand for enhanced customer experience, increase in usage of smart devices, number of emerging options in application areas, increased investment in healthcare industry, increased deployment of web and cloud based business applications and growth and machine to machine technology. This is from markets and markets.com.

Kirill: What are your thoughts on Natural Language Processing Hadelin? Do you think it's going to be a major trend? Why do you think it's going to be a major trend in 2019?

Hadelin: Yes definitely. It's going to be a major trend and the reason is because it is directly linked to big uptrend of Artificial Intelligence. And because AI is making so

much progress and actually now we consider that one of the branch of Artificial Intelligence is Deep NLP, when you combine Natural Language Processing to Deep Learning. And so right now companies like big tech companies are trying to build more and more sophisticated assistance, virtual assistance or Artificial Intelligence that contribute in your daily life, either your business or at your home. Well of course a central element of this assistant is an NLP. It is the system that's going to make the robot to talk with you on either a general task or specific task.

Hadelin: Actually there is a lot of research being developed right now. A lot of AI scientists are dedicating a lot of energy on to this researching about the new state-of-the-art models and Deep Learning for NLP. And these are the ones that are related to the sec to sec models, sequence to sequence models, the Lossless Triplet loss which is the latest I think, state-of-the-art model in deep NLP. And so, yes, the research is here. It is happening.

Hadelin: Of course this is to leverage all the opportunities regarding the chatbots, but also the opportunities and the diverse industries where NLP can be used as you mentioned, and [inaudible 01:45:46] the AI systems that we have, for example Alexa. Amazon Alexa has made [inaudible 01:45:52] NLP. And we can also talk about Okay Google. So this is happening. It's definitely one of the big trends in 2019.

Kirill: Yeah. It's really cool. I recently got my first Amazon Alexa [crosstalk 01:46:06], yeah, so interesting. So interesting to try it out.

- Kirill: Still not there. I thought it would be much, much smarter. It's still not there where I expected it to be. But that just means there's a lot of room for improvement in the coming year.
- Hadelin: Absolutely. Absolutely.
- Kirill: Okay. Awesome. So yeah, that was Natural Language Processing, and that was our eighth trend. So let's quickly recap on them.
- Kirill: First one was Hybrid AI models and the full world model and how that is going to really impact. That was our biggest prediction for 2019. Something we're most excited about and a course that we are releasing in a couple of hours that you can join us on to learn about Hybrid AI models.
- Kirill: Number two was data literacy on how organizations are more and more educating all their staff, all their personnel and creating what is called the citizen data scientists to help them become more data driven.
- Kirill: Number three was data moving to the cloud faster than ever and the cloud market growing to \$206 billion in 2019, which is 17.3% growth and why companies are going into that direction.
- Kirill: Number four was Internet of Things and how this is a massive market. Now it probably is very great to see it in comparison. It dwarfs everything else. Even the cloud market is only going to be \$206 billion, which is already a massive one. But the Internet of Things market is predicted to grow to \$1.2 trillion by 2022.

Something to keep in mind and something to get on top of asap.

Kirill: Number five was the rise of explainable AI, and the whole concept of a companies, organizations and even governments not really trusting Artificial Intelligence and what is going to happen there and is something actually gonna happen? We think something will happen in 2019. Keep your eyes open for explainable AI.

Kirill: Number six, Robotics Process Automation. A very interesting tool. Something that I have recommended to many data scientists. The market that will grow to \$3.11 billion by 2025. Reshaping how we do white collar work and replacing repetitive tasks, helping people free their time and focus on more meaningful things. Very interesting trend as well.

Kirill: Next one was number seven. Data storytelling as a new language of corporations. We are witnessing a rise in different visualization software from Tableau to Click to Power BI, to Python's Plotly and Seaborne to Shiny dashboard in R dashboards and Python. All of this is signaling to us that data storytelling is now more important than ever, especially with the rise of super powerful Artificial Intelligence tools and Machine Learning software. We need to be able to explain those insights, and those are the most successful data scientists, by the way. Those who can tell stories to the executives and the business decision makers. This trend will continue in our view and it's something to incorporate in your career regardless of your level.



- Kirill: Trend number eight, Natural Language Processing. So the NLP market is estimated to grow to \$16.07 billion by 2021. As you can see, all of the major players from Google to Microsoft to Apple, they're all jumping onto providing better customer service to their clients with Natural Language Processing. Something also to get good at because, that can be somewhere where your career will take you.
- Kirill: There we go, eight trends, man. Exciting Times.
- Hadelin: Exciting times and an exciting webinar as well. It was so good to talk about all this. I was actually saying on the chat that we're always happy to discuss our passion, but it's even more exciting when we are discussing it live with the rest of the world. So that was a truly great experience and such a good way to end the year.
- Kirill: For sure, for sure. And also, man, very excited for your course launch, for our course launch. But for the amount of work that you've been putting into it, I highly, highly recommend for everybody on the webinar to look out to your emails in the next three hours and 10 minutes to make sure you don't miss the opportunity to get the new Hybrid AI Model course with the super valuable bonuses.
- Hadelin: That's right that's right. I have never been that excited to work in Artificial Intelligence like that. And indeed the bonuses are super, super valuable. So huge.
- Kirill: Okay. Alright, our predictions all wrapped up. Thank you guys so much for being here. I hope you enjoyed this podcast. Once again, it's available on video

version. You can find it at superdatascience.com/223. There you'll also find all the show notes, all the materials that we mentioned or maybe used in the research for this episode. If you want to look into any of them, then head on over to superdatascience.com/223.

Kirill: By the way, if you're not connected on LinkedIn with Hadelin or me, then make sure to do that as well. You'll find the URLs on that same page.

Kirill: So hopefully you enjoyed our podcast and our accuracy rate for 2018 predictions. Let's see how it goes in 2019. Some very interesting, exciting topics and developments. Can't wait to take this journey in 2019 together with you. If you're interested in Hybrid AI Models, a good starting point is to check out the Hybrid AI course, which is also called the AI Masterclass. You can find the links in the show notes at superdatascience.com/223.

Kirill: Other than that, we'll be releasing plenty more exciting courses and updates in 2019. And, we both together, Hadelin and I, and the whole SuperDataScience team, we'll all look forward for you to be part of this journey and we want to make you as successful as possible in 2019. We want you to become the most successful version of yourself this year.

Kirill: On that note, thank you so much you guys for being here. Once again, Happy New Year and I look forward to seeing you throughout 2019. Until then, happy analyzing.