1:14

Alexey

**This week we'll talk about self-studying and continuous learning in machine learning and bioinformatics. We have a special guest today, Aaisha. Aaisha is a self-taught bioinformatician, machine learning engineer, and data scientist from Johannesburg, South Africa. She graduated from Machine Learning Zoomcamp that we have here in the DataTalks.Club and she studied Python and basic web development. She also maintains a blog on bioinformatics and machine learning topics. Beyond that, she is interested in many other things, such as photography and digital art. Maybe if you saw the picture we have for the cover today – there is this space mushroom, this is what we talked about – this is something Aaisha drew. Welcome to our interview today.**

2:04

Aaisha

Glad to be able to speak on the podcast and thank you for having me.

2:07

Alexey

**Yeah. The questions for today's interview were prepared by Johanna Bayer. Thanks, Johanna, as always, for your help. You're very helpful in preparing all these questions.**

# Aaisha’s background

2:17

Alexey

**Let's start. Before we go into our main topic of self-study and continuous learning in machine learning and bioinformatics, let's start with your background. Can you tell us about your career journey so far?**

2:30

Aaisha

My career journey, I would say, is just beginning still, considering I'm basically a student. I've been mostly doing my studies up to now. I started studying Python quite a few years ago. I don't remember how old I was – I think I was like 12, or something, or 11 maybe. I did introductory Python and then I did JavaScript and HTML and CSS – the standard, “I want to do coding, what do I do?” package. Then I discovered data science and bioinformatics and I was like, “Okay, this is a cool field to go into.” And I started studying that.

I was also studying biology and chemistry and the more science-y fields. Recently, I started going into more machine learning and actually focusing on trying to build my career in machine learning. So that is my goal now – to establish myself in machine learning and still be able to do my bioinformatics along with it. If there's some way I can merge these two different fields I've been doing. And then scientific illustration is something I want to pursue on the side, maybe as a second field or something like that.

3:45

Alexey

**Scientific illustration – what is that?**

3:47

Scientific illustration is… there are different types of scientific illustration. I'm not sure if you've seen things where they make infographics or animations explaining scientific concepts.

4:01

Alexey

**Like in the New York Times? Or the New York Times is different. Maybe they're not so much scientific, but I think I know what you mean.**

4:08

Aaisha

I've seen that there are scientific illustrations published in the New York Times as well. So that's one of them. Then it’s also just generally making art to explain science, basically. That’s how I describe it. It’s explaining science through art in a visually engaging, appealing manner for people who are maybe not so much into science. They just have a general interest in science. It’s dejargonifying science and explaining it in an easy, nice manner. That’s what I consider scientific illustration – or art as a whole.

4:41

Alexey

**I think we had a podcast episode maybe over a year ago or so. It was with Meor and we talked about visualizing machine learning. We spent most of the time of that interview discussing how exactly Meor comes to his visualizations – how he goes from a concept to an illustration and what the process is. Probably it's related, right?**

5:09

Aaisha

Yeah, it's a similar thing.

5:11

Alexey

**Okay. You said you started studying Python 12 years ago or so – quite some time ago. [cross-talk]**

5:21

Aaisha

No, it wasn't that long ago. I was 12 myself. I was 12 years old.

5:26

Alexey

**Ah. 12 months ago, not 12 years?**

5:29

Aaisha

No, it wasn't 12 months ago – I was 12 years old when I started studying Python. It was five or six years ago.

# How homeschooling affects self-study

5:37

Alexey

**I see. What I'm trying to ask is, you're not taking these classes as any part of a formal education, right?. You're just going on the internet, finding things there to study and you just study them, right? Or how does it work? How do you learn all these things?**

5:58

Aaisha

I wouldn't say I just go on the internet and just start studying things. I try not to be randomly pursuing everything I find interesting. [cross-talk]

6:08

Alexey

**But it’s formal education, right? It's self-study. You’re not doing this at university.**

6:11

Aaisha

Yeah, it’s self-study. I've been homeschooled, so technically I haven't gone through any formal education. I went to school. I've not gone to uni. Technically, if I was going to school, I would be going to uni now. I'm not going to uni. I've not been to any school. Everything I know, either my mom used to teach me before that or self-study. So I’m either homeschooled or self-taught.

6:37

Alexey

**Interesting. I don't think I’ve ever spoken to anyone who was homeschooled. How did it feel?**

6:45

Aaisha

That's such a difficult question to answer. I don't know what it would feel like going to school because I've literally never gone to school. [chuckles]

6:56

Alexey

**But it would be your mother just teaching you some stuff and then eventually, maybe it was just you studying things?**

7:03

Aaisha

Yeah. Obviously, when I was a kid there were my parents who would teach. We'd study whatever. We never followed a curriculum or anything. At that point, that's why I started studying programming or scientific stuff much earlier than I think I would have gotten in school. I found it interesting, so my mum would gather resources and let me learn it and teach me or whatever. After that, once I was old enough, I just started studying by myself online with online resources and stuff.

7:39

Alexey

**Interesting. Well, when my kid is sick, we need to do some homeschooling too. I just don't have the patience to actually sit with him and explain all this stuff. So your parents must be very patient people.**

7:53

Aaisha

Yes. [chuckles] My parents put up with a lot of stuff.

7:58

Alexey

**Well, I guess you have more flexibility this way. So if you want to travel, you just go and travel. Right?**

8:04

Aaisha

Yeah. Even not just traveling, but just in what I'm studying. There's so much more flexibility than in school where you're studying one thing and you can't study everything you want because you have to follow the school system. This way I can study things – I can pick and choose what I want to study. If there's something I already know, then I don't have to go through it again like I would have to in a school curriculum.

# Deciding on what to learn about

8:33

Alexey

**What I wanted to ask you next was what motivated you to take this approach. I guess you kind of answered that already because you have been doing self-studying since forever – since school days. [Aaisha agrees] So maybe what is interesting is – how do you decide to learn? There are so many things on the internet. You open any data science subreddit or any data science community and then you're immediately bombarded with all these links and all these new things. Then you’re like “Okay, I have to study all that. And if I don't have this I fear of missing out.” So how do you approach this systematically? How do you not go crazy when you need to do this? [cross-talk]**

9:21

Aaisha

As a general topic – let’s say I want to study bioinformatics or whatever – I think I started following it out of interest a bit more, because I always wanted to do this cool scientific research and stuff. But it hasn't always been possible to pursue that path. Then I discovered that there's something more realistic within my reach that I can do with tech stuff online and with the resources I have available. I still get to do the quiz science-y stuff, but it's practical because I can do it. That is how I began studying it.

In regards to finding resources, maybe I did waste a bit too much time doing introductory Python courses. [chuckles] Because I was like, “Okay, well I did this course and I did that course,” and I faffed around for a while. But then, I think I've just gotten good at finding the “good” resources. You get the hang of it after doing it for a while – finding out that these are the best resources. It also helped that I had a sort of guideline in my mind of what I need to know. I need to know this much of biology or chemistry or whatever and my Python skills need to be at this level.

For bioinformatics, specifically, I found this really cool pathway made by the Open Source Society University, where they make these tracks and stuff. So I followed that. I think, generally, filtering out information is a skill [audio cuts out].

12:33

Alexey

**You were talking about different tracks. There are some open curricula online and you found some tracks for bioinformatics and this is what you studied.**

12:48

Aaisha

Yeah. I was saying that, in general, for finding resources, I think studying a lot of them online helps with that. You can start curating the resources that you find and know, “Okay, this covers this skill set. Maybe this is not what I need right now. It might be cool, but maybe I can do it at some later point and not now.” You can also find communities where people have gathered resources, “Okay, to achieve this certain skill set, this is what you need to learn.” And then you can either follow those specific resources, or you can find alternative resources.

But I think majorly what has helped is having an idea in my mind of what skills I need. If I want to pursue machine learning, I need a basic introductory look at machine learning. That's why I did the Zoomcamp in the first place. I was like, “Okay, this seems like a good resource to get my basics down.” Then once I know a bit more about the field, then I can decide, “Okay, what skills do I need to develop further?”

# Establishing whether a resource is good

13:49

Alexey

**I have so many questions based on what you just said. There are so many interesting directions. First of all, you said that you developed a feeling – when you look at the resource, you know that it's good. I wonder – how does it work? How do you know? Let's say you look at a Zoomcamp – of course, the Zoomcamp is maybe not a very good example. [chuckles] Let's not take Zoomcamp. Let’s say you take a resource. How do you know if it's good? How do you understand that?**

14:22

Aaisha

There are a few things I look at. The first one I do is skim the syllabus or whatever and then see if the content that they're teaching is something that I need right now – if it's applicable to me right now. Obviously, there's so much good stuff that I want to learn and I'm like, “Okay, maybe knowing exactly how stars explode in space is not something I need to know right now.” Obviously, that's something I just throw out the window then and there. But then say I pick up a course on machine learning and I see that “Okay, the syllabus is good. It's teaching me how to use a framework that I need to know right now.” Then I watch the introductory videos and see that “Okay, does it feel like this course is offering quality? Does it look like something that is being taught in a good way? Does it look like the people know what they're talking about? Or am I gonna get ripped off here?” That kind of thing – just gauging the general quality of it.

If you were to pick up a book and you flip a few pages around, read a bit, and you'd see, “Okay, does this look like something that is quality? Or does it look like somebody just wrote a bunch of stuff that they don't know what they're talking about and published it.” Because obviously, on the internet, it's like that YouTube stereotype where there are people on YouTube who don't know what they're talking about. But there are so many good resources on YouTube as well. You can get an idea for how much the person knows what they're talking about, how beneficial it might be, if you skim through it a bit and just pick out bits and pieces and listen to them or whatever. Then you can decide that “Okay, up to now, this looks like something that's good.” And then you can commit to studying it and then see how it is.

16:02

Alexey

**You mainly look at free resources? Or do you also consider paid courses?**

16:07

Aaisha

I try to go for free where possible, obviously, because it's more affordable. But if it’s good resources, I'm not averse to investing in it. If this is something that will benefit me or my career down the line, then it's a worthwhile investment. But I will make sure that if I'm invested in something, then it is quality and it is worth it. I will try to avoid investing in something that I can learn with free resources, even if it's a harder study or whatever.

16:39

Alexey

**Skimming a paid course might be more difficult, right? Because you don't have access to the course, usually. Maybe some parts, but you don't usually get the access to the course to know if it's good or not. So you cannot really check it out in advance.**

16:54

Aaisha

For a paid resource, I'd go more like, “Okay, who's the author that published it? Is there any free content that they've put out?” Somewhere where I can get a general idea for their sort of content elsewhere – aside from this one paid course. You can get a general profiling of who is teaching the course before you pay for it – see if it's credible or not, see their credentials, what work they've done, that kind of thing.

Deciding whether a recourse is relevant to what you want to learn

17:21

Alexey

**It’s funny that you mentioned information about how stars explode, because this is what I was just reading the other day. That's pretty cool stuff and it's quite interesting. But maybe, like in this example, if you study machine learning, then obviously astronomy is not super relevant to that. At least most of astronomy. This is kind of a no-brainer. If you want to learn about linear regression, you know that how stars explode is not…**

17:49

Aaisha

[chuckles] It’s not going to help you.

17:51

Alexey

**Yeah. But when it comes to machine learning, there are many things. For example, when I was studying machine learning, I thought that support vector machines are super important to understand. Also because I was taking a machine learning class at the University and at that university, the teacher was doing a lot of research on support vector machines. I thought that it's very important to really understand these things well.**

**But when I started working, I understood that nobody really cares about them – support vector machines are not really useful anymore. So how do you understand that? How do you understand these things? Okay, astronomy is not relevant, but when it comes to machine learning, there are some topics that are perhaps more relevant, some are less relevant. So how do you understand which direction to go?**

18:37

Aaisha

This is just something you do and then realize, “Okay, it wasn't that needed.” I spent a lot of time doing a data science course that had a lot of data visualization, and also data cleaning and everything. At that point, I was like, “Okay, maybe this is not the direction I want to go in.” It's not that important. I was doing it for machine learning or data science more. Seeing how the data is cleaned is maybe good knowledge to have, but maybe not as relevant as what I wanted to do then. I did it and maybe it will come in handy later, but at the time it was not what I was looking for. I think that's just something you have to figure out, that this was not as relevant, after the fact that you studied it. Because there's no way you know that without studying it.

19:25

Alexey

**There’s no silver bullet. Okay. I thought maybe you would just tell me “Okay, do that and that. Then you know what is relevant.”**

19:32

Aaisha

[chuckles] No. Unless I maybe somebody can figure out some spells. Then please share with me. [chuckles]

19:37

Alexey

**Well, I guess in this case, the community is helpful. You can always ask people who went through it.**

19:44

Aaisha

I think to some degree, maybe you can get an idea by doing your own research or finding people more in the field and if they have done interviews or question/answers, you could ask them. Communities could be helpful. But I think to some degree, it's unavoidable that you end up studying something and you're like, “Okay, maybe it wasn't that important.” At least in my experience.

20:12

Alexey

**Sorry, I interrupted. I just wanted to say that while doing my Master's, and also my Bachelor’s, I also studied a lot of stuff that is not relevant. Maybe if I was doing self-study instead, then things would have been different, right? Maybe I would have actually spent more time on studying things that are relevant, not because of what the teachers thought.**

20:38

Aaisha

There was somebody who mentioned that they were studying computer science and they said that for the first two years of the curriculum, they didn't touch computer science at all. They must learn English, math and chemistry. It's funny how the school system works. Why must you study chemistry in your university when you're majoring in computer science? That's one thing to have basic knowledge of.

And it's one thing that you're studying in university when you're trying to study computer science. Whereas you could just focus on computer science and learn whatever is necessary and if there are any gaps in your knowledge, you can also go back and study it later. It's not like if you didn't study chemistry in your first year, but then you need it in your fourth year, it's the end of the world.

21:21

Alexey

**Yeah, indeed. Well, I did not have that when I was studying computer science. Well, we had chemistry later. [cross-talk]**

21:29

Aaisha

It also depends on where you're studying. I'm just giving an example.

21:33

Alexey

**We did have chemistry, but later, in the third grade. It was clear why we did. I mean, I had fun, I like chemistry. It was cool. At university, I also kind of enjoyed it, but it's not something I really needed to know apart from having pleasure from studying this, and not the obligation. Yeah, but we did spend a lot of time studying math. While it was fun – I enjoyed solving all these equations of these things – again, at my work as a data scientist, most of these things aren’t really needed.**

22:11

Aaisha

It's one thing to have to study something because you find it interesting, or if you want to go into a research field or something so you study it. But I think in a day-to-day application, you're hardly going to need a lot of this kind of stuff. And if you need it, again, say you’re pursuing a career path and you're like, “Okay, this is needed,” you can study it then, instead of wasting all of your time studying it when you could be building up a main skill instead.

# How Aaisha focuses on learning

22:42

Alexey

**How do you approach this? How do you approach learning? Do you focus on building projects? Do you focus on learning theory first? How does it work for you in general?**

22:55

Aaisha

I think a balance of both is needed. Obviously, without building projects, there's always that aspect to just theory, which is lacking. You could know something very well in theory, but in practice, your knowledge will end up falling short and you run into issues, which you wouldn't have in knowing how to solve with just a theory. But I also think learning new things in theory is important, like building new skills, or advancing your skill set, especially in something like tech if you build more projects in a particular field. But then you're not learning new skills. At some point, you're gonna be like, “Okay, these skills that I have are outdated. And I spent all my time building a bunch of projects with a skill that's now falling out of the market.”

I like learning more about building projects, but I also like reading and stuff. I'll just read a bunch about things and then I'll go and build a project. Then I'm like, “Okay, I did half of the things I learned weren't needed. And half of the things I needed to build the project I didn't know.” Then you hit Google. [chuckles] So I think a balance of both is a good way to go, so you’re covered on both fronts.

24:09

Alexey

**Yeah, I'm a big fan of the projects approach. I think I neglect theory, which is maybe not the ideal case. It should be both, like you said.**

24:21

Aaisha

To some degree, projects are always a bit more interesting because you've got problem solving or whatever. So I think that projects have a bigger appeal at some point.

# Deciding on what kind of project to build

24:30

Alexey

**I was wondering, how do you decide what to build? If you want to build a project, there is probably a skill that you want to master. How do you decide that, “To master this skill, I want to build this project that should do this, this, and that.” How does it work for you?**

24:50

Aaisha

I don't know. I just think of ideas first and I'm like, “Okay, this would be a good way to use these skills.” I like just surfing on the internet – and finding data and stuff, I like just finding good data. Then I think, “Okay, what can I do with this data? I want to use this data because the data is interesting. Okay, I want to get better at Pandas. I could use this data to build something with this framework. Let's just do it.” There isn't a lot of reasoning behind my projects sometimes beyond “It's cool. Let's do it.” [chuckles] I like going on those dataset searches and just typing keywords that I am interested in and then just seeing what comes up and picking random stuff that is cool.

25:41

Alexey

**Let's say, if you're interested in astronomy and exploding stars, you can go to Kaggle or whatever dataset website and then you can just look for astronomy. Then you think, “Okay, there is an interesting dataset. Let's see what I can do with it.”**

25:55

Aaisha

Yeah. Another way of finding cool data is – people publish research papers on random stuff, outside doing stuff, and for a lot of them, they publish the data with it. It's not clean data a lot of the time, because it is not meant to be used for data stuff. But if you clean up the data, it's a cool way of finding data that's linked to a study or something. Then you can see, “Oh, what else can be done with this data? Can I make something cool using this data in a different way?” I like just going to studies and reading them because I like reading scientific papers just for the fun of it. [chuckles] Sometimes I bookmark the studies that are cool and then just see what I can do with the data in my free time.

# Find research materials

26:43

Alexey

**How do you find these papers that you want to read?**

26:47

Aaisha

Mostly, if I just have some sort of question, for example I spent a lot of time reading about horse color genetics. I was like, “Okay, if the horses have this color, then how do their color genetics work? Then how does human pigmentation work?” And I just fall into a Google rabbit hole and I find cool research papers about it.

27:15

Alexey

**I don't typically do this every day, but I remember when I was preparing for my Master’s thesis (when I was writing it) of course, I needed to do some research to understand what was done before my work and what I can base my work on. I found Google Scholar very useful. Do you use it?**

27:41

Aaisha

Yeah, I use Google Scholar. But often I just go on the main Google and I just search “research article” or “article” as the keywords. You can get things like PubMed nature articles. There are quite a few. I forget the names now, but there are quite a few free publications that allow you to read the entire thing without paying for it. It's good for when I'm just sitting free. I just end up spending hours on Google wasting my time reading absolutely random stuff. But sometimes the data that comes from it is useful.

28:21

Alexey

**I remember that one of the most useful features of Google Scholar was the citation graph. You know which impactful papers a particular paper cites, so that you can kind of go back in time and see the different papers. [cross-talk]**

28:34

Aaisha

You can also see which papers cited this paper.

# Aaisha’s experience with the Data Talks Club ML Zoomcamp

28:38

Alexey

**Yeah, exactly. Then you have both directions – you can go to the past and see what was done before and then what kind of work was based on this paper? [Aaisha agrees] I also remember spending a lot of time on that. But I kind of had to do this because one of the chapters in my thesis was on state of the art research. That was a part of the thesis. But I can understand how fun it could be when you have a topic that you're interested in – to just explore it.**

**I'm really curious now to talk about your experience with our course Machine Learning Zoomcamp. How did you find it? Why did it attract you? Why did you decide that this is actually a good course?**

29:33

Aaisha

Mostly because it was fast. It was like four months. It's brief. And I get bored, so I didn't want to do something that was very long. I was like, “Okay, four months. It's fine. I can do it.” Also, it mentioned three… [cross-talk]

29:47

Alexey

**[chuckles] Four months is a lot of time. Many things can happen for months.**

29:50

Aaisha

Yeah, but it's not a huge long thing. You don’t have to study for one year to get a degree. I'm already studying bioinformatics, which has been going on for like three or four years. I wanted something that doesn’t go on for that long. It's something that, “Okay, just be quick about it. Don't spend years.” I thought it was a good way to break into machine learning. It's gonna offer me a good comprehensive look at the different aspects of it. I got this from reading your syllabus and everything.

I also saw that there were three projects mentioned and weekly small projects, so I thought maybe it was more project-oriented so that'll be fun. I didn't want to do too much theory. Mainly the things were that it's not that long and has projects. I was like, “Okay, let's give this a try. It should be interesting.”

30:38

Alexey

**Do you remember where you found it? On Reddit or on social media somewhere?**

30:43

Aaisha

First my mum mentioned it to me. I'm not sure where she found it. I think she follows the newsletter or something. After that I saw it on LinkedIn, so I was like, “Okay, I'm gonna check this out.”

30:59

Alexey

**Is your mom listening to us talking right now?**

31:01

Aaisha

I'm not sure. [chuckles] She might be.

# ML Zoomcamp projects

31:05

Alexey

**Okay. [chuckles] Well tell her “Hi.” Anyway, we were talking about projects, right? Since you mentioned it, this is what I wanted to talk to you about. In the Zoomcamp, we have these three projects. I wanted to talk to you and understand how exactly you approached them. What was your approach when it came to selecting projects? How did you decide what to do there? Was the dataset also your first approach? Or how did you go about that?**

31:35

Aaisha

Yeah, I've chosen the dataset first approach. The first capstone project that I was doing – the Kaggle competition for the kitchenware thing, I ran out of time to build a separate one for the capstone. So I used the same project in both places. But the first project I did (the midterm) was about predicting the toxicity of frogs based on their color. Initially, I was going to make something – I wanted to find something cool, because I didn't want to do the economic, political, property and price data, because those are boring. I don't want to do it.

I don't remember where I went – either it was a Google dataset search or some other website. I just searched for “poison” or something like that. I initially wanted to do “the most toxic poisons” or something like that. But then I found this one, where they did an entire study about how a species of frogs’ color indicates its toxicity – its brightness and everything. So I was like, “Okay. Well, what if I make a model that can, if you input the data, predict the species of the frog instead and its toxicity.” So that's what I built.

I built a model that takes the values – the values had to be given in an accurate form that the study measured them in, so it wasn't practical, probably – but then I would just predict how toxic that frog species would be. I just went on the dataset search in Google. I think the next one I did was landscape recognition. For that I also went on Kaggle. For that one, I wanted to do something with image recognition, so I just went on Kaggle and I opened the image recognition datasets. I saw a landscape classifier there. I didn't have too much time that time around, so I just picked an easier one and went for the landscape classifier.

33:33

Alexey

**Well, this one about frog toxicity is really interesting. I guess this is one of the things that were interesting for you back then and you decided to find something about that?**

33:42

Aaisha

Yeah, I actually wasn't even looking for anything to do with frogs. I was looking for something to do with poison. I'd been reading on poison recently and was like, “Okay, this is good. Let's do something poisonous.” I saw the frog one and did my research – I read the research papers and read about that species of frog and I was like, “Okay, this is way cooler. We're doing this.” [chuckles]

34:02

Alexey

**I kind of want to ask you more about – how did you even come across this poison topic? Because a part of self-study, I guess… you said you spend a lot of time just doing random stuff on the internet, reading things. So I'm really curious how exactly it happened. Did you even realize that now you're all of a sudden interested in poisons?**

34:29

Aaisha

No, I honestly didn't. I keep finding random things that are interesting and I just spend a lot of time Googling them until I'm bored with them and I don't ever think about them again. Poison was one of those things that I found interesting and read about. But it's not a lasting interest. [chuckles]

34:46

Alexey

**I see. Do you somehow structure all these things – all these topics? Poison, like you said, horse genetics, and all the other things? Or do you just keep everything in your mind? How does it work for you?**

35:04

Aaisha

Yeah. These are mostly just like, “I'm free. I have free time, so I just do random stuff.” But none of these are structured. It’s just like “Okay, whatever. It’s interesting at the moment. I'm not gonna read about it.” If I have free time or if I push my time around, then I'll just squeeze them in anywhere I can. But it's not something I dedicate time to reading about or anything. They are very unstructured.

35:27

Alexey

**Okay. So you wake up, eat your breakfast and then you have some free time. “Okay, what am I going to read about today? Let's think about frog poison.”**

35:38

Aaisha

[chuckles] It's more like, “I've been thinking about this for the past week.” I'm still reading about it and I'm like, “Okay. Well, next topic. I'm bored of frogs.” [chuckles]

# Aaisha’s interest in bioinformatics

35:47

Alexey

**“Now, let's read about horse genetics.” Right. [Aaisha chuckles and agrees] Is it related to your interest in bioinformatics in any way?**

35:56

Aaisha

Bioinformatics is more born from my general… At that time I was very much obsessed with being a researcher. I wanted to do it at any rate. I don't want to be one anymore. But at that point, I was like, “Biology and chemistry research is all I ever want to do in life.” Then, obviously, that was not possible at the time because I didn't have the resources available to pursue that. And that's probably a good thing, because now I'm not so sure if I want to do that.

At that time, I was like, “Okay. What else can I do that is related to this?” I discovered that bioinformatics is an entire field, which is the closest I can come to combining what I can do and what at the time I really wanted to do. This was a nice mesh of my obsession at the time and what I could actually do. Then I was like, “Okay. Well, I really want to do this long term.” Bioinformatics was one of the things that just kind of stuck around – one of these obsessions that just stuck around. [chuckles]

# Keeping motivated with deadlines

36:55

Alexey

**I'm really curious about… for example, you said you wanted to do research and that you studied but then you realized you don't want to do research. How do you stay motivated when learning by yourself? Because I imagine – for me, at least, I quite often need an external push coming from somewhere when I'm not motivated to actually keep learning. If I don't do this, then I just don’t do anything. So how do you keep yourself motivated when you learn by yourself when you don't have this external push? All your motivation is coming from you. How do you do this?**

37:41

Aaisha

Honestly, I'm not really sure. I think I work better when there's a deadline. When I'm demotivated, I just set up something like, “Okay, I have to finish this at this point.”

37:55

Alexey

**You set the deadlines yourself?**

37:567

Aaisha

I set the deadlines myself, yeah. I think, to some degree, being homeschooled might have helped with this. I've never had much of an external factor to keep me going. It’s been like, “Okay. Well, you have to do this at some point, so just pick a date and that date cannot move.” Even if I have to stay up to 2 AM, I have to finish it because of the deadline.

I just set my deadlines and then I try to plan them as best I can. Honestly, even if something very big comes up, the deadlines do not move. If I've been lazy one week, I can't say, “Okay, I'll push the deadline one week because I didn't do anything.” I'll just have to do it then. So I think that the “Oh, goodness, the deadline is almost here,” is my motivation. [laughs]

38:40

Alexey

**That requires a lot of discipline if you set the deadlines yourself. [Aaisha agrees] That's really cool. When you have a deadline and you know, “Okay, I have to do this.” But then this deadline is not real, kind of. I'm still trying to understand. It probably wouldn't work for me. Maybe, I don't know. [chuckles]**

39:08

Aaisha

I don't know. I think at some point, I’ll write my deadlines and I have a sticker on my computer (a digital one, obviously) and I just write in big bold letters to the point where it annoys me. And I cannot remove it until I finish it. It's mostly just bullying my brain into like, “Okay, you just have to do this now. Stop being lazy.” I don't think I'm very organized with my time. I should be better at it. Sometimes I will waste an entire week doing nothing much. But I'm like, “Okay. Well, let's not mess up this one deadline. Let's just stop messing around and do the work.” I think there are ups and downs. I won't say I'm the most organized or the most self-disciplined person but it works for me. So it's fine. I get the work done eventually. [chuckles] It also helps that I switch between lots of different things. If I'm bored of one thing and I'm sick of doing it, then I can just switch to the next thing. I run things in parallel. Therefore, I have an escape like “Okay, I’m sick of doing data science. Let's go illustrate something instead.”

40:17

Alexey

**I see. Yeah, that's cool. The mushroom is really cool. I wanted to ask about the Zoomcamp. In the Machine Learning Zoomcamp, we had some deadlines. I guess it was helpful for you, right? The deadlines were external. At least for me, that would be much, much more helpful than the deadlines I would set for myself.**

40:53

Aaisha

Yeah, the deadlines were helpful. At some point, I was ignoring the midterm project because I didn't want to do it. I was bored and I was studying other stuff. I only began in the second week. So I thought “I should do this now because I'm running out of time.” And I did run out of time because I got stuck. And then I finished it. I think I submitted it the Sunday before. I got up early on Sunday and was working the entire Sunday. I was like, “Okay, maybe I shouldn't have ignored this for all of the first week.” But having a deadline, it was like, “Okay, I gotta get this done.” I might have skipped it otherwise. But I wanted to stay on the leaderboard. I couldn’t skip this project. [chuckles]

41:36

Alexey

**Then while you were procrastinating – by procrastinating I mean taking some time off from the course…**

41:42

Aaisha

You can call procrastination, it's fine. [laughs]

41:48

Alexey

**So while you were procrastinating, you were thinking about the toxicity of poison frogs?**

41:50

Aaisha

No, I think I was making scientific illustrations or something. I can't remember. I was convincing my brain that this is productive too – just the wrong kind of productivity. [laughs]

# Notes and time-tracking tools

42:02

Alexey

**In general, how do you…? Well, you said that you use sticky notes to “bully your brain into doing stuff” as you said. [Aaisha chuckles] When it comes to actually studying, taking notes, and keeping your projects organized, do you have any system for that? Time tracking tools, goal setting tools?**

42:27

Aaisha

No. I don't take notes because I forget to read them and I forget to pay attention if I'm making notes. I know notes are something that will help me. If I do forget things, I just rewatch it or google it instead, because notes have never worked for me. As far as time tracking tools and stuff go – No, I don't use them. It’s just like, “Okay, I have a deadline.” But before the deadline, I just mess around and do whatever.

As long as the work gets done by the deadline, I don't care what my daily schedule looks like. Some days, I will do a bunch of stuff in the day and then some days, I will just do one thing in the day – focus on one thing. Whatever my mood is for that day, that’s what I end up doing. But I don't really use any structural tools or anything.

43:13

Alexey

**It's interesting that you mentioned that about notes, because for me, notes are the only thing that actually works if I want to retain any information. It's funny how everyone is different, right?**

43:24

Aaisha

Yeah. I tried taking notes because everyone says “Notes are your key to success. If you don't take notes, you never learn properly.” So I was like, “Okay. Well, I gotta take notes now.” And I couldn't. I would forget to pay attention to what I'm listening to. I end up listening to the entire lecture and I haven’t actually heard a word of it. I will forget to take them anyway. I wouldn't ever read my notes. I would forget what the notes mean. So notes just never worked for me.

# Drawbacks to self-studying

43:50

Alexey

**Are there any drawbacks to self-studying? Let's say we compare the Zoomcamp, where deadlines are external – they are forced on to you – versus self-studying, when you find material online and you learn it at your own pace. What are some of the drawbacks to this approach, when it's completely self-studying – completely based on your own motivation and discipline?**

44:20

Aaisha

I think one of the drawbacks could be the same motivation/discipline thing. It's easier to not fulfill deadlines when you are the one setting them and nobody else is responsible for them. Also, I think it can be a bit harder to make sure you are learning the correct things on your own. You could end up wasting time or resources studying something where down the line, you think, “Okay, I shouldn't have done that.” Whereas if you're following a course or a system somebody else made, you're like, “Okay, these are people in the industry. Obviously, they know what is more beneficial to study at a given time.” They have the resources compiled in a way that is obviously a lot easier, and maybe to some degree more efficient.

There's a higher chance of making a mistake when you're doing it yourself, because before you study, you don't know anything about that thing. Then afterwards, you can be like, “Okay, hindsight is 20/20. I shouldn't have done that.” At this point, because I am doing all the self-study, I think its benefits outweigh the cons. The freedom you get and it works a lot better for me personally. But obviously, it may not be for everybody. There are things that are maybe better when following a structured study program.

45:40

Alexey

**Do you find study groups helpful for you? Or do you prefer doing things yourself?**

45:46

Aaisha

I prefer doing things myself. I don't like study groups. I'm not very much a social person. I don't like doing things with others. [chuckles] I'm fine on my own. But I know for others it is vastly helpful. Lots of people have said that study groups give them motivation and stuff to self-study. I think for people that are of that personality, it would be very helpful for them, maybe. But personally, I don't like them.

46:11

Alexey

**Maybe another thing that study groups help with is the deadlines. As a group, you set up the deadlines, and then you work through a course even if these courses are self-paced. Then you’re working in a small cohort, sort of.**

46:29

Aaisha

I've never seen any appeal in that myself. Because that's just not how I like to study. But I assume for people who like the social part, that'd be a lot more motivating with multiple people doing it.

# Aaisha’s interest in machine learning

46:44

Alexey

**I think at the beginning, you said that one of the goals you have is to break into machine learning. [Aaisha agrees] Having this goal, does it help you to actually focus on studying and selecting which kind of material you want to focus on and things like that?**

47:00

Aaisha

Yeah, definitely. Now I'm reading more about machine learning. I'm trying to learn more about how the industry works. I'm trying to find out what types of opportunities are open in machine learning, because now I'm serious about wanting to do machine learning. Whereas previously, at most, I had a passing interest in machine learning, like, “Okay, it's cool but I don't know if I'm doing it or not.” I now paid much more attention to it, like,” Okay, I need to seriously do this. I should find resources. I should try and make connections in the machine learning world. I must try and get my name out there.”

# Aaisha’s least favorable part of ML Zoomcamp

48:05

Alexey

**[gets distracted] In the Zoomcamp, there were two parts – there was the data science part, which was more focused on machine learning theory, and then there was a more practical machine learning engineering part. Which one did you like more?**

48:30

Aaisha

I don't know. I kind of like both. I didn't have any particular preference either way. I didn’t much like the MLOps cloud part, with Kubernetes and Docker because I don't like it as much. I don't want to focus on the MLOps part. Obviously, I know it's necessary if you're going into this role, but I prefer working with code without any worry of how to get it running in deployment. The way it was handled in the Zoomcamp, I actually thought was a lot more difficult from what I had seen briefly out of the Zoomcamp. I thought that maybe it’s not so bad after I'd done it. But especially before we reached those modules, I was like, “Oh, goodness, we have to do Docker.” Because I was very much daunted by the fact that Docker is this huge thing. I thought “Okay, it's not so bad. It's fine. I can do this.” But I think those are probably my least favorite segments, especially the Kubernetes.

# Helping people as a way to learn

49:29

Alexey

**Do you have any tips for anyone who wants to start ML Zoomcamp as a student now, for example, in the self-paced mode?**

49:38

Aaisha

Yips? I don't know. Use the.. [cross-talk]

49:43

Alexey

**Apart from just studying it. [chuckles]**

49:46

Aaisha

I don't know. I’ve never really thought that much about doing it. I was just like, “Okay, I'm doing this.” I did find the Slack community really helpful. Using the Slack community not just for asking questions – because to be honest, I didn't use it as much as I preferred Googling instead of asking on Slack – but even just reading it. If anybody is stuck, help them. Because in trying to help them, you realize that, “Okay, I never understood this as well as I thought I did.” If you're helping them with things, you can further your own understanding. I think that was the one thing maybe I could give as a tip.

50:27

Alexey

**That's a good tip. I think, at least for me, teaching is the best way of learning something. When I can explain a concept, then I am fairly confident that I probably understand it, more or less.**

50:40

Aaisha

Yeah, because explaining in a way that somebody else understands is so much harder. I don't like going into Slack communities and interacting with people, because I don't like doing that. But I tried to make a point of doing it in this Zoomcamp. Grudgingly I must say that it did help me understand this better when I had to explain it and help other people do it.

# Using ChatGPT as a “study group”

51:02

Alexey

**I don't know if you use it – maybe you're tired of hearing about it – but I want to say something about ChatGPT. What I also find useful is just talking to the Chatbot about a topic – just asking it questions and then making sure I understand it. That was very helpful. I guess for you, you said you don't really like study groups. But it's like having a peer.**

51:30

Aaisha

A fake study group. [chuckles]

51:33

Alexey

**Yeah, a fake study group. Exactly.**

51:35

Aaisha

I never really thought about using ChatGPT in that way before. That's interesting.

51:39

Alexey

**Do you use it at all?**

51:42

Aaisha

I have messed around with it a few times, but not actually used it. I still go to Google first and never thought that I should ask ChatGPT.

# Is it possible to use self-studying to learn high-level topics

51:54

Alexey

**Interesting. I think we have a few questions. One question is, “How can we learn about advanced topics, like PhD-level courses?”**

52:07

Aaisha

Yeah, that could be hard. I don't know. I'm not sure how advanced you could go. There are lots of postgraduate resources available online as well. You might have to pay for them. It’s probably more paid than free – there might not be as much for your sources. But I think you could go a bit with paid resources and reading research articles. I definitely think it is possible, but maybe harder than doing undergrad stuff. Because there's a lot of resources for undergrad and maybe not that many for PhD or whatever.

52:42

Alexey

**Because I guess there is more demand for beginner-level stuff.**

52:47

Aaisha

Yeah. I don't know if many people who are doing online self-study pursue that high level of study or not. But I think it is possible. I don't think it is impossible. It might just be harder to study that kind of stuff on your own.

53:04

Alexey

**Also, doing PhD by yourself is probably difficult in the sense that you probably need an institution that helps you with research, that helps with connections, that helps you with access to labs or whatever.**

53:21

Aaisha

I don't even think it's possible to get a PhD entirely by yourself. But I've never really researched officially getting a PhD if you've not gone to uni or school before. I'm not sure how that would work.

53:38

Alexey

**I’m sure you can publish a paper without being a part of an institution.**

53:39

Aaisha

Yeah. I think you could get to that knowledge level on your own.

53:47

Alexey

**Also, if you spend time doing this, you need to live on something – you need to eat. Usually the university pays money. If you don't get the income you spend like six years doing research, it can be tricky.**

54:07

Aaisha

That's the practicalities of it.

54:11

Alexey

**But the main resource here is papers, right? There are not so many other resources that you can use. There is no Zoomcamp about some PhD level topic.**

54:21

Aaisha

Yeah, I don't think so. I think papers must be the major source. You can get a subscription to libraries or something, where they have more in-depth stuff. I'm not sure how that would work because it’s not something I've heavily researched myself. I've never been interested in getting a PhD.

54:41

Alexey

**By libraries you mean electronic libraries from Springer or Nature or?**

54:47

Aaisha

Yeah, something like a publication that can get you access to a lot more of the higher-level stuff.

54:54

Alexey

**Like IEEE, ACM – these kinds of organizations, I guess.**

54:58

Aaisha

Yeah. I'm assuming being in a uni would give you access to this. Often, if you have a uni email address, you can log in. I'm assuming that is the kind of stuff the uni already gives you access to.

55:10

Alexey

**I remember having access to all these major things. I didn't have to pay for written articles. It's another topic for discussion, right? Why do you need to pay 50 euros for a three-page, four-page scientific article? Also, it’s funny that researchers who publish articles need to pay to publish articles. This is wrong on so many levels.**

55:35

Aaisha

Yeah. I’m in a lot of scientific communities on Twitter and more than half of them are always complaining about how hard it is to just get research published. You’d think that scientific institutions would be more welcoming. It's new research. It's gonna teach more about the world. But you also need to jump like 5 billion hoops and pay an arm and a leg just to get your research out there. It seems like a very counterintuitive process.

56:02

Alexey

**That's why I like this archive, where all the prints are just there. But then again, you have to do a lot of filtering yourself. You don't know if the paper from an archive is good or not.**

56:14

Aaisha

I assume that is where some of the journal’s money goes – you get curated resources. There's a lot less chance of bad publications coming in those.

# Switching topics to avoid burnout

56:26

Alexey

**Another question is related to burnout. I don't know if you ever had to deal with anything like that – when you cannot just study anything and all you want to do is watch YouTube videos with cats. Did it ever happen to you?**

56:42

Aaisha

I don't know. I don't think so. I haven't really taken a break in a while, so I'm not really sure. I feel like if I stop, then maybe there'll be an issue. But I've just been going for a while so I have the momentum. [chuckles]

57:01

Alexey

**You mentioned a few times that you like to switch between topics. One day you read about machine learning and then the other day you create illustrations. This helps, right?**

57:15

Aaisha

Yeah. I switch between lots of things. Right now I switch between my bioinformatics, machine learning, and in my illustrations, I have two or three different projects I'm doing at the same time. If I get bored of one thing, I hop on to the other. I have a fallback route instead of doing nothing. If I were to do only one thing, I feel this would be a bigger issue, because I do get bored of things very easily. So I'm like, “Okay, I'm sick of this. I don't want to do it because I’ve been doing it two days in a row,” which I know is not a lot, but I just don't want to do it anymore. So I can work on another project. I can do something else. Then I have some more interest in that project a few days later.

# Aaisha’s resource recommendations

57:58

Alexey

**Interesting. Well, I think we should be slowly wrapping up. So maybe the last question is, “Are there any books or other good resources that you can recommend to the listeners?”**

58:11

Aaisha

That's a hard one. [cross-talk]

58:18

Alexey

**Maybe on machine learning, learning in general, bioinformatics – anything you'd think that would be interesting for the listeners.**

58:29

Aaisha

For Python, I can recommend a course I’ve done, which was very interesting. It’s called Python for Everybody. I liked it because the person was not spending too long on the stuff. It was a bit fast-paced. But also, if he went a bit more in-depth than like, “Okay, so and so syntax – just because.” For machine learning, I haven't looked up that many resources as I have other stuff, but I can recommend the Zoomcamp and your book, because I found those helpful. [chuckles]

I would say that they're good resources. I think I can recommend those. The thing is, I haven't spent a lot of time following specific resources because I jump between them so much. So it's hard for me to say. There are so many. I could dig into my resources and say. It's hard to say off the top of my mind, “That's a good resource.”

59:25

Alexey

**Did you take any course about studying? I know that there is a course on Coursera called Learning to Learn or something like that. Have you ever taken anything like that? Or you kind of knew how to do it from your homeschooling?**

59:39

Aaisha

No, I haven't really taken anything. I have seen the Learning How to Learn course and I think I watched the introduction or something. But I was so bored that I just closed it. I didn't watch it any further. [chuckles]

59:53

Alexey

**Okay, then. That's all we have time for today. Thanks a lot for joining us today for sharing your experience about self-learning. And thanks, everyone, also for joining us today, for listening in. I guess that's it for today.**

60:08

Aaisha

Yeah. Thank you for the opportunity to speak on the podcast. I really enjoyed it.

60:11

Alexey

Our pleasure. Have a great weekend everyone.