P-4

Absolutely.

P-4

For example, reliability is one non-functional requirement and my opinion is that has to do with the accuracy of the machine learning system.

P-4

And what you want to do is assistance, that is accurate enough, something it actually providing is useful predictions.

P-4

For example, I don’t know how much explainability is part of non-functional requirement. But I could say this is an important requirement.

P-4

In my opinion, I’m going to go with accuracy, that’s super important for machine learning.

P-4

For me, accuracy plus reliability is the most prominent a non-functional requirement in machine learning context.

P-4

Non-functional requirement that is very important is maintainability which I think is associated with the retrainability of machine learning system.

P-4

Retrainability is a new a non-functional requirement for machine learning system. When to retrain, how to retrain, which data use to retrain those are the requirements those you don’t define in traditional software.

P-2

Yes, I guess, based on my experience safety is very difficult to guarantee right so, now safety is not really non-functional requirement but you can break it down.

P-2

Then I guess performance as well because you can’t really a machine learning could behave frankly sometimes, so why you test that might perform one way while its operating might behave in a different way. so here again we kind have to guarantee or check for these things at run time as well. So that can be really tricky.

P-2

Usability I guess if you implement depending how you implement the user interface if there some machine learning like the road traffic app right, it tries to understand like what are my preference or where am I going and then depending on my history, its tries to change the suggestion it’s proposing but it’s trying so slow when I try to push something but it already showing something else then it chooses this one and then I to have to type again.

P-2

I guess the planning of how you implement the efficiency with could be better once it strange behaviour. Then its implement behaviour like storage efficiency you could design algorithm that’s really tend to be very efficient, then it is better with Machine Learning or AI than it with traditional system.

P-2

For me this is not the same like performance and efficiency, Like you said the system should respond in that many seconds, doesn’t really have to be only efficient. It just should perform and in a specific way.

P-2

think performance really, If it’s not included, this is really important for me for machine learning.

P-2

Then correctness I guess, but in a way that maybe for certain scenarios thaT should behave in the the same way. Maybe you wanna guarantee that it’s not really changing the behaviour at runtime or specific thing.

P-2

I guess the flexibility like in a relax language.

P-2

I guess testability is very tricky.

P-2

And flexibility is really a nice one

P-2

Hopefully that is done properly and you can guarantee in this situation will be fulfilled. Otherwise if it is not triggered this the situation then you might not executed this times. Then you end upon a situation where you rely, you will kind of a rely on the system its not really executed. So this things really to understand when will it be working more context situation and to guarantee.

P-7

I guess it does of course, but most of these non-functional requirements I have received from clients that do not know exactly what they need or want. So it’s up to me to translate exactly how they want something to work and then I come in.

P-7

I guess also maybe another different is like if I create a project, like the flexibility what they expect from an average research project,

P-7

Correctness and eficiency maybe. Especially the correctness. Maybe efficiency can be a bit slower but when I talk to my clients, they are ok, it takes a bit longer, but they want the data to be correct like hundred percent.

P-7

Yes the maintainability. Testability as well, lots of comments as well and very good documentation as well. That is one of the most important part.

P-7

For example, the portability as well. Like I try to make sure, I mean, I’m the user of the software usually, so I try to make sure that is portable all of the computer is from different operating systems I have.

P-9

Yes, I think non-functional requirement play actually a key aspect of not only quality, but in terms of the success of a software. I mean you have functional requirements and those are coming from the use case descriptions or from the customers wishes for. But a customer, he doesn’t or he shouldn’t need to think to make all the safety security aspect that kind of run a little bit of a background to insure that this system is working as it was supposed to work and those are the essential parts of non-functional requirements.

P-9

The customer wants to drive with the car from A to B, as an example, but he doesn’t want to think about how to do that in a way that the car is behaving always safe, and no one can hack into the car and take over control of it. So, this is our job as system designer to think about these non-functional requirements like safety, security but also other aspects of privacy for example, becomes a very important aspect especially when you have highly connected systems as in cars becoming more and more popular to have connected to the internet. So, it’s extremely important to the success of the product that these non-functional requirements are there and they are fulfilled and complete that they do not forget any safety critical non-functional requirement because that would be really bad.

P-9

I think one non-functional requirement that is more prominent is probably privacy and anything that has to do with data handling, because Machine Learning bases on having data available for training and you will have, when you deploy a Machine Learning algorithm, you will have to collect data to check the performance of that Machine Learning algorithm and also to retrain it eventually. And this will impose certain data requirements and especially privacy requirements. This might be a much more significant than in conventional software products.

P-9

I read few weeks or months ago about this thing. It was a Smartphone app with camera, and it could detect faces, and this camera app used some form of neural network that has been trying to detect all different kinds of faces. But they showed that actually this app is able to detect more than 99 percent of white faces but only 80 percent of colored faces. Now in a camera app this might worth somewhere but it’s not really safety or any other problem but imagining you have automatic emergency Braking System bases on the visual camera and detecting of humans on the road. Now we have the headline of this camera system can automatically braking can detect 99% of white people but only 80% of colored people. Then we have a significant problem on our head. Not that the algorithm is working wrong or in a bad way but it has been trained improperly with not correct training data or the training was not created or selected properly to ensure that the system performs in all situation correctly and this an extreme challenge that come up when you use Machine Learning with kind of safety critical systems. But you have to be sure that you’re trained it properly and correctly according to your safety requirements and you have the requirement it should work for all people no matter what the skin color of this person.

P-9

I can tell you from the safety requirement point of view and one big challenge is that we are not able to guarantee the completeness of the non-functional requirement that we really captured or possibilities that Machine Learning algorithm could decide in certain situation that we can completely guarantee the safety of the system.

P-8

Oh, yes. I use to teach in the academy or mentor a lot of researcher, and I tought that you should define very well what you are going to do, because if you ill-defined that, it will just waste.

P-8

Another bias, like we always talk about computable metrics, but it’s something that we call a shameful mistake, like it is OK to say that some software is a malware when it is not. But if you say about MS Word, it is shameful if nobody will ever believe you again, if you think that MS Word is malware and it’s non-functional.

P-8

Yes. Even functional requirements are part of the goals. If you ignore functional requirements, and then put a box of machine learning models, will do its magic and all the important stuff is in the non-functional part.

P-8

But other than that, there’s a lot of parts that influence a lot on the behavior of the system, like things that are even not related to you. You deploy the system, it works very well on your first customer and the second and so on, but, you know, in the customer number 20 crushes because of domain adaptation, something behaves differently. It works very well for all your customers, but times go on and there’s some way the data itself behave differently and the model that was great a year ago it’s horrible.

P-8

You know the way you say it, but in general systems, you have tests and in machine learning you have the data set and say the accuracy is 90 percent, but it is less common to have tests.

P-8

But let’s say a lot of times fault tolerant is not very important in machine learning due to the way that you deploy. If you deploy a model, it should be highly available and fast. But if you change the model every day, it will crush one day.

P-8

The machine learning model and are required to adapt a lot but a lot of that is done using the data. If you work on a data set and after a month you add new dataset, you don’t have to change a single line of code. But, if I want to add a new feature to the data set, some kind of adaptability is needed. At first, we need to know why, then have to use it. So, adaptability has a different meaning with machine learning.

P-10

it’s trying to make the Machine Learning decisions accountable. Sometimes the executives, even in a crucial application of Machine Learning, for example, in medical imaging or something, if a tumor is detected or not and the Machine Learning is saying that, OK, the tumor is detected with 90 percent accuracy, but then we also want to know why it was detected tumor. It may be something different, why the Machine Learning actually took the decision and for which kind of features Learning actually took this decision this is a tumor or not? That is why it’s not very straightforward because it’s nonlinear model we mostly use Machine Learning and then debug it to identify which features are actually responsible for that.

P-10

In terms of explainability, fairness, and other metrics, quality attributes, of course, it’s a very important part of making any software as a service better. Definitely I will say, this is very important because the non-functional requirements will trigger the accuracy and better service of any software.

P-10

I can say it is a military contractor of almost 90 countries almost around. It has branches in 56 countries. And if some of the technologies that Thales provides goes wrong or anything, and if there is an issue based on the transparency or the fairness or being in a biased decision taken from the technology, then it will be also violating some international rules.

P-10

There are some rules also, in fairness, the already accommodated and already have been taken into account by European Union and also by US law so that’s very important. Even though we can deliver some good product based on good accuracy, on the deep learning or something, that’s not enough in many cases.

P-10

I just talked about one that is fairness and explainability, because trying to give some decisions also delivered some additional answers.

P-10

But for my field nowadays, people are mostly talking and raising the voice for explainability and for the fairness, where Machine Learning is getting more criticized.

P-10

So, they want to give insurance to those people who will be reliable or something.

P-10

And nowadays they are feeding this data to a model, software is giving a score and based on the score, they are deciding whether I will give you the insurance or not or whether your insurance premium will be higher or lower. In that case, something is happening in the background. You can call it non-functional thing, because all the metrics are collected in the background. There are many things I will say that if I am denied a really good premium said that for some people the car premium insurance is $64 per month. Now they are saying that we can only offer $200 to you. Even if I talked to the customer service, they would say that only we don’t know why, it’s based on your credit scores, based on all this information we collect and maybe this is about this or that, but where is the transparency? I think that’s also a factor.

P-10

Of course, we cannot restrict innovations like that. But it also crucial to understand that, if you don’t have a good scope and feasibility of applying Machine Learning, why will we just adopt a Machine Learning or deep learning over the rule based system.

P-10

One challenge that I told that we have to make the whole system transparent, because most of the cloud services, if it is crucial like the banking and also the critical systems that we work in Thales, there is smart crane or if there is a boulder or something. Now, if we want to implement a computer vision system in autonomous car, then there are a lot of things coming that, OK, if it just kills the passer by, that happened last time. What we have to also make it better that should we take the turn or not? If there is a child, it came, it violated, maybe sometimes there was a interesting talk this year.

P-10

I attended a conference call EEEI and that was the professor called Pat Lang, He is very famous. So he gave one team, one term coined one term, it’s called justified agent. So what is justified agent he said, that looks like I’m a guy, I’m waiting in front of the counter of McDonald’s, waiting for now. I am in a hurry. My car is leaving or something bad happen, so I can go to some people and I can explain and I just can take the things I can come by and go, you know, it can happen sometimes people may ignore, people say no or something. But how you can make these computers that emotionally connected with people or not.

P-3

No, I don’t think so. I believe the full range of NFRs would apply to traditional software and machine learning enabled software as well.

P-3

Yes, there would be. For example, repeatability, accuracy. Those are certain things those come into place once start with ML based software. I think repeatability, complexity, would come into place.

P-3

Repeatability, accuracy, these things are often important in ML or deep learning based software which are not generally that much present in traditional software.

P-5

We do lots of work on interpretability because we can not provide any risk assessment system that the doctors will not understand.

P-5

I think it’s critical in this case, because specially in the medical field where you are sort of responsible in a sense, most of our system only providing recommendations. They shouldn’t be used it exclusively to make your decisions. But it is important, because at very extreme it’s matter of life. And that’s where you have to be very clear what your tools do and then it’s supposed to help the medical staff to get right information and see patterns perhaps, they wouldn’t have seen without these tools. But blindly relying that even if that would be excellent, if you could have computer to do all that, it will do some loss as a whole.

P-5

It is very important also that you have reproducibility. You can’t upgrade your algorithm and then same patient with then same symptoms coming again and then you can’t explain why this gives you different diagnosis this time. If you include another or if you include new data into your system like you start measure and if you have glucose level in your blood or some extra parameter, then perhaps you can explain it but you still you need to perform similarly on those patients that do not measure glucose and its tricky because you often your first shot not the best one.

P-5

Safety is obviously important but also following the laws of GDPR and ensuring that you don’t leak anything. If somebody is hacking the system your complete medical history, it can be very sensitive. If you are a politician for example and you find out that you have some psychological problems or whatever, it can be devastating for career.

P-5

So it sounds they are equally important but I think there is a bigger risk in machine learning when it comes to those sort of smart functionality. With deterministic algorithm probably not always but often you can predict how it will behave but that can be a lot harder in machine learning enabled software.

P-1

One we are dealing with sensitive data, it’s important that which data can be used by which person with what purpose. When you will build a system, you need to know which data will be handled by that system, how that will be handled and what will be shown to which person, which employees, which physicians etc.

P-1

Another one is trust I think. The users for the system need to trust. It’s very important they trust the predictions of the predictive model

P-1

You need to have explainability or explainable AI which is something very important specially if you want to go from human base to decision making more into machine automated decision making but still there’s human somewhere that take a decision and then explain like as transparency.

P-1

We are also having discussion like bias which is very important when it comes to gender, race, ethnicity. It’s very easy to focus to group of people and get predictive model and consider how does it perform to generalize and how well does it perform to different patient population basically. So that is also important consideration.

P-1

Ethics of course, how do we use this tools.

P-1

Usability can be important but it depends which users are using it. If it is used by all employees at our hospital, then usability might be very important.

P-1

Integrity is something important when it comes to data access, who will access in which data which is important for AI tool.

P-1

Usually efficiency is not such a big deal but when it comes to ICU or close to patient, how the tool needs to respond it can be important.

P-1

It could be important when we store a large amount of data but currently we are not generating a large amount of data.

P-1

Correctness is of course very important because making automated decision somewhat has to do with patient life.

P-1

Same as reliability, in general I think when you use this types of tools with patient, it’s important to evaluate AI in a good way. Statistically it should have consistency which is giving some benefits.

P-1

Maintainability is of course something very important. I think we are quite early in our AI phase, so we are not considering that too much because I know things are changing over coming years, so we will switch some tools etc.

P-1

As I mentioned like reliability and correctness are sort of very vital.

P-1

Integrity is important .

P-1

I think bias, ethics and fairness can be important.

P-1

I think correctness like reliability and way of assessing correctness and reliability. You need to be very much data driven evaluating these as well.

P-6

the scalability is very important because we have a software on server side and we have different devices which are connected, but how many devices can be correctly managed by the software with the specific characteristics, we do not have this kind of information so pointy.

P-6

Sure. Because they can’t compromise the effectiveness of the software. You can have very fantastic functionality, they can be very interesting but if the non-functional requirements are not fulfilled, then the user or the result can be compromised.

P-6

If the data are not secured, then you will lose your business.

P-6

I think it is important to expand the reliability. In which way your machine learning algorithm is able to predict the information, is a very important part. Because from this aspect, you can take decision and this software’s main goal is to take decision. The result of the software will impact on the business. So it is very critical. The level of reliability is really a part of software. But there is a different meaning. I would say it is more specific.

P-6

The performance is really important because it is very important to understand the speed for getting the results.

P-6

scalability and reusability are important part as well. If your machine learning algorithm is important for your business and this algorithm is scalable, you can relate data that you can feed this algorithm.

P-6

This algorithm could be useful to different products and this is the portability.

P-6

Testability and integrity could be important. I doubt integrity could be important if it is feasible demand. I think this is more difficult to apply. The result should be reliable.

P-6

The much important part of the software is characteristics and non-functional requirement, it will be the main part for all.

P-6

As a computer engineer, I will consider this non-functional requirement for sure for this module alone for my design because I need usability, portability which are important for the design part as a developer or a designer or an architect.