Interviewer- Can you please introduce yourself the role of your organization?

Interviewee- My background is also from computer science department. I was doing my PhD, in Gibraltargatan campus. I mostly worked in sort of the life science area and Machine Learning so to say. After Chalmers, I spent couple of years in USA working more on meta dynamics area of research. Then I came back ………. where worked in the advanced analytics center. And everything we did there was sort of border line Machine Learning depending on what you call it, bayesian statistics and random forest, gradient descent type of algorithms and use a lot of Machine Learning as well also some neural networks. Now I am at…………….. which is a company at Gothenburg, we are working with the emergency care. So, we are closely related to hospital and specially with emergency departments.

So, what we do is, we keep track of all the data that comes from SOS all the way till the ambulance picks you up and takes you to emergency department and you followed up the patient all the way until they discharged from the emergency department either you send to more or you send another part of the hospital. It’s sort of digital platform that is specialized for that and part of the hospital care. The value you get this, the data you collect is more vital parameters also takes the recordings from medical doctors when they make assessments about the patients and their medical history. So, it’s a bit like we have electronic health records that collect data, which is separate from the records they have on the other parts of the hospital. We sort of interact and we try to join data from those systems also when possible. We connected to things like you take X-Rays and order to lab test, you can do that in the ambulance. You make sure that, if you have a patient who is very ill, you may want to speed things up when you are in the ambulance, you already there try to order ordinate the test, so that want the patient to arrive to the emergency department, the doctor can already prescribe the test, and somebody can take them which is sort of connected. So, the type of Machine Learning we do is, first of all we look at the patient flows in the department to see how the patients are travelling through and what kind of things we can optimize. One example is the degree of the medical doctors. If you are very junior person you may prescribe more lab test than somebody who is very senior. You can look at different working groups those go at daytime verses those at night time and you can see differences what would happen if we change the stuff. So, what we do often, we use Machine Learning to find the certain path on them, so we try to verify with the simulation test, different type of thesis, what will happen when we change them up. The other thing is we work more on systems, where we try to help the doctors so that they will get the right information to right time depending on the data and we also make risk assessment, and one of those prjects is actually with ------- in Chalmers and around----, we try to as early as possible predict if the patient will be at risk Obsepsis. That can also treat different things like, you want to take this and that test one the person arrives at emergency department because you are suspicious. You can sort of start the process earlier for them and then that way they get better care, and the ultimate things release to improve things at the hospital. So, you think digitalization and smart decision support systems.

Interviewer- You consider yourself more of academic researcher or industry related person?

Interviewee- I probably somewhere in between, we are involved in research work and some of academic. So, I'm more nonacademic person in the role I have now at least.

Interviewer- Can you please tell me your total years of experience in this kind of work and how long you are in your current position?

Interviewee- So I have been bit more than two years where I'm now, before that ten years at ……………….

Interviewer-So can you describe little more of your experience about non-functional requirements?

Interviewee- I really don’t really know how exactly you defined that, so I'm not started talking about it.

Interviewer- Its ok, I can describe you a little……. . ……….

Interviewee- We do lots of work on interpretability because we cannot provide any risk assessment system that the doctors will not understand. One of them, we don't have complete freedom as we might have in car industry or elsewhere. If you provide any recommendation from an AI system to the doctor and you don't give them to any of the fact that answer to why you made that decision or why machine will make that decision, they will not use it. And when you present your evidence, you have to also make sure that things going on right direction. If something is going to opposite way than what you would expect, like if you have the saturation in your blood for example and you expect that you have low oxygen level in your blood, that’s bad. But if your care goes to other way around them. Even if your decision support system is good, nobody will use it. So that’s the one thing and the other thing is that many of these systems you need to have some sort of clinical evidence to be able to provide to the customers, and that’s a tough one because first of all you need to develop it and you need to prove that it actually does what it supposed to do. So, you can have your data, you can train it and you can show that it has this performance, this specific sensitivity and so on. Then in a way to do it correctly, you need to do also run it live in hospital for some time like clinical evaluation that can actually prove more like a clinical study where you evaluate the performance of it. Perhaps that goes to the fun*ctional* requirements, I'm not assessing. I don’t know where the border line goes.

There is lot of discussions going on and if you talk to different people, you will get different answers and where some is more liberal saying that you should just start using the algorithm where the others say no, this is not possible. You need to take the patient data, you need to make it available for all future, so they can see that, and when you put those requirements, you more or less stop all development of Machine Learning system, because you are not allowed. When it comes to clinical data and you have the primary use and then secondary use. The primary use is where most patient will give consent, so you are allowed to use this for this and that purpose. When you start to use it for other things, it is really boarder line what you allowed to do and make it publicly available that is most often out of the question. What you can do is, perhaps process the data or derive some intermediate data, then aggregate and then you start for your training which works in some cases and then make that available. It also not one hundred percent clear that you should do that correctly.

Interviewer- Do you think that these non-functional requirements play an important role for the success of any software?

Interviewee- 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 because 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.

Interviewer- Which non-functional requirements can be more prominent in ML context?

Interviewee- 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 need to perform similarly on those patients that do not measure glucose. It is tricky, because often your first shot not the best one. You need reproducibility but you can't also have complete static. 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.

Interviewer: Do you think there some difference non-functional requirements between the genetic software or traditional software which doesn’t have Machine Learning inside them and Machine Learning enable software?

Interviewee: I think it comes down perhaps to explainability or reproducibility that explainability in often easier in more genetic or more traditional software than Machine Learning. Reproducibility is also clearer I would say.

Interviewer- If I consider opposite like which non-functional requirements can be less important in Machine Learning context which can be important in traditional software?

Interviewee- It depends. Many of these things are unimportant. Even if you have just assistant, providing medical records without anything else, you are still responsible for the data. If you login in the system and even if your system doesn’t have Machine Learning all of the sudden by mistake you get somebody else medical record then can see exactly there mixed up and that happened a few years ago when you logged into …………. all of the sudden another patient’s record showed up. So, it sounds they are equally important, but I think there is a bigger risk in Machine Learning when it comes to those sorts 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.

Interviewer- You consider NFRs for the whole system or just Machine Learning model or just in data?

Interviewee- We are just recently been going over this marking and we are seeing that somebodies are applicable to more traditional. We are using more score-based recommendations also for patients and that also obviously applicable as well. Even if some doctors have come up with some smart way of classifying some patients into risky categories. In a sense by providing this, you are also responsible. These are clinically evaluated when you provide. That’s also hard to find the evidence. Even if has been used in the hospital very long time, it doesn’t mean that there is any prove that is actually working. Many of these scores are completely lack of sensitivity, specificity analysis. It’s more that people have got feeling of this is the way and it’s have been used for long time also gives the evidence.

Interviewer- What challenges you face for non-functional requirements of Machine Learning?

Interviewee- A lot, when it comes to data and how you are using data. It took us very long time to get the dataset from hospital and hospital stuff. One of the biggest challenges was really to identity the data to be able to use it. So, we spend more time that we did actual analysis later on and the training for system.

Interviewer- Do you measure non-functional requirements over Machine Learning enabled software?

Interviewee: When you talk about the performance that’s very important. We have a had a lot of problems and that has been a tough one, that’s not specific for Machine Learning. For example, your ipad is in the ambulance and you get disconnected and connected and there’s a lot of performance optimization that have been done and I guess that’s in also non-functional in a way. And we try to measure up. And it’s difficult to of course because clients are in different servers and it may work really good that even if we are having a large load on our system and still it can be different thing in the client environment.

Interviewer- Do you measure other non-functional requirements?

Interviewee- If you compare the functional requirements we are probably way behind the when it comes to non-functional requirements. We don't have the same strict system for that as we do in the functional requirements. Which is perhaps something we should get back to that.

Interviewer-Do you measures this performance or non-functional requirements or whole system for functional Machine Learning module?

Interviewee-Since I work mostly with the Machine Learning, I would say we can setup the rules for how fast something should react. And we do have some requirement around that we couldn’t take more than this and that. So, we do have some of that written down that but when it comes to the other things that I talked about, it’s mostly been around discussion. So, we all aware about this problem but it’s not that well documented. It’s not really part of our development process I would say.

Interviewer- So how do you capture the non-functional requirements or the measurements of those non-functional requirements for your system?

Interviewee: We do perform interviews and use the result of the system and see how they find the usability. Whenever we deploy the new functionality, we always try to follow up some interviews which are also documented and try to follow upon. Some of these ends up in our risk assessment as well and we have a long list of different risks and things that can have consequences for the patients, those are obviously inside the risk management matrix.

Interviewer- Do you think you feel any challenges for measuring these qualities for Machine Learning system?

Interviewee- No, not anything that I haven’t mentioned already.