Interviewer- In my interview session, I have three parts about non-functional requirements. The parts are background of non-functional requirements, Machine Learning and I have some specific non-functional requirement question, regarding non-functional requirements and I have some measurement related questions about non-functional requirements for Machine Learning. I will start with your background. You have already said something, but I want a little more. Can you introduce yourself, your role, what you have done to your organization and what you are doing?

Interviewee- My last assignment was as a post doc where I have been working mostly as a researcher in a research project, but I have been also working for one and half years for more like tools expert and requirements engineering.

Interviewer- How many years you are working in this area, requirement engineering and Machine Learning, and total work experience in this industry or in research field?

Interviewee- Well eleven years.

Interviewer- Please describes your responsibilities in the organizations or the companies.

Interviewee- Again I have been working mostly as a researcher in a research project for one and half years and doing post doc for two years and doing Ph.D for four years.

Interviewer- Do you have any organizational experience or industrial experience like product owner or developer, architect or like this?

Interviewee- Yes. I have experience as a requirements engineer basically for one and half years for customers’ projects.

Interviewer- Okay. Can you please describe a little more about your experience working with non-functional requirements?

Interviewee- Yes. I do not have so much in that assignment because, I was not working with the requirement, I was setting up a tool to support processes. So I was working with the requirements processes but not the requirement themselves. We have non-functional requirements but I have not been working on implementing them.

Interviewer- okay. But you have idea about non-functional requirements, right?

Interviewee- Yes.

Interviewer- Thank you very much. Now I am asking some non-functional requirements specific questions. Do you think non-functional requirements play an important role for the success of any software?

Interviewee- Yes, definitely.

Interviewer- How?

Interviewee- Well. It’s for any requirement that if you don't implement them, you will be in trouble afterword, for example; performance requirements specially are very important. We have been working safety related aspects. There you need to guarantee certain requirements as well. I guess usability is important but not necessary in that project.

Interviewer- Do you think there are differences in non-functional requirements between genetic software which are not using Machine Learning and Machine Learning enable software?

Interviewee- I think it's difficult to guarantee non-functional requirements in Machine Learning software. While you implementing generic software, you can say that it's traditional. Depending on the implementation, if you use deep learning, you can't really test everything. When you develop the software like traditional one, you can more or less define the test cases, but in deep learning it’s very difficult to understand how the system behaves. In that respect, it's tricky to test if non-functional requirements are really guaranteed. And how this system would behave sometimes in Machine Learning or deep learning, I guess it's also difficult to define the non-functional requirements which ones are really important while in more traditional. I guess you can understand how it implemented; you can also understand how non-functional requirements are related to functionality while in Machine Learning. It’s a bit trickier to understand the relationship between the functionality and non-functional requirements because the functionality might change even depending on how you implement it might even change. After the system is delivered you need to have really good tracing, understanding how this things are related and we need to test it properly. I guess no other in the industry is more tending not to test in that depth. As it’s getting complex more and more, the testing needs to become more and more complex. In some points, you can't really get complex testing. So you need some other methods of testing like simulations. I guess that would also play role when you do Machine Learning.

Interviewer- Recently I have read a paper and learned that maintaining Machine Learning enable software are becoming more and more difficult day by day. So do you think there are some non-functional requirements which are more prominent or important in Machine Learning context? If so, which are?

Interviewee- Yes. Based on my experience, I think safety is very difficult to guarantee. Now safety is not really non-functional requirement but you can break it down. It is really tricky to guarantee when you need some kind of model checking and performance. Because you can't rely on a Machine Learning which could behave frankly sometimes. When you test that might perform in one way and might behave in a different way while it’s operating. We have to guarantee or check for these things at the run time as well. It can be really tricky. if you implement the user interface or if there are some Machine Learning like the best traffic app, it will try to understand what my preference are or where I am going to and depending on my history. It tries to change the proposed suggestion but it is very slow. When I try to push something but it is already showing something else, I have to choose this one again. But if it will show that again, it really drives one crazy. Because it learns the behavior at run time, it can't really test these things; why do you develop the system and why do you develop my performance quite well. Because the context might behave as fun. These things are really tricky I think.

Interviewer- Do you think there are some non-functional requirements which are less important in Machine Learning context and which are more important for traditional software?

Interviewee- I don't know. Now I can see all non-functional requirements. It's really tricky.

Interviewer- If you want I can show you a list of non-functional requirements for traditional software. So that you can think about that maybe.( sharing screen) thus is one of the list of non-functional requirements. So these are for traditional software. You can see and think about those.

Interviewee- The planning of how you implement the efficiency could be better one if it frankly behaves. Its implement behavior of the storage efficiency with which you could design algorithm which is really trend to be very efficient. it goes better with Machine Learning or AI than traditional system. If it is hard coded, it is not always so efficient with AI system which is really trained to be very efficient. That's what I can think of.

Interviewer- Do you think any of the non-functional requirements which are not mentioned could be applicable in Machine Learning contexts?

Interviewee- If any of those could be applicable in AI or Machine Learning context?

Interviewer- Do you think any of those non-functional requirements, which are not listed here, can be implemented in a Machine Learning context?

Interviewee- these are not the same like performance and efficiency. You said that the system should respond in many seconds, it doesn’t really have to be only efficient. It should perform in a specific way. Performance is not included but this is really important for me for Machine Learning.

Correctness for certain scenarios should behave in the same way. You may want to guarantee which is not really changing the behavior at runtime or specific thing. If is functional requirements or non-functional requirements, it could have functionality which you are write on but it should not be the flexibility in a relax language. You have a way of saying; it could be some degree differently. It is stated that on the top of functional requirements could have requirements which should not always be consistent.

Testability is very tricky. And flexibility is really a nice one. I think it's interesting to use all these non-functional requirements for Machine Learning or system-based Machine Learning. But you know that implementing Machine Learning will help with these non-functional requirements in main or Meta level.

Interviewer- You can use both ways; Machine Learning for identifying non-functional Machine Learning or you can have non-functional requirements Machine Learning as well.

Interviewee- Exactly. That’s the ability you could have. Some say that lay on the top of that would test what is wrong about these things.

Interviewer- Do you think of non-functional requirements for the whole system or just for Machine Learning model or some data or any other parts?

Interviewee- Well. I guess it depends on your implementation. then you would have some for the Machine Learning part and I guess if there are other parts included in the system. Then you need to have parts part of the system, It depends on really how you should have them quite a concrete right for the specific part of the system.

If you have Machine Learning integrated, you should have Machine Learning for very specific purpose. You would put it either on top of that or in the parts of the Machine Learning system.

You can also combine different methods to have the result. At the top of that, you could have non-functional requirements, for example you can combine data mining or something else, you could even have like different techniques for doing the same job and comparing which one performs the best. Depending on the implementation, you would have done low level or higher level. It is very tricky to say Machine Learning is just an implementation.

Interviewer- What challenges do you face with non-functional requirements in Machine Learning normally?

Interviewee- I haven’t worked in that field.

Interviewer- Do you think about any challenge in general you didn’t work?

Interviewee- I think the challenge is the behavior which could change. Like you implement it and you can test it and you can see the result but it could be work in differently once you delivered. Also I think the challenge is really like how you defined the ODD operation design domain. Is it really suitable?

Hopefully, it that is done properly, you can guarantee in this situation. Otherwise if it is not triggered in this situation, you might not execute this times. After that you end upon a situation where you rely on the system which is not really executed. You have really to understand when it will be working as more context situation and to guarantee. Especially you need to guarantee the safety domain which is always triggered. When you assume, it should be triggered and always executed in the same way so that it doesn’t fail; for example I don’t know the active safety system which can avoid the accident and it should always be triggered before there is a crush right or near to a crush. As you defined the situation, you need guarantee which will always be executed. I think that's very tricky. You can mess with the safety. I think that's why companies are afraid of using Machine Learning techniques mostly for more traditional system where you can check that. It will always be executed. It assures one hundred percent safety. That's difficult to guarantee one hundred percent safety in Machine Learning. Actually the system will change something at run time.

Then you can talk about the dependency between different requirements. If you have the updates, you will have changes after the system is delivered. Usually once the system is delivered, at the end everything will be tested and things are fine. If you do over the updates, you can't really test everything. Now I'm speculating that I haven’t worked on that. That’s what I can imagine.

Interviewer- Thank you for your answer. Now I will ask you some measurement question. Though you don't have experience or measurement thing, but you can engage or you can answer. Do you think you can measure non-functional requirements over Machine Learning enabled software?

Interviewee- We will need to measure non-functional requirements. I mean if we phrase non-functional requirements which have some specific values, like performance. We need to measure or test and trace it up to the code level. I think that you need to do it.

Interviewer- How do you measure the non-functional requirements which you have mentioned you can think of?

Interviewee- You run it and you measure it for the response; for example you can measure how the system is running. You can calculate the time simply.

Interviewer-There may be different measurement techniques for different non-functional requirements. Do you measure those non-functional requirements over the whole system performance or for the Machine Learning part only or for some other parts?

Interviewee- It depends on how you trace non-functional requirements’ which parts or set like you could have like non-functional requirements the Machine Learning parts also for the others parts. Or probably you will not have system for Machine Learning part will have for other parts as well. While it’s Integrated the part of the system so then you will have you might have non-functional requirements for the other parts for Machine Learning you might have something for the overall system. Like I said the example different different algorithm running then you compare and then you choose the best one. This is higher level testing that I needed to check if it’s really delivering the best algorithm. Then you are needs to check on the higher level.

Interviewer- How do you capture these non-functional requirements for Machine Learning enable systems?

Interviewee- Usually it’s relaxed in implementing stuff. They will implement some algorithms which will run and measure the time; for example, if there are some implementations which are related to anything with the safety, you will have to measure the result and compare the result. You will need to trace everything from the requirement design test and implementation. You will need to have all the test results as well as you need to implement something that would exactly capture the result of the test. That’s my understanding which is based on ISO26262 and has the full traceability for safety related system.

Interviewer- Do you think about any challenges for measuring these non-functional requirements?

Interviewee- Yes. Machine Learning will not behave in the same way for all challenges. I don't know how you want to measure that. If you want to test to run time or if you want to keep a complete lock out of how the system behaves to understand their problems, this will really be tricky I think. Because usually implementation will behave same in the same situation. Whereas Machine Learning could behave differently, and it depends on how it trained and how it perceived, how it interprets the sensor information. All these aspects make it really difficult.

You can test the system when it is done. If you want to test for each scenario, the context operational design domain will be important even though so many things play into this. In Sensor Interpretation, it is important how it is implemented and how the relationship between different components might be again a communication problem. maybe that again if you don't test for these things.

Interviewer- Thank you for you all the answers.