EXCHANGE REPORT

Name
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Year and term for exchange
Fall 2023

Exchange university
TU Delft

Degree programme
MSc Machine Learning (TMAIM)

Work, work, work – and a bit of fun

Before departure

My main motivation for going on an exchange semester was to get a change of pace from Stockholm, to spend a couple of months in a new place and learn something new. I had always been curious about the Netherlands, and I was keen on staying in Europe for my exchange. Since TU Delft is a great technical university, this seemed like the perfect place to go. My expectation, however, was not to live in Delft, but in Amsterdam or Rotterdam – and I ended up in the former. This, in turn, came with some expectations of a big city life slightly different to that of Stockholm, and perhaps a bit closer to what you would have in Copenhagen. The preparations, however, were quite seamless thanks to the EU. I did not have to do much before departure, except for the necessary steps to complete registration at TU Delft.

Upon arrival

Due to a summer internship in Berlin which ended the week prior to my exchange semester, I arrived in Delft on the same morning as when lectures started – which is indeed quite late. Since I was also set on living in Amsterdam or Rotterdam, I had not arranged with accommodation in Delft prior to arrival. Instead, I stayed with a friend in Amsterdam for my first weeks. However, finding housing in the Netherlands is *very difficult*. There is an extreme pressure on the housing market and finding a room can take weeks – and for some it takes months. Hence, I would recommend anyone going to the Netherlands to arrange with accommodation well ahead of departure – and definitely to accept any offer made by the university.

One thing that you might hear a lot about when going to the Netherlands is *registration*. According to the university, and according to whatever municipality you are moving to, you need to register *within five days of arrival*. However - and this is not any kind of recommendation – I have not heard of anyone meeting any consequences when missing the deadline. It seems many do not register at all. It took me two months to get registration in Amsterdam, and no one mentioned anything about the five-day deadline. So, I would not worry too much about this detail.

Financials

With the exception of ERASMUS, I did not receive any scholarships. Delft (and Amsterdam) is slightly more expensive than Stockholm. Housing is somewhat cheaper in the Netherlands (per my experience), since most people share flats. For me, the largest expense has been traveling. I would recommend arranging with registration as soon as possible in order to apply for student discount travel products from NS. All in all, CSN and ERASMUS covers the cost of living in the Netherlands quite well.

Accommodation

I lived in Amsterdam. It was about an hour's commute to the university. However, the trains in the Netherlands run smoothly and there's always a comfortable, quiet section where you can work. I usually work on the train and hence do not feel like I am "losing" any time by commuting. I appreciate living in a larger city and was not particularly keen on living in Delft. However, finding housing is difficult – much more so than in Sweden. There's enormous competition for rooms and flats. I found housing mainly through Kamernet and Facebook groups. I also had some success with personal connections. However, I would recommend mainly checking Facebook groups – and especially the Dutch groups, rather than the international ones.

University and studies

TU Delft has some 30 thousand students, of which almost half are graduate students. Hence, it is somewhat larger than KTH. TU Delft offers a wide range of courses in different subject areas. From my experience, the workload is *very high* – but so is the quality. The material is very good and challenging. I would say that the workload is somewhat higher than that of KTH – and it is more difficult to gauge the workload required to complete a course or assignment. Many graduate students seem to take less than 30 ECTs per semester. In summary, doing a good (or even acceptable) job requires a lot of work – but, in many cases, it is highly rewarding, and the courses are designed for you to learn fundamentals and focus on problem solving.

Courses

My main objective with choosing courses was to get more width – as I felt the courses at KTH already provided a lot of depth. Hence, rather than focusing on pure ML, I chose coursework in e.g. robotics and C++. Specifically, I took the following courses:

- **RO47001 – Robot Dynamics & Control**, which covers the fundamentals of dynamic and kinematic models in robotics. The focus is primarily on robotic manipulators, i.e. robots arms, and how to control the force or position of an end effector. There is also a (somewhat oversized) segment on the fundamentals of vehicle simulation and control. *Recommended.*
- **SET3061 – Energy System Modelling,** which dealt primarily with energy market clearing problems, as well as economic dispatch and allocation problems for energy markets. Specifically, the course focused on a fairly limited set of tools from optimization and auction theory. *Not recommended.*
- **CESE4075 – Supercomputing for Big Data**, offering an introduction to Scala and modern tools for big data analytics. There are three segments in the course: (1) exploring Spark on a single machine, (2) Spark employed in a cluster (specifically on ASW using Hadooop), and (3) streaming applications using Kafka. The course gives a solid introduction and exploration of an increasingly important part of the data-science ecosystem. *Highly recommended – IF previous knowledge of Java.*
- **CS4400 – Deep Reinforcement Learning**, which has been the toughest course by far. It covers a wide range of theory and practice. A single lecture can contain as much theory as an entire course given at other departments/schools. The assignments cover both implementations using PyTorch and theoretical aspects of DRL through proofs. Incredibly useful and challenging course. *Highly recommended.*
- **WI4771TU – Object Oriented Scientific Programming with C++**, covering a wide range of fundamentals in C++. Very nice and instructive assignments and great lecture material. Finished with a final project where we built a neural network from scratch – including a class for matrix operations. I think these types are courses are great for adding more depth and width to your ML repertoire. *Recommended.*
- **IN4089 - Data Visualization**, a great course for learning the fundamentals of different visualization techniques and how visualization can be used in a scientific context. The course blends theory with practice, going down on a very granular level (e.g. why certain colors are used and why they are conducive to analyzing/highlighting different aspects of a dataset), up to a practical level where we got to build visualization tools in D3 (JavaScript) and C++. *Not recommended.*

City and country

The culture in the Netherlands is very similar to that of Sweden (and Scandinavia). I would say the culture shock was negligible. The food culture is somewhat different, and things like public administration and quality of housing is perhaps a little bit worse than in e.g. Sweden. But overall, it is not a big adjustment.

Leisure and social activities

Both Amsterdam and Delft are great cities offering all kinds of activities. For my part, I have honestly not had too much spare time to do all the usual touristy stuff. But I have enjoyed the afternoons and night life in Amsterdam, which I would highly recommend. There's so much to do, from museums and markets to bars and night clubs.

Sustainability

For all my travels to and from the Netherlands, I have taken the train. There's a night train going from Malmö, which is a very comfortable alternative. You depart from Malmö on e.g. Sunday night, at 10 pm, and arrive in Hamburg early in the morning. From there, you are one or two trains away from Delft, Rotterdam, or Amsterdam. There are also many buses going between Germany and the Netherlands. There are also trains going all the way from Berlin/Hamburg up to Stockholm. So, there are some good alternatives if you want to travel without flying.

Other recommendations and observations

My main recommendation would just be to sort out a good housing option. This, at least in my opinion (and indeed for many others), is the main headache when you move to the Netherlands as an EU citizen. Other than that, the transition is seamless. Everyone knows English very well, so there's no problem in getting around.

Also, if you are planning on taking graduate courses in Computer Science, I would highly recommend checking the course requirements and the course content thoroughly. For some courses, the workload is very high. However, as I said, you will also learn a lot. So, I definitely recommend taking some of those tougher courses, such as Deep Reinforcement Learning – but make sure to balance it out with something where you have a little more margin.

Finally, I would also just put in an overall word of caution. TU Delft is a very good school, with high quality faculty and material. However, they take their graduate studies seriously. I know several exchange students who have failed more than one course, others who have worked to the point of regretting their trip to the Netherlands. This does not mean that you should steer clear of TU Delft if that's the place you would like to go – but if you are looking for an easy-going exchange semester, I would *not recommend* that you go to TU Delft, or at least that you structure your courses and workload very carefully.

Best wishes,
Oskar