

MACHAZINE

Volume 20 - Issue 2
January 2016

Wiskunde
Informatica
Studievereniging



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Huygens'

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Dublin

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Editorial

Sandra Maring & Anouk Rentier

Hello fellow students, professors, alumni and other interested people!

In case you have not noticed, we have arrived in the second quarter of the academic year already! Let's say time flies when you are having fun. There were not a lot of activities from Christiaan Huygens in the first quarter, which means we could study very hard. But the month December had a lot to offer. Just before December started the WiFest was held, followed shortly by the famous 'SinterklaaslunCH'. During this month, there were all kind of old committee members drinks in the /Pub, the 'oliebollenborrel', the first master activity of CH ever and last but not least the cosy Christmas dinner.

Personally, I like the food activities. Because December and especially Christmas is about the winter days, when we are inside most of the time and it is nice and cosy. It is about being together with people you love and sharing food together.

There are things I like and I do not like a lot in the winter. Like when you are going to study in the morning and it is still dark outside and you are on your way to EWI (EEMCS). When you are studying, you only have artificial light from the lamps or your computer. Then after a day of studying, it is already dark and you have no idea if there has been any sunlight at all. However, there are always good things you can make out of bad things. Because when you are home after a day of studying, you can eat a solid meal like 'stampot' or pot roast with candle lights. And although the winter is cold here, we can put on nice caps and gloves and there is ice-skating, which I really like.

Hopefully there will be snow this year. Then the world looks very different and everybody behaves different. Cycling will be difficult, but you can make snowmen and throw snowballs. The streets, trees and everything else will look perfectly white. It is the best time to drink hot chocolate and eat 'speculaas-staaf'.

So because you are probably inside, read this MaCHazine with some drinks and food and remember or think about how the last quarter has been for you. And do not forget to enjoy the winter. 🍷

Although the weather is still playing autumn, winter is coming soon,

and Delft is preparing for that. All over the streets you will see cute

Christmas lights and the Christmas trees will be set up soon. By the time

this issue is published, the Christmas holiday will probably be over, and

the exams will take place soon.

This year I will celebrate the winter in shorts or swimsuits, since I am going to Dubai and Brazil. It's time to start travelling! I am not the only one who will be spending December in the sun, since Laura flew off to Australia a few weeks ago. For the people who are staying in the Netherlands: enjoy the winter-holidays! The only time of the year where you can wear your Christmas sweater without being embarrassed. Where you have two or three days in a row spending time with your family and only eating and eating and eating until you feel like you are going to burst. And then the dessert comes along and you can't resist to take a bite. Or two. Also that time of the year where it is time to say goodbye to one year and hello to the next.

With 2015 coming to an end, it is also time to look forward to the new year. The year that there will be Olympic Games again, and Adele will come to the Netherlands. The year where hopefully the world will become a better place and more people will be safe and healthy. The year wherein I really have to decide which master to enrol for, and the year in which I will always do my homework and start studying in time for the exams. Really. What are your resolutions? Did you already make plans for the next year?

Because I am going to Brazil, it is time for me to say goodbye for now, but not before I have welcomed back Saskia and Ghiline! I wish you all happy holidays, lots of presents, a great new year and loads of luck for your exams. 🍷

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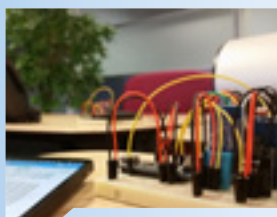
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From the board

Ruth Koole

Outside, it is getting colder and darker, but inside the building of Electrical Engineering, Computer Science and Mathematics, I hardly sense it. Since the appearance of the previous MaCHazine, Board 59 has been busy with their work, the work which we are used to a lot more than before. In the first weeks, everything we had to do was new for us, but we are getting used to it quickly. Getting used to the long list of things to do, the full mail boxes and a lot more a board member has to deal with. But what do we do the whole day? A question I hear many times, often from members. I hope that this part in this MaCHazine will make a little more clear to you how it is like to be treasurer of our association.

As a treasurer, you have knowledge of every euro inside the association. Every time you buy a book or you buy a little snack at the fridge, I will put it in our financial administration. That is a lot of work and also the reason you will see me sitting at my desk very often. In the beginning of the year, this part of the financial administration was very difficult. The vocabulary of the treasurer expands really quickly with words like journal entries, reconcile invoices. Funny that I did not even know the English words for those, while I have been using the Dutch ones several times a day. In the beginning, every little part of the financial administration took me a lot of time to understand it, the bookkeeping software Exact Online seemed like a huge labyrinth. However, the first quarter of the year has passed, I have done every single part of it several times, so I think I possess the skills necessary for bookkeeping.


At the end of the quarter, the treasurer will make the balance sheet and the income statement. This is the first moment where I had a good overview of the finances of the passed time. However, it took me a lot of time to make this and I really liked to do this.

However, besides this office job, being treasurer of the association is a lot more. Of course, we have many committees and most of them have started in the previous quarter. For me, this means that the treasurers of the committees are busy with making their budget estimates for the upcoming year. I am giving advice to every one of them, so many of them come by often to ask questions, which is enjoyable. I like to see the enthusiasm of all the committees, mostly when they have succeeded to organize an amazing activity for the association. This makes me even more curious about the upcoming activities!

While you are reading this part, the participants of the study visit to Brasil will be known. Thirty participants will start soon with their case studies, which is part of the preliminary program. This studyvisit is the biggest challenge for our association this year and for me as a treasurer aswell.

In the upcoming time, there are a lot of exciting activities waiting for us. When writing this piece, the registrations for the skiing trips will open very soon. In the first week of February we will go skiing in France with 50 members. I am really looking forward to this week of partying and relaxing in the mountains with members of Christiaan Huygens.

More time for relaxing will come with the Christmas Holidays nearby. I will be going to the south of the Netherlands, visiting my family again. Something I have not done very often since I have been in the board.

Thank you for reading this piece and if you have questions for me or would like to have a little talk, you can always come by to drink some coffee or tea with me! Have fun reading the new version of our MaCHazine! 



Current Affairs



What's going on at our university and especially our faculty? The treasurer of Board 59 will tell some more about herself and of course you will find the latest TU Delft news in the next few pages.



TU Delft News

Stijn Ruiter

Delft University of Technology is the biggest and oldest Dutch publicly available technical university, established by King Willem II on January 8th, 1842. But what is currently happening on and around the TU Delft?

In this article, we will list in short the most important events of the recent month.

Delft in THE ranking

Delft University of Technology is doing great this year. Currently, the university has rank 74 in the worldwide Times Higher Education ranking in the category Physical Sciences. Last year, Delft wasn't on the list of the best universities in this category. Subjects like research, education and quotes make up this list.

In the general ranking of the THE best universities, Delft has rank 65, which is an improvement of 6 places compared to last year. Moreover, in the category Engineering & Technology ranking, Delft University of Technology is this year's rank 19.

This ranking is one of the most important university rankings worldwide. This list is good for the publicity of Delft, which attracts international students and scientists.

More students in Delft

Despite the disappearance of the Dutch government student grants, the number of newly enrolled students at Dutch universities did not decrease this year. These are preliminary figures, but there is even an increase of 8% at Delft University of Technology. Unfortunately, there was a small decrease in Dutch students, but this is lifted by an increase in international students.

The number of students at EEMCS has also increased. The bachelor applied mathematics has an increase of 16% compared to last year, and the bachelor computer science has an increase of 10%, which is great.

This increase in students caused some troubles at the beginning of the study year with regard to the amount of space for bicycles. Luckily, these parking spots have increased drastically in numbers, resulting in 1154 more spots throughout the campus.

Leakage in EWI

On October 13th, the 6th floor of EWI was flooded, due to a damaged rubber component around the heating pipe. This resulted in a broken pipe with pressurized water. At some point, there was more than 5cm of water. In addition, the 4th and 5th floor were also flooded, due to excess water. This water also went into the elevator shafts, making some elevators not operational.

Fortunately, because of the quick acting, the damage was limited. However, the flooded floors were not accessible, resulting in a lot of employees having to work at home. Moreover, the heating system was non-operational for the remaining week, resulting in a cold tower block.

Unfortunately, a week later, another heating pipe broke, resulting in a water damage on the 4th and 5th floor. Luckily, this pipe resulted in considerable less damage. Currently, all the rubber components, which caused the pipes to fail, are being replaced to prevent further leakage.

Spooky action at distance

Einstein couldn't believe it actually existed, but 80 year later, it is proven to be reality by students and scientists of multiple nationalities on the campus of Delft.


Quantum mechanics predict that when you measure a particle, this can have an instantaneous consequence to another particle, even when there is a distance between them. This should mean that information can be exchanged faster than the speed of light. Einstein could not accept this.

There was already a test (the Bell test) to check if this phenomenon actually existed, but there are measuring loopholes which could influence the test. However, for the first time, they managed to exclude these loopholes, and proven that this spooky action at a distance really does exist.

This does not only give answer to one of physics largest debates, but also opportunities to things like secure communication. Namely, it is impossible to track the information between points, since there is no communication between these points.

Dream Teams are on fire

The Dreamteams are doing great this year. The Nuon Solar Team managed to win the Bridgestone World Solar Challenge in Australia. In August, they presented their new model of the solar car, the Nuna8. Clearly, the performance wasn't inadequate, though the competition this year wasn't easy. They only had a 3 minute lead over the Twente Solar Team.

Furthermore, the DARE team also established a new record. In Spain, their rocket managed to reach an altitude of more than 21km. The exceptional thing about the Stratos-II+ rocket is the fuel core. This rocket runs on nitrous oxide and a mixture of paraffin, sorbitol and aluminium powder. The first attempt to launch failed due to an ignition fail, but the second attempt later that week did succeed. 

Referenties

[1] <http://www.tudelft.nl/actueel/laatste-nieuws/>

[2] <http://www.delta.tudelft.nl/nieuws/>

[3] <http://intranet.tudelft.nl/nl/nieuws/>

[4] <http://www.ewi.tudelft.nl/actueel/laatste-nieuws/>



Robotics, what can mathematical modelling do here?

Fred Vermolen

In many production environments, humans are more and more being replaced with robots. This replacement makes life easier, less dull and even more importantly, less costly. Despite these merits, a disadvantage is the loss of labour, which in particular impairs employees who are working in assembly jobs. Which role can mathematical models have here?

At this moment, I am recovering from a drinking night that I had the previous night with my colleagues in Cambridge, UK, where I am staying for a couple of weeks as a visitor. The beers improved their taste in the course of yesterday night and for now, on Saturday morning, I decided to take it a bit easier. This is all very human and I am happy that I am not an old-fashioned surgeon who could be called anytime to operate on a patient. At this moment, yesterday's alcohol made my hands too unstable for a surgical tasks. Last June, when I visited Shanghai, I had the opportunity to take a look in the operating room, where I saw a surgeon carrying out an operation on a shoulder of a patient. The operating room that I saw in Shanghai was full of electronics and I was impressed to see how the actual surgical procedures were merely carried out by robots and computers. The surgeon showed me how everything worked on the computer and how he, through the computer, made the robot perform certain tasks. In nowadays operating rooms, surgeons sometimes even operate remotely, that is, from a different location. It is amazing to see how remote communication works and to see how actually robots are taking over more and more tasks that used to be done by humans. However, still, humans are the ones that make the decisions. This can also be observed in the assembly of all kinds of devices and products, such as cars. It is robots that actually do the 'stupid' assembly.

This robotic assembly makes life easier for humans, since they no longer have to perform boring, cumbersome tasks and that is a good thing. On the other hand, the development of robotics and further automation makes a lot of labour people lose their jobs, and it is needless to say that this is a bad thing. If this happens more and more, then the question is whether we will reach a point where hardly any mechanical workers are needed at all. One could repair damaged roads, build houses, etc, by using robots. In Japan, where they seem to have fewer ethical restrictions than in other Western societies, one could have robotic waiters, hosts or people you could consult when you enquire about your further travelling at railway stations, airports, etc. These robots take away the jobs of the people who used to do this. Of course, a lot of money could be saved by the use of these robots. A further advantage could be that if the robots are really intelligent to have good conversations with, they might not suffer from bad moods, unreasonable temper, which all are very humane. One could even think of using very communicative robots to use for company or

even more. In Japan, and also in other countries, they even use robots as pets. Other countries want to use killer robots for warfare, and here you can see that the movie 'Terminator' was less science fiction than we actually used to think.

I also saw several documentaries where robots were taught how to walk and this really makes them more humane than I could ever imagine. In the documentary, it could be seen that the trainer pushed the robot so that it stumbled and fell, which was necessary to train their balance. I even felt a tendency to feel sorry for the robot when it was pushed so that it fell. This emotion perfectly illustrates how we are inclined to attribute humane emotions to robots when they actually start looking like us. One could find this scary, however, on the other hand, this also illustrates how robots

can be used to take care of very sick and elderly patients. In particular, it is important for bedbound patients that they are turned regularly in order to prevent pressure ulcers. It is not hard to imagine that all these features require complicated mathematical routines such as systems theory or artificial intelligence. One could also think of robots that investigate patients by carrying out medical imaging such as X-ray radiography, magnetic resonance imaging, etc, which will take optimisation algorithms as well as a lot of numerical linear algebra. Subsequently, the robot could use biophysical modelling to compute the time evolution of a certain medical-biological process, e.g. the growth and metastasis of cancer (spread of cancer to other body parts). These techniques require high resolution finite-element modelling which could possibly be done by the use of parallel computation on multiple processors in the robot, combined with probabilistic and statistical principles to predict the likelihood of success of medical treatments or to predict the risk of spread of cancer to mention an example. Hence many disciplines of mathematics, as well as computing can be very helpful in robotics in many different aspects.

Well, this has become a long piece of serious text after an evening of drinking beer. It is time to get back to the pub. Have a nice evening, all of you! Don't drink too much and don't drink to little. Cheers, Skål ! 🍷



Faculty Student Council

Floris Verburg

Every academic year a new Faculty Student Council (FSR) is elected by the students of EEMCS to represent them within the faculty. One of the means to keep students informed of the activities of the FSR are articles in the MaCHazine. This edition, we'll discuss several key points of what we'll be discussing the coming year.

Contact with students

In order to effectively represent students, it is important for us to keep in touch with the students themselves. This entails that we keep students informed, for example via the MaCHazine and our Facebook page, in order to let the students know what we as FSR accomplish during the year and what we can do to help the students. But we of course also ask you for your opinions. We would like to pursue this by organized feedback moments, for example with coffee outside of the lecture halls. We also want to regularly create poll questions on our Facebook page in order to get feedback from the students in a fast way.

Facilities

Facilities on the campus are crucial for students. The quality of the facilities that are available have a big influence on the experiences of the students. We also think that group work is one of the key components of studying. This implies that there have to be enough workplaces for group work just as there is also a need for more individual workplaces, while the workplaces in the EEMCS faculty are often overloaded. This year, we aim to create enough workplaces for students of our faculty for group work as well as individual work.

We want to provide more laptop workplaces, including enough power outlets for laptops. Furthermore we would like to improve the stability of the Eduraom network, despite there are some improvements made last year.

Motivation

Studying at the TU Delft is challenging and requires a strong motivation. For many students, staying motivated is a challenge. The FSR wants to look into this problem, together with the educational board, and see what the cause of the problem is and what possible solutions could be.

Grading deadline

It is important for students to receive proper feedback on their work within a reasonable amount of time, because students can learn about their mistakes. The earlier the feedback is given, the more useful it is for the students. A limit has been set for the teacher, with a deadline of how long is allowed to take and this is also included in the student regulations. Though setting this limit is a good step, it isn't always properly upheld. The FSR wants to pursue a stricter regulation of this deadline, while making sure the quality of tests and the reviewing is not affected.

Study guide


We noticed that the study guide is not always up to date and we want to make sure this will be improved. The student regulations refers to the study guide as the binding source of the courses. However, some of the courses contain outdated information because the information is not updated every year. We will look after this in order to make sure the study guide provides the correct information about the courses and that the information will be updated every year if necessary.

Evaluation student assistants

Projects form an important part of our educational programs. The proper guidance of student assistants is important for the quality of these projects. The quality of the assistants frequently varies, with various student assistants delivering subpar guidance. The FSR wants to look into this problem and set up an evaluation system for these assistants in the coming year.

Faculty regulations

The faculty regulations are not changed since 2011. Because these regulations are not up to date anymore, it may contain some inaccuracies. The FSR aims to be actively involved in the renewing of the faculty regulations in order to be able to review the correctness of the regulations.

Naturally, these subjects don't cover the entirety of the subject we will cover the coming year as FSR. Furthermore, we find it important to look into problems students run into themselves. Please don't hesitate to contact us at fsr@ch.tudelft.nl or by talking to us directly when you see us. 



Who is Emirhan Ilhan and why is he saying all these terrible things?

Emirhan Ilhan

Writing's hard and it's kind of a pain in the ass when you have to do it.

You know how you wait and wait and wait as you look at the deadline,

getting closer to you each day and you think "It's fine, I'll be super-

productive in the last days."? You have this implicit confidence in the

fact that you don't write the words, the words write you. And when you

are ready, the inspiration will come and the words will flow through you.

Well sometimes, they don't.

Sometimes you are stuck with staring at the blindingly white screen, looking at the winking cursor and winking it back. Maybe you find yourself thinking if it is flirting if you wink back at it. Maybe you then start imagining how it would be to have a love affair with the cursor, what your kids would look like, whether you and the cursor's kids would be bullied at school or not. Or maybe you don't. These things could go in either way, there's really no way of telling it.


I never really finished anything, except maybe ice-cream. Most of the times, I feel, these things are just abandoned. And I catch myself thinking if it's a curse or a blessing. On the one hand, you want to be able to finish things, you want the sense of completeness, the sense of perfection and satisfaction. On the other hand, things that can actually be finished tend to be rather straight-forward and boring if you will. Finishing something implies that you actually stop working on it and anything you can stop working on may very well be not worth to work on in the first place. I don't know. As Kerouac said, I have nothing to offer but my own confusion.

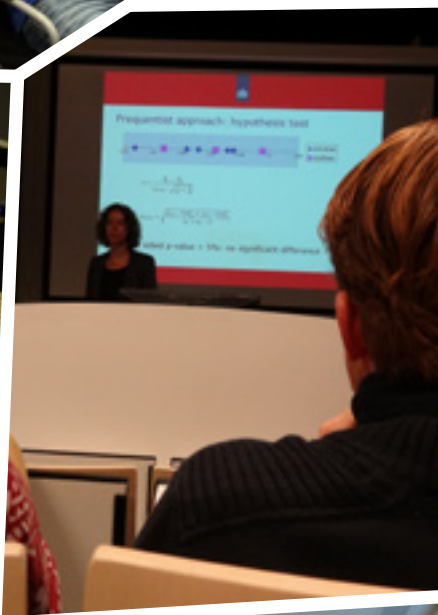
On another note, the Dutch language course is going fine. You will most probably unconsciously ignore this, but it is hard. Not the language per se, but the so-called Delftse methode. It is especially true if you're a piece of neushoorn¹ who can waste time endlessly. Just like any other thing, it does become a chore really quickly and the method itself doesn't help. I'd say in total, prepare to spend a good 6-7 hours including the actual lecture hours. It doesn't sound so much now that I've written it down, but it sure feels that way. It is safe to say

that I am very unforgiving of things that stop me from wasting more time. The nice part of it all that is you learn a lot, I mean A LOT. But then again, learning a lot is also forgetting a lot, so there's that.

All in all, I would say I am comfortable enough in fairly scripted scenarios along with the useful phrases like Reken maar van yes, Komt wel goed schatje, Helaas pindakaas, klaar is Kees and so on. (Anyone writing so on or etc. is running out of examples.) I have also decided to use the phrase "Unfortunately Peanutbutter" in everyday conversation, as often as I can get away with. It couldn't possibly hurt, right?

Now, here is some good news and some bad news for the speakers of Netherlands. For years, you've been told by outsiders that you are too direct, too rude at times. I have come to the bottom of this problem! And you might be happy to hear that it is not your fault. Well, it actually is completely your fault, but little less than you think so. *cute, please don't hate me face* It feels to me that most of the time the things you would like to say have to be summarized quite a lot and ripped of any elegance and grace in order to be said in Dutch at all. Why else do you think that the Dutch subtitles in the movies can ruin the whole movie? It seems as if the whole nation decided to perfect their English so that they can enjoy watching movies, finally breaking the chains of slavery and being free of the subtitles. Joking aside, a group of Dutch people and I couldn't translate something as seemingly simple as "I hate myself for loving you" and ended up having to literally say "I hate myself that I love you". These sound like the same thing, but they really, really aren't. But we're going to have to deal with that in the next issue.

Since I got going, I should also point out that Guus Meeuwis is surely the person you need to recommend to people who want to listen to Dutch music. The guy does an onderweg cover that is way better than the original by Abel. Zeven dagen lang is also another song a beginner as myself will appreciate. In fact, I'm going to go out and recommend Hollandse Meesters by Gus and the New Cool Big Band. It is available at bol.com as well as in YouTube, but let's be honest. You will go to YouTube. As you should. 





Association



As always, the association organises lots of events. In October, Polish students found their way back to Delft after our visit in Krakow in June. Together with them, we paid TNO a visit. Also, the Committee Kick Off took place again this year, and the first other events have been organised.




iCom part one

Boris Mattijssen

Last June we went to Cracow with everyone from the iCom. We stayed in Cracow for five days in a hostel that is located at the prettiest square in Cracow. In this beautiful city the local study association, who guided us through the city and showed off their university, welcomed us. They showed us their favorite places to eat, get some casual beers and party. In Cracow we also visited IT companies, Motorola and IBM, a gigantic salt mine, the imposing Auschwitz and off course the local nightclubs. After the summer holidays the Polish students, who showed us around in Cracow, would come to visit us in the Netherlands. Then the rolls will be switched.

The Polish students arrived last October. Unlike us they did not stay at a hostel. Instead of that we hosted them ourselves. So I had to actually tidy up my room and make sure my new Polish friend had a place to sleep. As with the other Dutch-Polish pairs, there was a bit of a difference in student culture between us. But I was a bit sick at the time so I did not really care having to drink a cup of tea instead of the beer I would normally drink.

Of course the iCom had worked their very to make the Polish have a good time while they stayed here. They had organized a lot of activities to show our Dutch traditions, food and places. We had traditional Dutch dinner (Stamp-pot!) in the /PUB, went on an excursion to TNO in The Hague and visited the even smaller Netherlands, namely Madurodam. Of course we have also shown them the inside of one of our favorite bars in Delft: 'de Ruif', but the difference in student culture I mentioned before made us suspect that their actual presence inside was rather politeness then true willingness. 

iCom part two

Marjolein Bouwmeester


The international trip of 2015, organised by our International Committee (iCom), was a great success. A group of 40 students had a good time in Poland last June, and this October the Polish students had a taste of our life here in Delft, as you can read in the article next to this one. It was a fun and educational trip. An exchange like this gives you a lot of new insights in what it's like to study abroad, work in a foreign country and experience the culture among another student town.

This year the new members of the International Committee will organise another trip. The destination of that trip is yet to be announced while I am writing this, but if you have not been on the trip before, it might be nice to hear some general things about it.

The trip I have been talking about is a visit to a European city. The visit will take five days. In these five days you'll get a taste of the life at, and culture around, a foreign technical university. We will visit the university, meet Mathematics and Computer Science students of that city and, if they have a Study Association, we are going to have a look and see if it is a bit like ours.

Apart from the university, we will also visit some companies. We are selecting companies that are interesting for both Mathematics and Computer Science students; companies you might end up with. It's important, and above all fun, to start a little orienting in any work field you might like. The borders of the Netherlands should not be a limit for you. So let's get international and visit some companies abroad!

There is some time to see the city too. We will add a group activity that will teach us something about the culture, people, habits and/or history of the city we are at.

As you've just read, the trip has a bit of everything. We, the members of the International Committee, think this is a trip you should not miss. Do you agree with us? Keep April free from the 19th till the 23rd! 

Association



TNO excursion

Ilona Post

Thursday, October 8th, an interesting excursion was awaiting the members of 'Christiaan Huygens'. With quite a big group we were heading to The Hague to visit TNO. We went there by train and had to walk for a bit. When we arrived there, the security got us all a nameplate and we handed in our bags and all devices that were able to make pictures. Before this Thursday, some of our personal information had been collected because TNO is working with government secrets and the Ministry of Defence. Our identification cards were checked and we were allowed to go in. It was quite tricky when we found out that some of the Polish students that joined us had forgotten their identification cards, but all went well in the end. It was very clear that it was not very usual for people from outside to come in there since they even joined us for a walk to the toilet to make sure we did not do anything stupid.

First I was very curious whether this business trip would be interesting for me as a freshman and whether the information was of a too high level or not. But now I can say that, although there were more older student with us, it fitted perfectly for me and the other first-years.

The people from TNO started by introducing us to the company. They told us all about the different things they were working on and about all the different branches like the marine, investigation in health, security, and so on.

In some smaller groups we were informed on different issues TNO was working on. Very interesting was the water basin. This basin has a special wall to test small submarines and to investigate sound under water. The basin was once opened by our current Queen Maxima of which they showed us some pictures. The room smelled like a swimming pool so we were surprised by the possibilities of the "swimming pool" for all these kinds of investigations.


Later, we watched a presentation by a woman who had only been working there for one day after spending much time at TNO for her study. She told us all about image recognition. One of the things she explained was how shady, suspicious people or movements on a picture or a security camera can be noticed by the computer itself. This skill can be very useful in situations where thousands of people are together or in places that need to be watched 24 hours a day. It was a very interesting thing to learn about, since it was a subject that is appealing

to both the mathematics and computer science students. It was also a good example of someone who worked on a project in a company like this because we could be just like her in some years from now.

The third presentation was held by a woman who knew all about forensic investigation. She took us into a CSI-like world and showed us all kinds of equipment with which they were able to find fingerprints and bloodstains even from days ago. She taught us that finding some kinds of evidence was a lot harder then it appears to be on television. With her, she had brought an infrared camera. This was super exciting since most of us had never seen or even used something like that before. The infrared camera did not only point out the difference in warmth but also where stains of chemical stuff or fingerprints were left. She could show us those things by just letting behind a fingerprint on a phone screen or watching a dirty piece of clothes through the camera. Very interesting in this part was also that this woman had worked together on this forensic project with students.

Business trips are very interesting because it augments the amount of possibilities we students are aware of. It is sometimes difficult to picture yourself in the future because we cannot always realise what things we are able to do with our studies. But these people, these projects and a company like this shows us some of these possibilities.

In the end we were shown a small museum. In this room were numerous machines that TNO had worked on in the past. There were also old pictures of scientist and investigators. The difference in materials and size of the equipment and machines was very big with those we have now.

After all the serious stuff the TU Delft students, Polish students and some of the businessmen went to the canteen downstairs for a drink and snack where we had the possibility to converse with the people from TNO and ask any further questions we had. 

Big Data als aanjager van innovatie

Senior Director Enterprise Analytics Benelux Gwellyn Daandels

Succes en groei ten tijde van een digitale revolutie

Een nieuw tijdperk met nieuwe regels

De nieuwe regels van het digitale tijdperk zorgen voor een transformatie van complete branches. Het tempo van veranderingen ligt zo hoog dat gevestigde bedrijven van de ene op de andere dag aan marktaandeel kunnen verliezen, terwijl nieuwe uitdagers een koppositie innemen. In het huidige klimaat is het vermogen van bedrijven om succesvol te blijven – en in sommige gevallen zelfs te overleven – afhankelijk van een effectief gebruik van de nieuwe informatie die door het digitale tijdperk wordt ontsloten. We noemen deze informatie, die mensen, organisaties, processen en producten omringt, Code Halos.



Moderne bedrijven staan voor de opgave om in zeer korte tijd enorme hoeveelheden ruwe gegevens te verzamelen, verwerken en analyseren. In het bijzonder strategische beslissingen vragen om snelle analyses en inzichten. Klassieke methodes voor informatiebeheer die gebruikmaken van datawarehouses, BI-tools en de traditionele waterval projectaanpak lopen langzaam maar zeker tegen hun grenzen aan. Een onbevangen kijk naar de oorspronkelijke informatie en een analyse daarvan zijn van essentieel belang om innovatieve ideeën te genereren, ontdekken en onderbouwen. Moderne bedrijven hebben daarom een nieuwe manier nodig om informatie te beheren.

Om succesvol te blijven moeten zij 'outside the box' denken, nieuwe mogelijkheden verkennen en een omgeving creëren die innovatie stimuleert. Ze moeten de interacties van Code Halos analyseren, doorgronden en op effectieve wijze benutten.

Het laboratorium voor nieuwe ideeën

Big data wordt vaak beschreven aan de hand van drie of meer Engelse woorden die ieder met de letter V beginnen. De meest voorkomende daarbij zijn volume, variety en velocity. De data is 'big' omdat het grotere volumes betreft, omdat de variëteit van formaten verder gaat dan de traditionele tabulaire vorm, en omdat de data met enorme snelheid tot ons komt.

Veruit de belangrijkste letter V staat echter voor 'value', oftewel waarde. Het centraal stellen van waardecreatie middels data en analyses is niet nieuw en is al sinds de eerste dagen van datawarehouses en business intelligence de grote belofte. De realiteit toont echter dat veel van deze initiatieven gestrand zijn in het automatiseren van bestaande Excel rapportages, zoals die van de financiële afdeling of de verkoopafdeling. De enige waarde die ontstond was kostenreductie van de bestaande processen en systemen. Nieuwe ideeën werden hoogst zelden middels data analyses getest, omdat automatisering alleen dan zinvol is als een proces – het produceren van een rapportage – op schaal plaatsvindt, dus voor meerdere mensen en/of op regelmatige basis.

In de huidige tijd waar producten in een mum van dagen door concurrenten gekopieerd worden en processen en organisatiestructuren onder invloed van de nieuwe economische realiteit zover mogelijk gerationaliseerd zijn, richt de concurrentieslag zich vooral op de klant zelf. Het success – of zelfs overleven – van bedrijven is afhankelijk van de capaciteit om snel op de mogelijk nog sneller veranderende vraag van klanten in te spelen. Men moet dus niet alleen snel nieuwe producten en diensten middels wendbare en efficiënte processen op de markt kunnen brengen, maar veel meer moeten bedrijven deze diensten en producten baseren op betere en snellere inzichten in de wensen, voorkeuren en behoeftes van hun klanten. Daarnaast is het van belang om snel inzicht te krijgen hoe diezelfde klanten op nieuwe danwel aangepaste producten en diensten reageren, zodat men snel bij kan sturen om optimale zakelijke resultaten te behalen.

Eigenlijk zijn de andere drie V's een afgeleide vorm van deze focus op waardecreatie voor de klant. De data over de wensen, voorkeuren en behoeftes van klanten heeft tegewoerdig niet meer middels rondvragen op straat in kaart gebracht te worden. Deze inzichten kunnen middels toepassing van moderne analytische technologie op de combinatie van data uit enerzijds snel opkomende sociale media, mobiele platformen, en sensoren, en anderzijds de traditionele systemen ontstaan. De data van deze nieuwe bronnen komt typisch in grote volumes, continue en in niet traditionele vormen tot ons.

De noodzaak om nog onbeantwoorde vragen middels data te kunnen adresseren, op hun waarde te kunnen testen alvorens ouderwetse data productielijnen te bouwen, leidt tot de vorming van analytische laboratoria. Net als bijvoorbeeld



in de farmaceutische industrie, worden er in het laboratorium een pijplijn van innovatieve ideeën middels data en analyses getest op hun waarde. Pas als de waarde bewezen is, en er behoefte is aan een optimalisatie van het produceren van deze inzichten, zal een zogenaamde data en rapportage productielijn opgebouwd worden om de kosten voor het produceren van de inzichten te optimaliseren.

Parallel aan het voorbeeld van de klinische pijplijn bij farmaceuten, zullen ook niet alle geteste ideeën waarde toevoegen. Dit vereist een andere instellingen ten opzichte van waardecreatie. Niet ieder analytisch experiment leidt tot een positief resultaat, en een case-by-case berekening van het rendement is dan ook niet zinvol. Echter zullen de positieve resultaten van sommige onderzoeken dusdanig indrukwekkend zijn, dat zij de kosten voor de niet renderende onderzoeken meer dan goed maken. Men moet data en de analyse ervan dus als een strategisch initiatief behandelen, en geloven in de waarde van het geheel. Met andere woorden, zonder de overtuiging en het geloof van het top management en de daarbij passende bedrijfscultuur is de kans van slagen gering.

Het goede nieuws is dat de toegankelijkheid van de middelen om de belofte van big data waar te maken ongekend is. Door de rase opkomst van cloud modellen in combinatie met open source software, en bedrijven die deze elementen bundelen in platformen met abonnements-vormen moeten er geen grote investeringen in infrastructuur en licenties gedaan worden, alvorens experimenten uitgevoerd worden. Bovendien kan de benodigde opslag- en berekencapaciteit op basis van de actuele behoefte eenvoudig aangepast worden. Iedereen kan dus snel, makkelijk en kostengunstig zo'n laboratorium inzetten.

Een Big Data-platform voor nieuwe ideeën en innovaties

Nieuwe ideeën en waarde ontstaat uit de combinaties en interacties van de Code Halos. De succesvolle bedrijven in deze nieuwe wereld hebben allemaal iets gemeen. Hun experimentele zone wordt gevormd door een platform waarin onderstaande mogelijkheden optimaal gecombineerd worden.

Het platform moet zo nauwkeurig en uitgebreid mogelijke informatie bevatten die van Code Halos is verkregen. Met nauwkeurigheid wordt hier bedoeld dat de ruwe gegevens hooguit technisch zijn verwerkt, bijvoorbeeld door van een bepaalde opmaak te zijn voorzien.

Er wordt gebruikgemaakt van een catalogus als bewaarplaats voor technische en zakelijke meta-informatie, waarmee de inkomende data verrijkt wordt. Het is de bedoeling om deze meta-informatie te verzamelen tijdens de eerste verwerking van de ruwe gegevens, idealiter met behulp van geautomatiseerde processen. De catalogus is ook de plek waar feedback van zakelijke gebruikers, opmerkingen ten aanzien van de betrouwbaarheid van de data, en semantische verbanden worden opgeslagen. De catalogus en zijn automatische indexingssysteem bieden de mogelijkheid om Code Halos en hun verbindingen en interacties te verkennen en daar inzichten uit te destilleren.

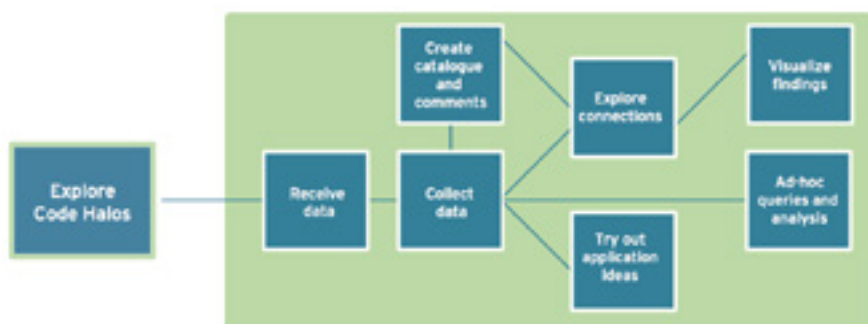


Figure 2: Het ontginnen van de waarde die in Code Halos opgesloten zit

Om Code Halos te kunnen analyseren, hebben zakelijke gebruikers en datawetenschappers een verscheidenheid aan hulpmiddelen nodig. Datawetenschappers maken vaak gebruik van wiskundige tools en algoritmes om naar statistische verbanden tussen Code Halos te zoeken. Vervolgens moet de functionele betekenis van deze verbanden worden onderzocht. Zakelijke gebruikers hebben een makkelijke en intuïtieve manier nodig om Code Halo-analyses in diagrammen en grafieken weer te geven en interactief te rangschikken. Dit maakt het makkelijker om verbanden te ontwaren en presenteren.

Zoekindexen en meta-informatie vereenvoudigen de zoektocht naar waardevolle informatie en bieden de mogelijkheid om in te zoomen op specifieke data. Voor het uitvoeren van flexibele zoekopdrachten en het genereren van ad-hoc-rapporten – bijvoorbeeld ter ondersteuning van de strategische besluitvorming – hebben zakelijke gebruikers behoefte aan tools die geen gedetailleerde kennis van de technische structuur van de data of de query-taal vereisen en evenmin ondersteuning door ICT-experts.

Ten slotte moet de mogelijkheid aanwezig zijn om omgevingen te creëren en te beheren voor het uitproberen van nieuwe ideeën zonder dat dit gepaard gaat met een al te grote inspanning of torenhoge kosten. Dit maakt het mogelijk om nieuwe plannen snel en flexibel in de praktijk te testen.

Samenvatting

Steeds meer bedrijfssectoren ondergaan ingrijpende veranderingen als gevolg van de toenemende digitalisering, groeiende datavolumes en opkomst van Code Halos. Bedrijven die succesvol willen blijven, moeten snel en flexibel opereren. Een essentiële vereiste hiervoor is het gebruik van een op Big Data gebaseerde experimenteerzone die hen in staat stelt om uiteenlopende Code Halos en gerelateerde meta-informatie te verzamelen en daar zakelijke inzichten uit te destilleren. Met behulp van de juiste tools kunnen dataspecialisten en zakelijke gebruikers onderlinge verbanden tussen Code Halo-informatie verkennen en visualiseren, het besluitvormingsproces ondersteunen met ad hoc query's en nieuwe toepassingsideeën analyseren en in de praktijk uitproberen. Bedrijven moeten voortdurend blijven zoeken naar nieuwe manieren om Code Halos in te zetten om hun zakelijk success te vergroten. Innoveren door het benutten van nieuwe informatie moet uitgroeien tot een gewoonte.

Wil jij bedrijven helpen bij dit soort ontwikkelingen?

Cognizant is op zoek naar jong talent om hierbij te helpen. Je kunt starten als developer (front end of back end), data scientist, quality engineer of business analyst: kijk op www.cognizant.com/careers of neem contact op met onze graduate recruiter: leonie.westerman@cognizant.com

Gwellyn Daandels, Senior Director Enterprise Analytics Benelux





Committee Kick Off!

Davey Struijk, Lotte Bryan, Menno Looman, Sterre Noorthoek

There is a no doubt about it: the committee Kick-Off 2015 was awesome.

It consisted of a GPS hunt through the city centre of Delft. Every team

got a GPS and a piece of paper with photo's we had to recognize on each

point. For each correct photo you received a text message with a hint to

solve the primary question: who is the murderer? And equally important:

where is the treasured beer recipe only the victim was known to have?

Here are a few reports from different committees who participated.

Sjaarcie

Participating in the Committee Kick Off is often a lot of fun, but there is one thing that makes it even more fun: winning. When the team captain showed up 15 minutes late and didn't even know she was the team captain, everyone had given up most of the hope. With no time to lose, we picked up a steady pace and after some time we had found quite a few photo's: not an easy task as it was late and dark. Two of our team members got a lot of exercise during the running tasks, but the thing that got our hearts racing the most, was the haunting text we got: 'someone is coming for you. He/she may be walking or riding a bicycle. If you let them tag you, your team loses 25 points.' From that point on, every person we saw was a possible culprit, which made us extremely paranoid. It even escalated up to the point where we started running from an innocent pedestrian, which was very embarrassing when he passed us with a puzzled look in his eyes.

Eventually, the point when we had to send the identity of the murderer arrived. Our team's mastermind had come up with an extensive theory and... she was right! But even with the location of the prized beer recipe, it took a ten minutes search and even a small fight to seize the prize. Of course we would have gladly won just to show everyone how amazing and capable the Sjaarcie is, but there was no complaining when we saw the real prize: two cases of World Beers!

MatCH

On November 10th, 'Christiaan Huygens' organised the Committee Kick Off: An event for all new committee members, consisting of a GPS hunt and dinner afterwards. Our committee — the MatCH — and the MeisCie formed a team together. The MeisCie was wearing red ribbons and members of the MatCH were dressed up as bees.

We gathered at the market and began with the GPS hunt immediately. Our instructions were to solve a murder case by gathering clues throughout Delft. The whole team was feeling pretty competitive in the beginning, though after a while we decided to just have some fun. A couple of team members urged themselves to the supermarket to grab some beers, while the others had already found an 'evening store'. The guys returned quickly thereafter and even

brought some chocolate bars along the way. What followed was a fun evening of running around the city, making terrible jokes and the occasional encounter with other teams.

When the final moment arrived to 'solve' the murder case, we guessed wrong so many times that we ended up last with -200 points. We caught up afterwards with the other committees at Billy Beer, where some nice burgers were waiting for us. All in all we had a great time and were super happy with our 'troostprijs' (more chocolate bars!) and our absolute winning score!

AnnuCie

Tuesday some weeks ago, there was something special. The new people from Board 59 had invited all the committees for an event they had organised, the Committee Kick Off. This is because the committees do a lot of stuff for the student association. I was invited this year to do the AnnuCie, this is a committee that makes the Annuario (or "almanac").

Back to the Kick Off. Me and my committee mates were grouped together to play the game that was organized. We had to search for precise details and link them to the location where you could find that detail in Delft. Between the search for pictures there were other assignments you could do for more points. After the whole running and searching through Delft, we were eating at Billy Bear. A restaurant in Delft, famous for their unlimited spareribs on Wednesday. There we also got a presents from our QQ'er (Qualitate Qua). It was a mini measuring cup so we could be very precise at how much we were drinking. After the dinner we had and all the crazy festivities, I left the place to end my evening at my sport association for another beer and some free "bitterballen".





ADSL 2015

AkCie

Op woensdag 18 november werd de /Pub omgetoverd tot een spacebar voor de ADSL (Algemene Docenten Studenten Lounge), de allereerste activiteit georganiseerd door de nieuwe eerstejaarscommissies. Een ware eer voor deze gloednieuwe, onwetende sjaarschjes. Er moest veel worden uitgezocht en gedaan om de /Pub gereed te maken voor het groot aantal verwachte mensen. Wie wilt er immers geen gratis bier drinken met docenten! Hapjes, drankjes, versiering, pizza; er was veel verwacht van dit evenement en toen we met een aangeschoten kop terugkeken op de avond met het laatste biertje in ons hand waren we als AkCie zeker tevreden.

Voorbereiding

Ter voorbereiding van de ADSL moesten er verschillende dingen geregeld worden. De /Pub moest worden gepimpt in het thema van de avond: InterAkCie in je ruimtepAkCie. Ook moesten er inkopen gedaan worden voor de hapjes en knabbeltjes. En de AkCie moest er natuurlijk vooral voor zorgen dat jullie allemaal kwamen! Iedereen heeft zijn taken fantastische uitgevoerd. De /Pub was fantastisch versierd met sterretjes, raketten en aluminium folie, er kwam wel 200 meter aluminiumfolie aan te pas om de hele /Pub te bekleden! Team Frituur heeft boven de frituurpan staan zweten om bitterballen te verzorgen. Hapjes werden snel en vaak verversd door Team DoeEensWat. En heel de commissie heeft voor het hypen van het evenement hun best gedaan door tijdens de pauzes in hun bekende galaxy-truien nietsvermoedende studenten lastig te vallen met beloftes van gratis bier.




De avond zelf

Om 16:00 ging de ADSL van start en al snel liepen de eerste dorstige studenten binnen. Die konden jammer genoeg nog niet gratis aan een pilsje komen, doordat de docenten nog druk bezig waren met het nakijken van de tentamens. Uiteindelijk, om een uurtje of 17:00 druppelden de eerste docenten binnen, gevolgd door een golf studenten om 17:30, nadat de laatste colleges waren afgerond. Prime Time incoming baby. De frituur stond vol op aan om de intense gesprekken te verwennen met een momentje stilte, terwijl je je tong verbrand aan een te hete bitterbal. En stiekem, helemaal achter aan de bar, kwamen de eerste gratis pinten uit de tap.

Pizza's werden besteld, raketten vielen uit elkaar, de eerste studenten begonnen door te krijgen hoe leuk het is om met aluminium folie te spelen. De avond was volop in gang. Docenten bleken meer te kunnen dan je in slaap lullen in college. Overal om me heen hoorde ik enthousiast gelach, geïroost en goede verhalen. De hapjes gingen hard en de pizzalist stond al propvol.

Alle docenten hadden het reuze naar hun zin. Althans, degene die ik heb gesproken. Er waren er namelijk te veel om een voor een te spreken en al hun verhalen te horen- maar gelukkig precies genoeg om iedereen te voorzien van wat bier hier en daar. Cor Kraaijkamp zat bier uit te delen alsof hij snoepgoed strooide op 5 december en Mark Veraar heeft de ADSL zelfs uitgespeeld! De docenten die tijd van hun familie, kinderen, schoonmoeders etc. hebben genomen om toch te komen integreren met studenten (en/of genieten van het gratis bier) hebben de ADSL gemaakt tot het spektakel dat het was. Fantastisch!

De pizza was lekker (toen die eindelijk kwam) en de hapjes raakten langzaam maar zeker op. Zelfs de AkCie had niet kunnen voorspellen dat de ADSL in zulke grote getalen zou worden bezocht. De studenten die zijn gekomen, ontzettend bedankt! De studenten die dit evenement niet hebben mogen mee maken: jullie weten nu wat je gemist heb, en ik hoop jullie daar volgend jaar te spreken.

Dank jullie wel voor de top avond en ik hoop dat iedereen er evenveel van genoten heeft als de AkCie! 



WiFest: WiFindest du eine Party mit Anton und Heidi?

Niek van der Laan

Have you heard about the WiFest? You probably have, it was the most amazing party of the year! The night where Tiroler pants and Dirndls were common wear and the best DJ's of CH made sure we all had a great night.

Theme of the night: "WiFindest du eine Party mit Anton und Heidi? Alles hat ein Ende nur eine Wurst hat zwei. Schnee Mann, ich will noch nicht gehen!".

This party was organised by the WiFi committee. With their outstanding outfits that consist of pink Tiroler clothes and fancy pink hats, they cannot be missed. If you haven't seen them by now, you are doing something wrong since they occasionally wear these outfits, even at EWI. Recently they were promoting the skiing vacation in front of CH by setting up a Wii. They then invited all people passing by to give it a shot at setting a high score on the virtual ski slopes. The WiFi organises an epic skiing vacation, a still secret activity and this unforgettable WiFest.

The party was held Thursday the 26th of November at Feestcafé de Tobbe. This café seemed small from the outside but luckily inside it was much bigger than expected. The place was decorated with inflatable pretzels and pink garlands to get everybody in the right mood. The WiFi was excited to see that many guests put effort in their outfits as well. Hats, dirndls, lederhosen and braids were spotted everywhere. Even those who were not able to afford themselves a suitable outfit came in other fancy outfits, among which soup cans and beer pulls. Of course, the traditional zoo came by, as everyone in Delft owns several animal suits.

At 22:00 the party started and the first guests started to enter. Upon arrival, everyone older than 18 got a Flügel welcome drink and went to the dancefloor to party. Soon the dancefloor got crowded and everybody met up with their friends. Because the party is organised by our own study association, you don't need your best pick up lines to meet new friends, as you basically know

everyone around you already. The party also offers our freshmen a great opportunity to get together with their new friends. However, this time without a deadline, because 'gezelligheid kent geen tijd'.

At the dancefloor the DJ's played great tunes. The night started with DJ Sprokkereef. He came all the way from Amsterdam to play at the WiFest and certainly didn't let us down. He played great variation of music, including but not limited to house music and popular hit songs. This offered everyone a great opportunity to show everyone their fresh dancemoves. We have seen the well known cosine and sine dance moves, but one of you even showed mastery of the 'tangent move'. Next came DJ Struijkrover, a very familiar face at all our study association party's. He continued to play great music to dance to, and also played some Après-Ski hits for us which made the WiFi very happy. Some of our favorites are 'dicke tetten kartoffel salat', 'scheiß drauf' and '99 luftballon' (or was it 59 luftballon?). Last but not least was LK Law with his buddy. This is a pair of DJ's and one of them is a freshman at CH. They played some awesome deep house and trap music, completely blowing the people away if they hadn't been blown away already. As usual, everyone gets a little looser towards the end of a party (I wonder why), so no one was shy to go absolutely crazy on the dance floor. After this performance we are sure that we will see them again at some other party's of our study association.

Unfortunately, alles hat ein Ende (nur die Wurst hat zwei), so also this party had to end. At 4:00 everybody had to leave and the WiFi could look back on an amazing night. Right now we are even more excited about the skiing trip that's going to take place! The registrations went really quickly and we expect the Wispo to be even more epic than last year. But even if you can't join the skiing trip, there is something to look forward to. We can't give any details about our secret activity yet but it will be worth the wait!

To conclude this article we, on behalf of the whole WiFi, want to thank everybody who came to the WiFest for the amazing night! Tschüss! 🍷



Computer Science



The Computer Science department has a lot of different interesting fields in which they do research. In this issue, the chairman of our association will tell some more about his interesting Bachelor's thesis, Danique tells some more about her SEM-project and Friso writes about his Master's thesis!



Predicting Task Throughput in Human Computation Systems

Friso Abcouwer

Human computation platforms offer requesters the possibility to outsource human intelligence tasks or HITs to large amounts of workers around the world. Researching the various aspects of human computation task design has the potential to improve the human computation experience for both requesters and workers. In my Master's thesis, I researched the relationship between quantitative aspects of human computation tasks and the perceived complexity of these tasks.

Introduction

In recent years, exponential increases in easily available computing power have enabled computer systems to complete tasks that used to be considered impossible or would have taken days, months or even years to complete. This increase in computation speed, however, has not led to computers being able to perform complex tasks such as those involving subjective judgements or natural language processing. While progress is being made in finding fully automated solutions for a lot of these types of challenges, for a very large amount of problems, state of the art automated solutions do not come close to providing a solution that can rival the performance of an average human working on the same task. However, work done by humans is usually significantly more costly and time-consuming, and the quality of the results can also be unpredictable.

A compromise in solving this dilemma can be found in the field of **human computation**. By **crowdsourcing** those tasks that can be completed more easily by one or more humans than by itself, an automated system can offer solutions to problems it would normally not be able to solve on its own, while still offering advantages inherent to an automated system like reliability, speed and low cost. Tasks completed by humans on such platforms are called **Human Intelligence Tasks**, or **HITs** for short. HITs are divided up into HIT groups or *batches*: a single task might have hundreds or thousands of instances, where the same task is performed with a different input value. An example of this might be a HIT batch of translation tasks: the interface is the same for every instance, but the text to be translated is different.

In my thesis, I attempted to measure the complexity of human computation tasks based on their attributes. In this article, I will describe how I measured complexity based on attributes, and elaborate on part of my research: several experiments I conducted to predict HIT throughput based on their objectively measurable attributes.

Measuring Complexity

Because previous research into human computation and HIT design had not yet focused on the complexity of a task, I chose this as the area of focus for my own research. Before I could measure complexity, I needed a proper definition of it for the purposes of my own research. In my thesis, I used the

following definition, based on work by Campbell [1]:

*The **complexity** of a HIT can be approximated by the sum of the complexity of its objectively measurable attributes, as perceived by its workers.*

Based on this definition, which focuses on an *objective* approach to measuring task complexity, I selected three attribute categories from which to measure task attributes. These were the following:

- **Metadata:** attributes that are unrelated to the content of a HIT group, but are instead made up of task metadata like the required qualifications or the HIT description.
- **Content:** attributes that relate to the HTML content of the HIT group, or in other words, the actual body of the task. These include basic HTML attributes like the word count or amount of script files used on a page, but also more advanced semantic features relating to the keywords and unigrams in the task body text.
- **Visual:** attributes that relate to the visual complexity of a page, based on visual decompositions of a page or the use of colors on a page.

To measure attributes in all three categories, I constructed a system to crawl data from Amazon Mechanical Turk, the largest crowdsourcing platform on the Internet. This tracker was based on previous work by Panos Ipeirotis [2]. The additions I made made it possible to restore HITs much more accurately than before: this meant it was also possible to obtain measurements of visual complexity by using screenshots of reinstantiated tasks. I will not discuss the tracker in detail here, opting instead to focus on my experiments. Readers interested in the tracker are welcome to read Ipeirotis' paper or my full thesis, which is available on the TU Delft repository. For now, the most important thing to know is that the tracker was run continuously for a week, and delivered a set of HIT batches for an entire week, including measurements of their task attributes and market statistics for the period in which the tracking took place.

Predicting Throughput

In addition to the data crawled by my own tracker, I obtained a very large dataset that was used in a previous research by Difallah et al. [3]. They used market data and Metadata attributes of tasks to predict *task throughput*, defined as the number of tasks in a batch that are completed within a given hour. I chose to repeat this experiment because it can be argued that throughput is in some ways a proxy for task complexity. Existing research, including work by Rogstadius et al. [4] has shown that a more complex task will typically take longer to complete. It is important to note that Difallah et al. wanted to predict market movement, while I was interested in task complexity. This leads to differences in the approach used. For example, to maximize task diversity and prevent large amounts of nearly identical HITs dominating the dataset, I filtered the data to only use one HIT per task type per requester.

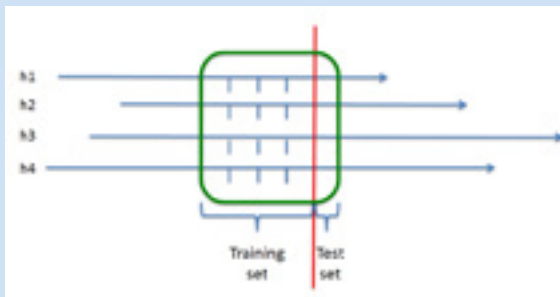


Figure 1: Throughput Prediction Experiment

To perform this experiment, the data is used as shown in Figure 1. Given the HITs active on the market during the time the tracker was active, we split the measured time interval up into blocks of 5 hours. For each block, the task attributes and first 4 hours of market statistics and throughput data (training set) are used to train a regression model, and the model is then asked to predict throughput for the fifth hour (test set). The results of these predictions altogether then form a result from which a Mean Absolute Error score can be derived - in other words, a score that indicates how close the prediction was to the actual measurement. While I tested several regression models, I will only discuss the results for the most successful one in this article, which was a Random Forest model similar to the approach used by Difallah et al. We can also see which task attributes (used as input for the model) contributed most to the prediction, or in other words, how important they are to predict what we want to predict. Because this article is in the Computer Science section, I won't go too much into the numbers and use some easy-to-understand graphs instead!

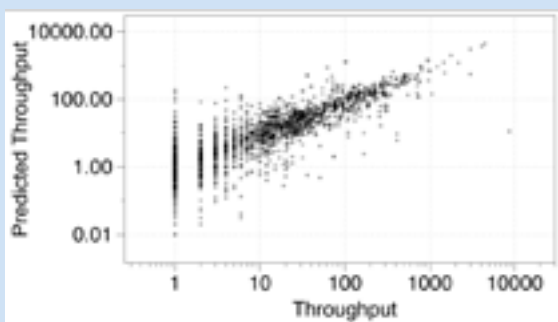


Figure 2: Predicted vs. Actual Throughput - Historical Dataset

Figure 2 shows predicted versus actual throughput when we performed our experiment on 5 months of Amazon Mechanical Turk data that was also used by Difallah et al. These results are similar to their own, with some key differences. In their experiments, market statistics such as the amount of initial HITs in a batch were critical to the prediction. However, in our dataset with more HIT diversity, several semantic features of tasks were almost as important to the prediction as market statistics. It can be seen that predicting throughput is much easier as the value of throughput (or batch size) increases.

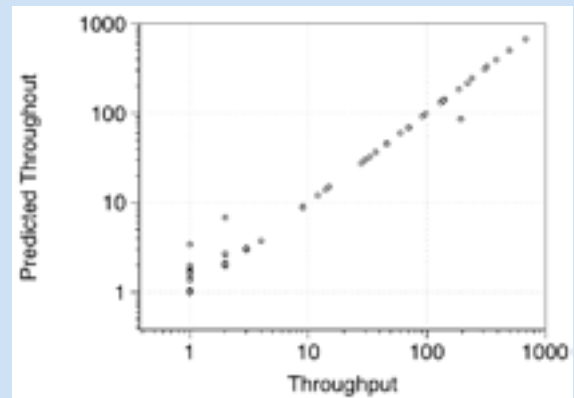



Figure 3: Predicted vs. Actual Throughput - New Dataset

This was also visible in the experiment performed on the dataset collected using the extended tracker, of which the results are shown in Figure 3. Predictions for actual throughput values smaller than 10 had a mean error rate of over 11%, while predictions for actual throughput values of 10 or greater had an error rate of approximately 3,6%. Because this dataset is much smaller, it is easier to see the difference. However, because of its reduced size, it is difficult to draw conclusions about the entire market from just this sample. What was found based on these experimental results did not differ much from the results of other experiments, however: market statistics and semantic features are both important in predicting throughput. Another notable conclusion was that while this dataset added visual features to the prediction, none of these features had a significant contribution to the end result.

Conclusions

By measuring task complexity in an objective way, it is possible to measure it as a function of task attributes. One way to apply this knowledge is to perform a throughput prediction experiment, which can tell us more about the complexity and quality of design of tasks and how these aspects relate to the attributes of the tasks. In my thesis, I further discuss the implications of this for task design and also compare the objective approach to a subjective complexity score for a set of tasks that was collected by performing a survey among crowd workers. If you are interested in reading more on the subject, my full thesis can be found in the TU Delft repository. 

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1

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3

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4

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Chemical Engineering
- **VSV 'Leonardo da Vinci'**
Aerospace Engineering
- **W.I.S.V. 'Christiaan Huygens'**
Applied Mathematics and Computer Science

IMPORTANT DATES

21st of January:
Deadline reduced
entree fee

24th of February:
Deadline registration
for In-House Days and
Interview Days



The Sensitive Office

Daan Rennings



It's Friday the 23rd of January, nearly a year ago. Simon Kassing, my bachelor end project (BEP) partner, and I are waiting just outside the office of professor Houben of the Web Information Systems group, at the 8th floor of EEMCS. In his office we meet Robert-Jan Sips, a research lead from IBM. About an hour later, we leave the office, with the knowledge that we will do our BEP at IBM, the company that developed the first personal computer. You can imagine our enthusiasm.

Fostering employee well-being

Before we jump into the research question of our project, let's start with a cliché. A commonly known proverb states: "money can't buy happiness". Some will agree and others won't. But what does science tell us? And how does this relate to the modern working environment?

Well, if we focus on employees, it seems that they do not care as much about salary as you might think. We can conclude that employee well-being currently plays a bigger role in their job satisfaction [1], so let's keep that in mind. Another thing to take into account is the modern age we live and work in, something we, as engineers, should definitely take advantage of. The up rise of Ubiquitous Computing (UC) and the Internet of Things (IoT) is namely promising to have a disruptive effect on various domains [2], among which the Enterprise Environment (EE) is also an important domain. Which brings us to a question that will become more and more important: how can we foster employee well-being through the EE in the current age of UC and the IoT?

From this question our work started. The thinking described above was namely already done by our supervisors and had led to IBM and TU Delft collaborating in research in the area of the Inclusive Enterprise, an enterprise "advocating well-being and inclusion as core properties of next generation enterprises" [1]. Under the Inclusive Enterprise topic, several research projects were initiated regarding the physical and emotional state of an employee. It was up to us to develop a system that can measure environmental factors that might have an impact on employee well-being.

The Sensitive Office

Over a period of ten weeks, we developed this system and named it "The Sensitive Office". The system is a demonstrator for sensing several phenomena such as temperature, light-intensity and humidity at a human centric scale in the enterprise environment by means of a sensor network. That's a bit of a bulky sentence, so let's elaborate on its origin and relation to the question stated in the previous paragraph.

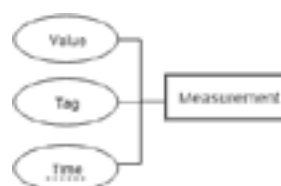
When you enter a room, you feel for instance the temperature and humidity and see the light-intensity, factors that might influence the way you feel while being in the room. If the temperature is too high, you can shut down a heater. If the light-intensity is too low, you switch on a light. In most buildings such actions are automatized by a Building Management System (BMS). These systems measure for instance the temperature of the room with

several sensors in the ceiling and regulate the temperature based upon those measurements, but may also automatically switch on a light when you enter a room. A downside of using a BMS is that measurements are not done at a very precise scale and granularity and these systems are also found to be difficult and expensive to change (since those BMS's are often installed during the construction of a building and are deployed at fixed positions) [3]. Therefore, with a BMS, we can't really sense the environmental factors at the scale of the working place of a single employee. On the other hand, we would need measurements at such a scale if we want to say something about the influence of environmental factors towards employee well-being. Time to look outside the use of a BMS to get the measurements we need for our research.

Based upon a literature study we did preliminary to this project (together with two other students [4]), we concluded that a sensor network would be the perfect candidate for this job. Such a sensor network would comprise several sensor nodes that are responsible for doing measurements. This would result in a system that is easy to deploy and adapt in an enterprise environment, since you are in control of the placement and type of the sensor nodes. Of course we asked ourselves whether the system we were looking for, already existed. But when we looked at existing solutions in the field of general wireless sensor networks and human centric sensor networks (e.g. Medusa, PRISM), we found that these solutions did not fit our problem. They were for typically still in a prototypical state or licensed commercially nonviable. We concluded that we would have to develop our very own system, instead of relying on clunky research projects.

From Data to System

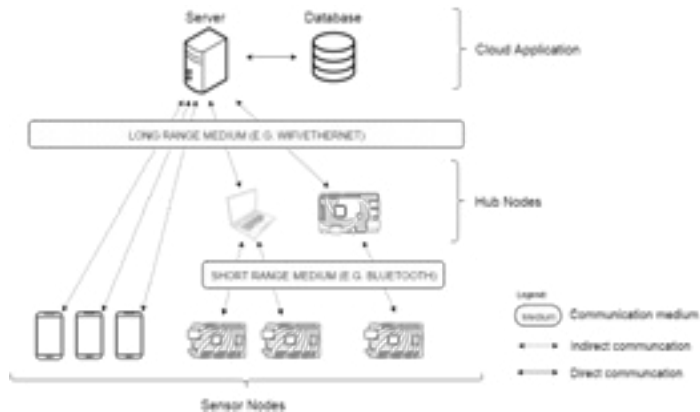
So how do you create a sensor network system that can sense in an office environment? Well, we started with the end in mind [5]. And if you think of it, the data delivered by the system would actually be the endpoint of our project. Therefore we started with developing a data model. We did so by looking at the measurement centric and device centric requirements we assessed together with the customer and created an ER model that would fulfill them. We actually started with a single entity, which depicted the actual data we needed, as you can see in the figure below. But in order to keep the system controllable, we needed to have a whole bunch of other entities and relationships as well, forming a total scheme of 10 entities (and 11 relations and 39 attributes). For instance, we would need an entity to hold the location of the measurement, an entity for the device that did the measurement and an entity to for the sensor on the device that did the measurement (if you're wondering why the latter two entities would be handy, think of one sensor at a certain device being broken, producing bogus measurements).



Good, we have a data model. But how do we actually get this data? If we do it backwards – from data to origin, we need a database to store and access

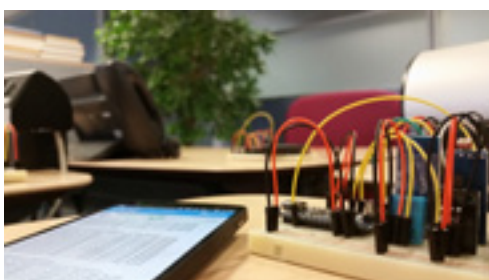


the data, we need a server to regulate the communication processes, and we need sensor nodes to do the actual measurements. As you can see in the figure below, we used two types of sensor nodes.



On the right hand we have the Arduino sensor nodes. These nodes simply consisted of a breadboard with an Arduino and a Bluetooth chip for processing, some dedicated sensors for sensing the environment and some wiring to connect everything. These sensor nodes are very cheap and do provide really precise measurements. The only problem with these sensor nodes is their limited communication capabilities regarding speed and range. We therefore had to use hub nodes (e.g. laptops or Raspberry Pi's, with a stronger communication signal and higher processing rate) to form a communication channel between the sensor nodes and the server, to make sure all of the measurements would be delivered, even if connections failed for a short amount of time. We did use another group of sensor nodes though. The problem with the first group of sensor nodes is that these sensor and hub nodes would have to be deployed by ourselves (except for the laptops, which were already out there). But what about devices that are already out there? Can't we use those to make our solution even cheaper and easier to deploy?

Yes, we can! To this end, we created an Android application, enabling us to use the sensors of the smartphones of the employees (see the figure at the bottom), which they already carried with them anyway. Though, there is one thing to keep in mind: the measurements of these sensors are more biased (towards usage of the phone, type of the phone, place of keeping, etc.) than the measurements obtained from the Arduino sensor nodes. How about combining the two? Giving us both reliable measurements from the Arduino's to use as a baseline and measurements from the smartphones that can therefore be corrected and done without actual deployment. In the end, thorough analysis of the data provided by both groups of sensor nodes would maybe allow for leaving out the Arduino sensor nodes, only making use of devices that are already out there. Due to our limited timespan, we unfortunately had to add this feature to our "future work" section, but we did create a basis that would allow for realizing this feature.



Making Programmers Happy

Now you have a basic understanding of the system and its background, I want to say two more things about our project. First of all, if you're interested in the details of our software implementation of the project, I would recommend you to read our public report [3], which does go into detail about the hardware, the software and the research we did, whereas here I try to stay at a more abstract level for the broader public. Second, since we created a project that had to be built upon in the future, the quality of our product in terms of validation was also an important factor that I haven't enlightened here yet. So how do you get a high quality software project? Well, we started out by adopting an agile approach, but that can be considered to be a requirement instead of a rarity for bachelor projects, or software projects in general, I guess. What truly was special about our project was the thorough documentation and extensive testing of every component (at the level of units, components and the whole system). Next to this, we used a tool named Sonarqube to inspect all of the code elements to improve on metrics such as complexity and duplication, but also to adopt a standardized code-style. That's how we aimed to get a product of high quality, trying to make future programmers happy with the work we did.

Worth your while

Did I enjoy the project? Well, of course I did. It was a wonderful experience to work within the Inclusive Enterprise research line at IBM, accompanied by an internship at their HQ in Amsterdam. Just like any other bachelor end project it was cool to develop a complete software product by ourselves from scratch. A thing I particularly liked about our project was the knowledge that the product would be further developed within IBM and was part of a bigger whole. Something we could also sense when we were working at the office at a floor together with all of the other interns from all over the world, doing research in similar fields. To top our experience off, we also got some great news just after finishing our project. Two days after our final presentation we namely heard that even the Wall Street Journal was talking about our work. Although our names were not stated there and my partner and I had to settle for a reference of "two Delft University of Technology students" [6], it gave us really the feeling that we accomplished something in those 10 weeks. On the other hand, I do have to say it was not a coincidence we stepped into the elevator on the 23rd of January with a big smile. We namely did spend a considerable amount of time to get such a project at such a company. I hope I have convinced you that it may be worth your while as well when you're looking for a bachelor end project. Companies and research groups will have quite some projects to be executed by students like you, but that comes second. Start with thinking about what you want to achieve with your bachelor end project, it may bring you quite some enthusiasm in an elevator!



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Software Engineering Methods

Danique Lummen

The second year started on the first of September for most second year students. The first class we had was for the course Software Engineering Methods, and we could immediately see that they expected a lot more from us, now that we managed to succeed the first year and continued to the second.

We started off with the project that we would have to do that semester, and found out that it was about making a game! It sounded like a lot of fun, but after finding out that the deadline for a complete working game was within nine days, it started to seem like a little bit less fun and a lot more like hours of hard work. In groups of six people, we were given a choice between six different games which we could implement and expand ourselves. The choices were: Space Invaders, Bubble Bobble, Bubble Trouble, Temple Run, Fishy and Bejeweled. Me and my team decided to go for the game Fishy which we were planning to transform into 'Fishy' game without fish, but maybe with other animals or even aliens. During the whole process of the project all groups were obliged to work in sprints of four days, in which we created the sprint plan during the group session on Tuesday and had to hand in the deliverable on Friday evening.

All the assignments had some exercise which was different from all the other exercises in the assignment, most of the exercises were for example about implementing a few different Design Patterns about which we learned during the lectures or to eliminate the design flaws in our system by refactoring. These 'special' parts of the assignments were mostly "20-time" exercises, which is a

concept Google uses. Google asks its employees to spend 20% of their time at Google on a project that their job description does not cover. As a result of the 20% project at Google, we now have applications such as Gmail, AdSense and Google News. Such an assignment in our case was that we could decide for ourselves what we wanted to implement in our game, without the TA's and the teacher telling us what to do, which could for example be an extension or improvement from any perspective, such as improved code quality, or novel features like a high score system or a story mode. In our case, we decided to add different types of fish to our Fishy game and we implemented a high score system.

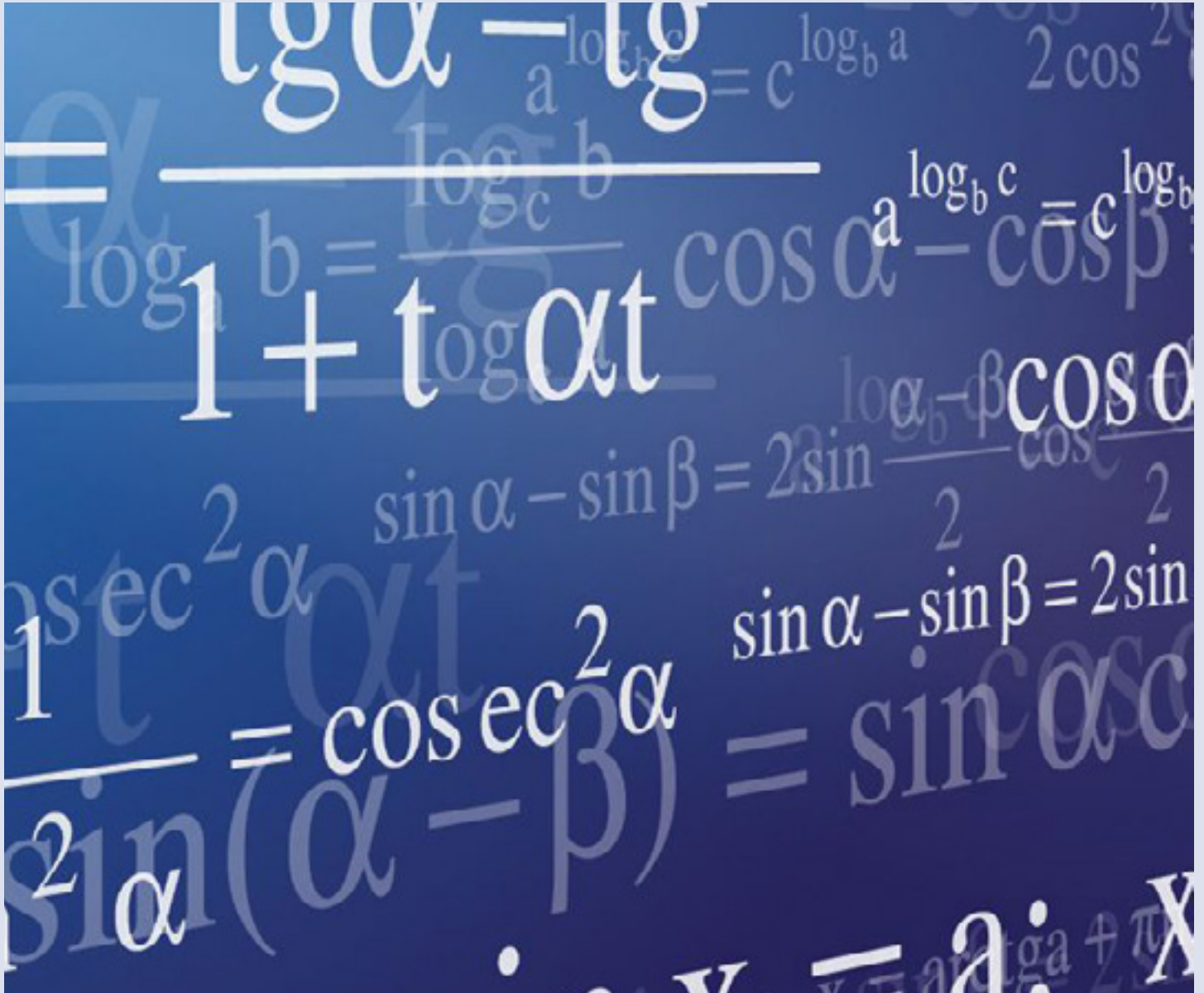
Next to the project there were also two classes each week, of which the part before the midterm mostly covered the SCRUM methodology, Responsibility Driven Design and Software Engineering Economics. For most of the students, the first part of the lectures was a lot of recurrence from courses we had in the first year, such as Software quality and Testing and Object Oriented Programming, but nonetheless the lectures were very interesting. The second part of the course explained the use of Design Patterns and all the different applications different design patterns have, which was very interesting. We also had a guest lecture from Erik Meijer in which he explained why he hated SCRUM and why we should all use the Hackile way as a rational alternative for Agile.

We had a lot of fun making the game for our project, due to the fact that it was a game we were making, and not some random application which we had no clue about. The lectures really helped us understand the code more and gave us solutions to problems we didn't even know we had, but were very nice to have!





Mathematics



The first floors of the EEMCS building are home to several Mathematic departments. Our own committee member Laura just finished her bachelor thesis before she took the plane to Australia!



Characterising tree-based phylogenetic networks

Laura Jetten

For centuries, evolution has been an important topic in biology. Commonly, the evolutionary history of a set of taxa is described by a phylogenetic tree, but a phylogenetic tree is not always able to fully describe the process of evolution. In previous research [1] the term tree-based was introduced for a phylogenetic network, meaning that it can be drawn as a phylogenetic tree with additional horizontal arcs. My Bachelor Thesis focusses on the tree-basedness of phylogenetic networks.

Outline and purpose

First, it will be shown that a binary phylogenetic network is tree-based if and only if there exists a matching in a certain bipartite graph that is associated to the network, where every omnian is covered by the matching. We will then show that a binary phylogenetic network is tree-based if and only if every subset S of its omnians has at least $|S|$ different children. Then, a graph-theoretic characterization of binary phylogenetic networks that are not tree-based will be given. With these characterizations, biologists are able to check whether a binary phylogenetic network is equal to a binary phylogenetic tree containing horizontal arcs that represent for example gene-transfer between bacterial species that do not share a common ancestor.

Definitions

In order to understand the research, some essential concepts around binary phylogenetic networks will be explained. A (rooted) binary phylogenetic network is a directed graph $N=(V,A)$, which is acyclic. It contains 1 unique vertex, the root, which has in-degree 0 and out-degree 1 or 2. The other vertices in N are one of the following forms:

- a vertex with out-degree 0, a leaf;
- a reticulation, a vertex with in-degree 2 and out-degree 1;
- a tree-vertex, a vertex with in-degree 1 and out-degree 2.

A (rooted) binary phylogenetic tree is a binary phylogenetic network that contains no reticulations. Notice that every arc is drawn as an edge, but they are directed to the lowest vertex.

Take $(u,v) = a \in A$, an arc from vertex u to v . Then, vertex u is a parent of v and v is called a child of u . If there is also an arc $(u,w) \in A$, an arc from vertex u to vertex w , then vertex w and v have a joint parent, so w and v are called siblings. When a vertex z has only reticulations as children, then z is called an omnian. A binary phylogenetic network N is tree-based with base-tree T , when N can be obtained from T via the following steps:

- Add some vertices to the arcs in T . These vertices, called attachment points, have in- and out-degree 1.
- Add arcs, called linking arcs, between pairs of attachments points, so that N

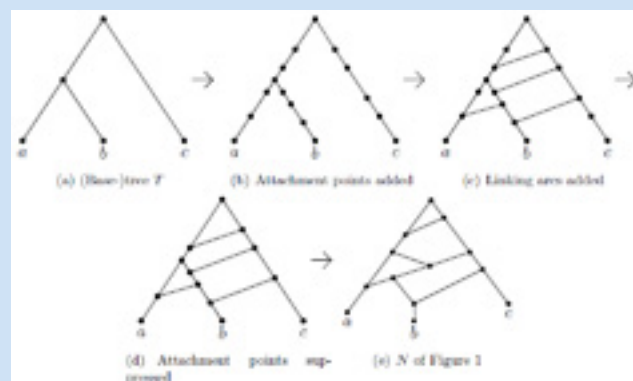


Figure 1: From phylogenetic tree to phylogenetic network in steps (a) to (e), which shows that by definition N is tree-based.

remains binary and acyclic.

- Suppress every attachment point that is not incident to a linking arc.

An example of the procedure is displayed in Figure 1, in which the tree-basedness of the binary phylogenetic network N of Figure ?? is examined. By definition, we see that N is tree-based, since the last picture in Figure 1 is N and it is obtained from tree T displayed in Figure 1(a).

Let $G = (V, E)$ be a graph. If $v, w \in V$ so that $(v, w) \in E$, then w is a neighbour of v . For a set $S \subseteq V$, the neighbours of S are denoted by $\Gamma(S)$. A matching $M \subseteq E$ is a set of edges so that no vertex $v \in V$ is incident with more than one edge in M . A maximal path in G is a directed path that is not contained in a larger directed path. When, in graph $G = (V, E)$, there is a path from vertex a to vertex x , without passing through a vertex twice, and there is an edge (a, x) , then the path and edge together are called a circuit. Let $N = (V, A)$ be a binary phylogenetic network. Let $B = (U \cup R, E)$ be the bipartite graph associated to N . For each vertex $v \in V$, if v is an omnian, put a copy of v in U and if v is a reticulation put a copy of v in R . If v is an omnian as well as a reticulation, we put one copy of v in U and one copy of v in R . There is an edge $\{v, v'\} \in E$ if $(v, v') \in A$, where $v \in U$ and $v' \in R$.

Research

Hall's Theorem is a well known theorem, which is essential in my research.

Theorem 1 (Hall's Theorem). [2] Let $B = (V \cup W, E)$ be a bipartite graph with vertex set V and W . There exists a matching that covers V if and only if for every $V_1 \subseteq V : |V_1|$ is smaller than or equal to the number of different neighbours of the vertices in V_1 .

From a presumption of my supervisor, we are able to give a condition for a network to be tree-based.

Theorem 2. Given a binary phylogenetic network N . Let $B = (U \cup R, E)$ be the bipartite graph associated to N . N is tree-based if and only if there exists a matching M in B so that $|U| = |M|$.



Proof. Proof can be found in my report, which can be found on <http://repository.tudelft.nl/>. \square

Combining Hall's Theorem ([2]) with Theorem 2, gives us a characterization for a binary phylogenetic network to be tree-based.

Corollary 3. *Let N be a binary phylogenetic network and U the set of all omnians of N . Then N is tree-based if and only if for all $S \subseteq U$ the number of different children of S is greater than or equal to the number of omnians in S .*

Proof. Proof follows directly from Hall's Theorem and Theorem 2. \square

We will look at an example of a binary phylogenetic network N and the bipartite graph $B = (U \cup R, E)$ associated to N in Figure 2. We use Theorem 2 to verify that N is tree-based.

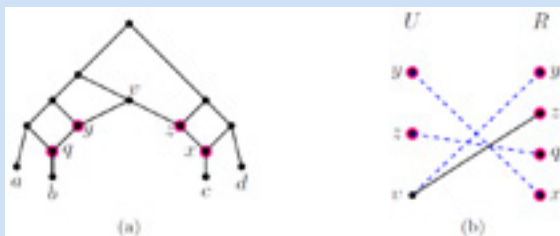


Figure 2: Using Theorem 2 to show that this is a tree-based binary phylogenetic network.

After looking at examples of non-tree-based networks and the bipartite graph associated to it, we came across a pattern. Combining this with Theorem 2 leads to a graph-theoretic characterization that is stated in the following theorem.

Theorem 4. *Let N be a binary phylogenetic network and $B = (U \cup R, E)$ the bipartite graph associated to N . N is tree-based if and only if B contains no maximal path which starts and ends in U .*

Proof. Notice that every vertex in B is of degree at most 2, therefore B contains paths and circuits. We distinguish four cases:

- A maximal path begins and ends in R .
- A maximal path begins in U and ends in R .
- A maximal path begins and ends in U .
- A circuit.

i) All vertices in R are of degree at most 2. Because the maximal path begins and ends in R , all omnians have degree 2. Let $S \subseteq U$. The number of edges incident with $S = 2|S| \leq$ the number of edges incident with $\Gamma(S) \leq 2|\Gamma(S)|$.

So, $\forall S \subseteq U : |\Gamma(S)| \geq |S|$. It follows from Hall's Theorem that there exists a matching in B that covers U .

ii) Let $S \subseteq U$. All vertices in R are of degree 2, except for the reticulation where the maximal path in S ends. All omnians are of degree 2, except for the omnian where the maximal path in S begins. All edges incident with $S = 2|S|$, except for the first omnian of the path in S . So, all edges incident with $S = 2|S| - 1$ are all edges incident with $\Gamma(S) = 2|\Gamma(S)| - 1$, because the maximal path in S ends in R , the end-vertex has degree 1. It follows that $|S| = |\Gamma(S)|$. So, $\forall S \subseteq U : |\Gamma(S)| \geq |S|$. It follows from Hall's Theorem that there exists a matching in B that covers U .

iii) All omnians in U are of degree 2, except for the omnians where the maximal path begins and ends. All reticulations in R are of degree 2, because the maximal path begins and ends in U . Let $S \subseteq U$, so that $U \subseteq S$. All

edges incident with $S = 2|S| - 2$ are all edges incident with $\Gamma(S) = 2|\Gamma(S)|$. It follows that $|S| - 1 = |\Gamma(S)|$. So, $|\Gamma(S)| \leq |S|$, from which follows that $\exists S \subseteq U : |\Gamma(S)| \leq |S|$. So, it follows from Hall's Theorem that there does not exist a matching in B that covers U .

iv) All vertices in B are of degree 2. Let $S \subseteq U$. The number of edges incident with $S = 2|S|$ is the number of edges incident with $\Gamma(S) = 2|\Gamma(S)|$. So, $\forall S \subseteq U : |\Gamma(S)| = |S|$. It follows from Hall's Theorem that there exists a matching in B that covers U .

Hence, there exists a matching in B that covers U precisely if there is no maximal path that starts and ends in U . The theorem now follows from Theorem 2. \square

An example of a phylogenetic network is given in Figure 3. The blue colour indicates that the vertex is an omnian, the pink that it is a reticulation and the yellow that it is a neighbour of an omnian. Since there is a maximal path in the bipartite graph associated to the network, it follows with Theorem 4 that the network is not tree-based.

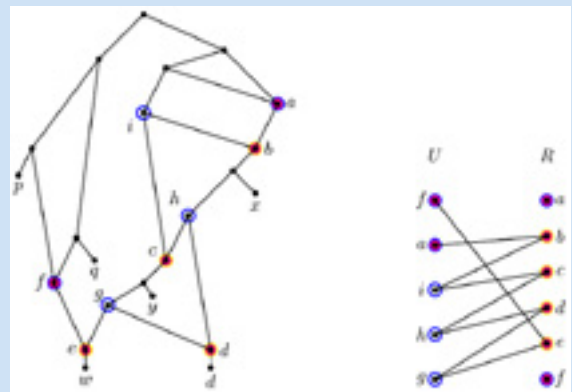


Figure 3: Example of a non-tree-based binary phylogenetic network N and the bipartite graph B associated to N .

Conclusion and discussion

In the binary case we have seen that a network is tree-based if and only if there exists a matching that covers all omnians in the bipartite graph associated to the network. This theorem, combined with Hall's theorem, gave us an even simpler classification of a tree-based network. It turned out that a binary phylogenetic network N is tree-based if and only if every subset S of the omnians of N has at least $|S|$ different children.

Biologists could come across a network that is not tree-based while doing research. In my report you can see how we can make non-tree-based networks tree-based, an upper bound for the number of base trees of a binary phylogenetic network is given and additionally there is research on non-binary phylogenetic networks.

After the overall process, there still remain some open questions, which mainly apply to topics that have not been elaborated in this article. Therefore, please see my report for more theorems, examples, conclusions and open questions.

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- [1] Andrew R. Francis and Mike Steel. Which Phylogenetic Networks are Merely Trees with Additional Arcs? *Systematic Biology*, 64(5):768-777, 2015.
- [2] Peter J Cameron. *Combinatorics: topics, techniques, algorithms*. Cambridge University Press, 1994.

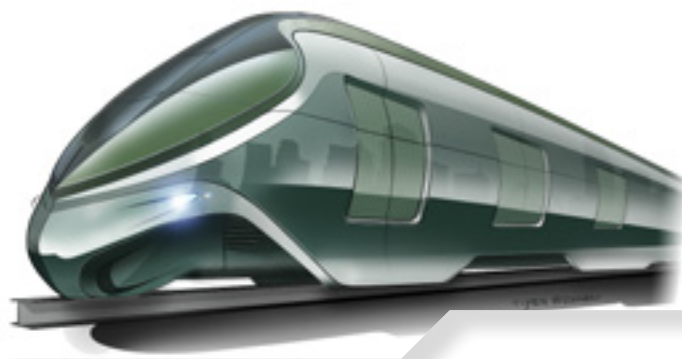
With special thanks to Leo van Iersel, my supervisor, who is always full of enthusiasm and optimism.



Delft Hyperloop: Travelling at the speed of sound

The Delft Hyperloop Team

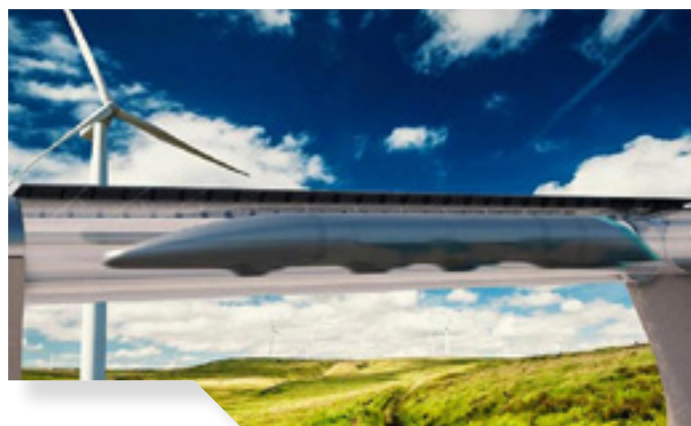
The Hyperloop is a revolutionary new concept that allows people to travel with the speed of an aircraft, but with the convenience of a train. In addition, the Hyperloop only uses a fraction of the energy used by high-speed trains and other conventional means of transportation. The Hyperloop brings you hundreds of kilometers away without producing any sound.



In brief, the Hyperloop is a conceptual high-speed transportation system incorporating reduced-pressure tubes in which pressurized vehicles travel. As a result, the air resistance is so low that you can travel with 1200 km/h, which is almost the speed of the sound. The Hyperloop is also a lot cheaper, more efficient and more convenient than airplanes.

The concept of Hyperloop was firstly proposed as a vague science fiction idea in the 70s. In 2013, SpaceX lifted this concept to the next level and Elon Musk has published a white paper about the Hyperloop. Since then there has been enormous worldwide attention to the Hyperloop. To encourage the development of a working prototype, Elon Musk launched in 2015 the "Hyperloop Pod Competition". The idea is simple: Student teams and companies from all over the world design, build and test their own Hyperloop capsule that will run through the test track. This test track of 1.6 kilometers will be built by SpaceX next to their headquarters in California. The Hyperloop competition is an international engineering design competition with over 300 teams competing from all over the globe. The competition will take place in June 2016 in Hawthorne, California. The capsules will be judged on their design and performance by experts from Tesla Motors, SpaceX and associated professors. Several thousands of engineers are present, along with more than a thousand visitors and companies.

The Hyperloop competition has generated a lot of interest all over the world. In the USA, CNN, Business insider and Forbes have already written about the Hyperloop. In the Netherlands it has been covered by RTL-Z, Nu.nl, NOS, The Volkskrant and NRC.



In June 2015, immediately after the launch of the competition, the team Delft Hyperloop started with a small group of six highly motivated and experienced students. These students knew each other from Formula Student, where they have built record-breaking electric racing cars who have won one of the fiercest student races in the world. Because of this experience Delft Hyperloop can make this project a great success. Currently, the team has expanded to 33 members in order to achieve this success. These students are selected from nearly 200 applicants. Delft Hyperloop can reach further, work harder and do better than all the other teams competing in the Hyperloop competition. Everyone in this team is extremely motivated to make the world cleaner, faster and more efficient. The goal of Delft Hyperloop is clear: Winning this contest! Delft Hyperloop wants to prove the technical and commercial feasibility of the Hyperloop by winning the competition with a safe, fast and affordable capsule.

To do this, the Delft Hyperloop team has chosen to renew and improve Elon Musk's concept. We are going to win the competition with the design of a capsule with an aerodynamic shape which is suspended by permanent magnets. The propulsion system is powered with solar panels on top of the Hyperloop tunnel when the capsule is stated at the station. To suspend the capsule in the tunnel, we have chosen for permanent magnets with a result that there is no mechanical contact to minimize wear and maintenance.

To learn more about Delft Hyperloop's design and actions, follow us on Facebook: Delft Hyperloop. Also, check our website to meet our team and partners: www.delfthyperloop.nl 



Miscellaneous



This year, you'll find different departments of EEMCS introducing itself in the MaCHazine.

In this issue, we have three different departments telling their story! Furthermore, we have updates from all over the world and some exciting Gadget-news!



Minor Sweden

Céline Swennenhuis

I've always dreamt about going abroad for my study. To meet a lot of new people with different cultures and to improve my English. In August it was time for my adventure to begin in the north of Sweden, Luleå!



I've chosen my new hometown carefully. Since learning a language isn't my biggest talent, I preferred a country where most people would understand English. Also, I wanted to go to a special place, somewhere I normally wouldn't go. Since Luleå lies near the north pole circle, this brings a lot of differences in the daily life. In the summer, it's the whole day light and in the winter you barely see the sun. From October on it's getting cold, really cold. The river and a big part of the sea freeze here from the end of December. Once that happens, you're able to skate to the island in the archipelago. There also falls quite a lot snow, this is why there are a lot of sports here like cross country and skiing. There's even a small ski slope in the city...!

One of the big advantages of the north is that you are able to see the northern lights from your student room. It's one of the most amazing things I've ever seen. Though, I have to say I'm really lucky with the lights, this year they're quite active and I see them almost every week. You actually have radars like the rain radar that predict the northern lights!

Another advantage is that Swedish people here are very relaxed. No one here likes to stress and it's very important that you take your time for everything. For example: if you're waiting in line in the supermarket and there are 10 people in front of you, nobody gets agitated. It really feels like everyone is on a Holiday and has the whole day. Even if you're late in class, the teacher won't be mad, being late can happen.


Swedish people are really nice, they really like it when you try to speak Swedish and they're all very friendly. Most people in the north are very healthy and like to sport a lot! Favourite sports here are basketball and ice hockey. Especially

ice hockey is a really big thing! They made a special team for the international students here, where they teach us how to skate and hockey. I'm really glad I joined the team, it's a lot of fun and I have a lot of respect for the professionals now.

I'm not 100% sure about the level of the studies here, but I have the feeling you can learn a lot if you really want to. In a lot of courses, you are quite free to choose your own project, for example. So it's possible that someone who's really good at a subject makes a really hard project compared to the beginners in a subject. It's actually stimulated to just choose the project where you learn the most of. So maybe the level isn't really high here, but you do have to work hard to get your points.

Of course, partying is a part of the student life here too. Although it's quite different from Delft, since the alcohol is a lot(!) more expensive. In a club you easily pay 8 Euros for a bottle of beer, for example. Also you have to buy your alcohol at a special shop, owned by the government. However, this leads to a very interesting habit: Swedish people don't drink at all during the week here, until Friday or Saturday evening. And when they drink, they try to destroy all the brain cells they have. On a party, people fall all the time because they can't stand anymore and people push a lot, not because they're mean, they just don't notice anymore. Oh and kissing is also a very interesting happening here, guys will actually ask a girl if it's OK that he kisses her. And then they stand snogging, drunk on the dance floor and push everyone around.

Any negative points about Luleå? Well, if you don't like cold weather of course you should never go here. Also, don't expect any really good food. Except for knäckebröd, they don't have any normal bread and also for dinner it's really hard to find all ingredients fresh sometimes.

Overall, I really enjoy my time here, not just because of Sweden, but also because of all the new people you meet and the new cultures you learn about. Everyday I learn new English words and discover some weird Dutch habits I have. It's really fun to redefine what's 'normal' in life and it can give you a new view on the world. I would recommend everyone to consider going abroad. 





Minor Lisbon

Chantal Olieman

Ever since I started studying I had known that I wanted to go abroad.

Everything about it just seemed amazing, a new city, country, but most of all, a complete new culture!

The start of my adventure

Picking a university was not so hard for me, I've had enough of all the bad weather in the Netherlands, so I started looking for a place a bit more south. Eventually, I found Instituto Superior Técnico in Lisbon! Every year loads of students from there come to TU Delft, but I would be the first to go to Lisbon in a while.



The first problem I encountered was picking my courses at Técnico, unfortunately only the masters courses were in English. Since I am still in my bachelor phase, I decided to take computer science courses so I would not be surprised by difficult subjects I had never heard of. Before picking my courses I had a talk with the director of education in Delft to make sure my courses would not overlap too much.



On the first of September it was time to say goodbye to the Netherlands and fly to Portugal, to a city I had never been to in a country I hadn't been either. A bit scary I have to admit, but I arranged a lot before hand, so I wasn't that worried! When I arrived I was amazed

by all the activities organized for the exchange students. During the whole month of September, there were different activities every day. From trips to the Algarve to daily parties, beach trips and city tours! Not so strange if you know that there are more than 4000 exchange students!

Due to the fact that my classes started the third week of September, I had a long time to get used to the city and meet loads of new people! But when my classes started everything got a bit more serious, though I still have enough time to go on trips, go out and discover new places!

Life as an exchange student

During my first class, a Portuguese guy came to me to ask if I was an exchange student. When I said I was, his second question was if I still needed a group for one of the lab assignments and of course I did! After this he showed me around on the campus and helped me to get to my classes. The Portuguese students at my university have been very helpful and because of this, I got a good feeling of the way the students live here.



The biggest difference for me are the coffee and lunch breaks. In Portugal it is quite normal to go to a terrace and drink a coffee a few times a day whilst in the Netherlands I would mostly grab a quick coffee and get back to work/studying. Furthermore, the lunches are way more extensive than I was used to. Almost every day people eat out during the lunch and all around the campus (and city) there are loads of places where you can get a complete lunch (A dish, drink dessert and coffee) for less than five euros.

Exploring the country

As an exchange student, you live your life a bit different than the normal students, you want to explore the city as much as you can and see all the good spots in only 6 months! This is why I have also met a lot of other exchange students. With this group we go out at least a few nights a week to explore new restaurants, clubs or just have some drinks in one of the amazing miradouro (viewpoints) of the city.

Until now I made two trips: one to the Algarve, and one to Porto. In the end of November I will also be going to the Azores, an island group that belongs to Portugal. The trips to Algarve and Porto were both awesome, in the Algarve we went with an organized trip, which means big parties and a lot of fun on the beach! With some of the people I met on the Algarve trip, I also went to Porto by car, this way we could do a road trip on our way there and we managed to see five cities in only three days! Right now I'm really looking forward to my trip to the Azores since I will be going with most of my best friends and the nature there is said to be stunning!

Up until now I really love my exchange! I have met a lot of new people and seen so many beautiful things here! The country is stunning and the weather amazing. Even in November we are still able to go to the beach and watch the sunset! The exchange experience is something I can recommend anyone and if you have questions or want to know a bit more you can always contact me.

Love and kisses from Lisbon!



Minor
Lisbon



Minor China

Robert Carosi

Sinds begin september studeer ik in de Chinese hoofdstad Beijing. Ik ben nu 3 maanden hier en zal proberen een sfeerimpressie te geven.

Op 3 november vertrok mijn vlucht van Bali, waar ik mijn zomer heb doorgebracht, naar Beijing. Rond een uur of 3 's nachts landde mijn vliegtuig en begon het avontuur. Na het ophalen van mijn koffer en de nodige douane formaliteiten stond ik in de aankomsthal. Ik had ongeveer 80 euro aan Chinese Renminbi en een koffer. Zodra ik mijn eerste stap buiten zette werd ik bestormd door 5 mannen die mij een taxi aan wilde smeren. Ik haalde mijn Chinese taal voor beginners boekje tevoorschijn waarin de nummers en hun vertalingen stonden. Ik vroeg de chauffeur de prijs aan te wijzen. Omgerekend 60 euro was me wat te gek dus ik ging op zoek naar een alternatief: de metro. Deze opende echter pas om 6 uur 's ochtends dus ik moest 3 uur wachten. De hal liep langzaam leeg. De enigen die overbleven waren slapende daklozen, en ik.

Na een verrassend vlotte metro rit arriveerde ik in Haidian district, de streek waar de meeste universiteiten zijn gevestigd. Ik kon mijn dorm nog niet in dus verbleef in een homestay die ik eerder geboekt had via AirBnB. Mijn host sprak geen woord Engels, wat een terugkerend thema bleek te zijn gedurende mijn verblijf in China.

Drie dagen later was mijn kamer klaar en liep ik voor het eerst over de campus van Tsinghua University, waar ik de komende 5 maanden zou doorbrengen. Aangekomen bij de international office was ik verbaasd dat ze zelfs daar moeizaam Engels spraken. Nadat mij eerst werd verteld dat ik niet in het systeem stond, ontving ik na de nodige handgebaren en Chinese kreten mijn sleutel.

Ik verblijf hier in het Asian Youth Center. Een gebouw dat twee jaar geleden is opgezet door een welvarende jongeheer. Zijn doel was om de interactie tussen Chinese en internationale studenten te bevorderen. Alle kamers zijn opgedeeld in een kleine gemeenschappelijke keuken, een badkamer en twee kamers met ieder een aparte deur. Het leuke is dat iedere internationale student een kamer deelt met een lokale Chinese student. Zo is het gemakkelijker om vertrouwd te raken met de Chinese gebruiken, cultuur en levensstijl. Zeggen dat ze anders leven dan wij is een understatement. Ik wist vrij weinig over China voordat ik hier aankwam. Na 3 maanden heb ik het idee dat ik het volk steeds beter begrijp en bepaalde gewoontes die ik vreemd vond, kan verklaren en begrijpen.

Mijn roommate Eric komt uit een klein dorpje in Sichuan province in de buurt van Tibet. Om hier te komen moet hij meer dan 30 uur in de trein zitten. Zijn ouders kunnen lezen noch schrijven. Ook spreken ze geen Mandarijn maar een lokaal dialect en hebben geen elektriciteit in huis.

Tsinghua is een van de beste universiteiten van China. Omdat China zo groot is vindt er van jongs af aan een strenge selectie plaats. De beste leerlingen op de basisschool mogen naar de beste middelbare school en de beste van de middelbare school mogen naar de beste high school enzovoort. Omdat er zo weinig plekken zijn, worden kinderen vaak door hun ouders aangespoord om na



school, in het weekend en in de zomer ook te studeren. Dit is de enige manier om naar een top universiteit te gaan, maar of het gezond is of gelukkig maakt weet ik niet.

De campus van Tsinghua is vrij groot. Iedereen gebruikt een fiets of een elektrische scooter met een maximum snelheid van 15km/h. Veel Chinezen fietsen voor het eerst, dus het gaat niet zo soepel als in Delft. Ze steken hun hand niet uit, vinden rechts inhalen dood normaal en kennen geen voorrangsregels. Gelukkig zijn alle fietsen klein en zonder versnellingen, dus kan niemand snel rijden en valt het mee hoe gevaarlijk het is.

Alle vakken hier zijn semester vakken. Om de benodigde 30 ECTS te halen volg ik 7 vakken tegelijk. Dit is wat hectisch, vooral gepaard met de grote cultuurschok en het feit dat veel van de systemen zoals blackboard e.d. in het Chinees zijn. Dit maakt het op de hoogte blijven van deadlines en announcements lezen soms wat lastig.

Sinds ik hier ben heb ik de nodige tripjes gemaakt naar o.a. de Chinese muur, het terracotta leger in Xi'an, en meerdere kleine dorpjes in de buurt van Beijing. Het is erg makkelijk om met de trein te reizen. Het treinnetwerk van China is de grootste ter wereld en werkt goed. De afstanden zijn groter dan we in Nederland gewend zijn, maar slaaptreinen zijn daarvoor een goede oplossing.

Al met al heb ik het erg naar mijn zin hier en kan ik iedereen aanraden om een half jaar in het buitenland door te brengen. Het is een hele uitdaging om in een vreemde omgeving je draai te vinden, maar dat maakt het zo'n leuke en leerzame ervaring.

Ik schrijf een blog op carosi.nl/travel voor wie het leuk vindt om die te lezen. 



Minor Japan

Tung Phan

みなさんこんにちは!

As a current exchange student in Japan at Tokyo Institute of Technology, I was invited to inform you briefly about my experiences so far. So hang on tight as I take you on a journey to the wonderful Land of the Rising Sun, filled with すし (sushi), カラオケ (karaoke), 酒 (sake) and more!

The first week was both exciting and weird. Navigating through the urban maze called Tokyo (and surrounding districts), armed with a mobile phone without internet was like trying to find your way in the dark with a broken flashlight. All the signs are in Japanese, the metro system is humongous and all the streets look alike. Fortunately, there are Wi-Fi hotspots every other corner and the people are super friendly. Almost too friendly it seems, because there is one thing you have to keep in mind when you're in Japan: the people are really helpful, almost to fault. One time, we were lost and we asked a group of construction workers for directions. After performing the Tourist's Rite of Pasagatm (using hands and feet to convey our message, as English is sadly not a commonly spoken language in Japan), we came to the conclusion that they did not know the directions. Normally that would've been the end of it, but instead they started asking other people for directions on our behalf. They in turn asked other people and before we knew it, we had a small search party frantically trying to help us find our way! I was really impressed with the Japanese mentality at this point. Of course, our destination was only 50 meters from our current location, solidifying our position as the Dumb Touristtm. So why didn't they just tell us that they didn't know and leave us to our own devices? Because Japan.

Naturally, the first thing I did after that event was acquiring a data subscription for my mobile phone. After making sure I was somewhat self-sufficient, I was off to the best district a nerd from TU Delft could go to: Akihabara. The moment you set foot in the main boulevard of the district, you're bombarded with electronics, anime, manga, figurines, games, theme cafes and gigantic advertisements portraying the aforementioned. The boulevard stretched on for what seemed like an eternity with on both sides of the street buildings of at least 5 stories high. You could easily lose a whole day in that street just by window shopping. A fair warning, though: while the lower floors are relatively tame, the upper floors are not for the faint of heart. If naked skin, toys of pleasure and obscure fetishes make you squeamish, then you're going to have a bad time up there. Otherwise, steel your nerves, keep an open mind and you'll be fine, my brave, adventurous friend. As a cherry on top, the streets are closed off on Sundays, meaning that it's free to walk around wherever you want as a pedestrian. Still, most Japanese still walk neatly on the sidewalks and wait (fruitlessly) at the traffic signals. Why? Because Japan.

Of course, I've been nerd-shopping and traveling a lot in Japan (Okinawa, Fukuoka, Dazaifu, Yanagawa, Kyoto, Hakone, Kamakura, Yokohama and, fortunately, the list keeps on growing). Unfortunately, I haven't stumbled upon a pot of gold yet. Luckily, it's quite easy to find a part-time job as an exchange student in Japan and since a few weeks I've been active as a chat host at an

English Café. Even though I've mentioned that English is not a commonly spoken language in Japan, they are definitely putting their best effort in learning the language. One way of doing so is by going to an English Café, where people sit at tables in groups and chat away in English. The task of the host is to ensure that the conversations are proceeding smoothly and that every guest has a chance to speak. You lead the conversations and make them feel at ease, creating a comfortable atmosphere for casual English chatting. It's completely different than the usual jobs available for the aspiring computer scientist, but frankly, I quite like the change. You meet with a lot of different and interesting Japanese people who share with you their daily lives and experiences while also sharing the best things to do in Japan.

Finally, after work, I do what every sensible Japanese exchange student does in Japan: I meet up with friends to conclude the day in Shibuya, renting a karaoke room with an all-you-can-drink arrangement. In Japan, these karaoke boxes are immensely popular, especially paired with 飲み放題 (nomihoudai, all-you-can-drink). They are not only popular among the young people, but also with the salarymen. The salarymen regularly drink with their colleagues and bosses after work, complete with alcohol-fueled staggering towards their last train afterwards. So while we go back with the same last train, praising all the possible Lords that it's Friday, the salarymen wake up the very next morning only to work on a Saturday, toughing it out like champs. Why? Because Japan. And I'll have it no other way. 🍷



Effectieve visualisatie van bestuursinformatie

Guido van Capelleveen, Informatie Analist (Topicus Onderwijs)

Waarom moet ik mijn gegevens registreren, mijn dokter weet toch wel wie ik ben? Dit zou je opa of oma zomaar gezegd kunnen hebben toen je daar op bezoek was. Vertrouwen en persoonlijk contact stonden vroeger hoog in het vaandel, tegenwoordig leggen we alles liever in systemen vast en delen we al deze informatie. We doen dit onbewust, elke dag, maar waarom eigenlijk? EPD, Leerlingvolgysteem, hypotheekaanvragen, zelfs de vlokentest ligt ergens in een systeem vast.

De één zal argumenteren dat het sneller werken is met de computer, de ander ziet het voordeel van het eenvoudig kunnen delen of versturen van informatie. Zelf kan je waarschijnlijk ook tal van redenen verzinnen waarom het voor jou van belang kan zijn om bepaalde informatie vast te leggen. Wie bepaalt eigenlijk dat dit goed is en welke afwegingen worden gemaakt bij het opstellen van het ontwerp en invoering voor dit soort systemen? Ervaren de gebruikers het systeem als een last of juist als een uitkomst? Met veel belanghebbenden bij informatiesystemen zie je vaak dat er geen ideaal is dat aansluit op ieders wensen, maar dat er wordt gezocht naar een situatie waarin alleen de informatie die van belang is voor het werkproces aanwezig is. Het is daarbij zoeken naar het kunnen dekken van de gemeenschappelijke van informatiebehoefte, waarbij werkprocessen marktgebonden getracht worden te generaliseren.

Processen beperken zich ook niet enkel tot één organisatie, maar vragen vaak een breder perspectief. Deze vorm van informatisering wordt ook wel keteninformatisering genoemd. Al deze gegevens creëren vervolgens een bron van nieuwe informatie die gebruikt kan worden voor de procesoptimalisatie of voor de processturing. De eerste vorm levert nieuwe inzichten vanuit de

data op waarmee processen kunnen worden doorontwikkeld. De tweede vorm van procesanalyse dient juist als benchmarking, controle op eigen situatie ten opzichte van gelijken, historie of doelen. Beide kunnen op strategisch niveau zeer waardevolle inzichten bieden aan bestuurders om bedrijven winstgevend te houden.

Oké gaaf! Maar welke informatie uit het werkproces is dan interessant om te visualiseren om van te leren of om op te sturen? Laten we de Universiteit als voorbeeld nemen. Zij ziet graag haar ambitieuze studenten zo spoedig mogelijk in hun studie doorstromen, maar wel zo, dat ze voldoen aan de inspectienormen, opdat de onderwijskwaliteit op peil blijft en tevredenheid onder de studenten blijft heersen. We nemen deze versimpeling van drie pijlers even als uitgangspunt: doorstroming, inspectie van onderwijskwaliteit en studenttevredenheid. Neem in gedachten wie er belang hebben bij inzicht in deze metingen. Zelf dacht ik aan: directie, docenten, maar ook studenten. Voor ieder van de doelgroepen kan je formuleren waarvoor deze informatie zou worden gebruikt. Het liefst zien we deze aangevuld in de vorm van 'use cases'. Hoe eenvoudig het misschien ook klinkt, het stellen van de vraag aan een gebruiker wat zijn 'use case' is voor de gestelde informatiebehoefte levert soms geweldige inzichten. Een gebruiker komt erachter dat de informatie eigenlijk overbodig is, of verkeerd gevormd (verkeerde visualisaties), niet aanwezig (niet geregistreerd), onbetrouwbaar (de gebruiker weet niet hoe de informatie tot stand is gekomen), of nog niet beschikbaar (niet vastgelegd of gemeten).

Bij het bouwen van je systeem zal je je ook mogen afvragen voor wie de informatie bedoeld is. Kan de dezelfde informatie voor alle doelgroepen op eenzelfde wijze worden gevisualiseerd, of behoeven de verschillende groepen verschillende interpretatie, focus of misschien zelfs afscherming van gegevens. Daarbij mag je met al je ambitieuze ideeën wel nog rekening houden met budget, ontwikkelcapaciteit en technologische uitdagingen. Dus er zullen keuzes gemaakt moeten worden omtrent welke 'use cases' je gaat uitwerken.





Voor het gemak in deze casus betaalt de Universiteit en is op zoek naar sturingsinformatie voor hun dagelijkse directie. De doelen voor het komende jaar moeten worden opgesteld en de directieleden zijn voornamelijk benieuwd naar de uitdagingengebieden voor het aanstaande jaar. Zij willen meten hoe dit gedurende het jaar (jaren) zich zal verbeteren op basis van metriecken zoals studentendoorstroming. Nu loop je bij het definiëren van doorstroming echter al snel aan tegen verschillende interpretaties. Wat bedoelen we met doorstroming, wat meten we dan eigenlijk? Je zou bijvoorbeeld de doorstromingstijd kunnen meten (van instroom tot uitstroom). Instroom meten we dan op basis van inschrijfdatum van de student, de uitstroom op uitschrijvingsdatum van een student. Nu zijn er echter studenten die een tussenjaar nemen en zich niet inschrijven. Hier eindigt mijn perfecte statistiek al.

Maar er speelt nog veel meer. De doorstromingstijd geeft bijvoorbeeld ook niet aan in hoeverre er gewisseld is per studie. Daarnaast weten we ook niet wat een doorstromingstijd van 6 jaar zegt wanneer we als gebruiker niet beschikken over de domein specifieke kennis. Wat is 6 jaar als er vaak ook andere studies worden gevolgd? Een langere doorstroming kan namelijk tal van oorzaken hebben die juist in het kwalitatieve vlak gemeten behoren te worden. Zo kan een student een tussenjaar nemen, werken naast zijn studie en nevenwerkzaamheden vervullen zoals een bestuursjaar. Het mag de student dan wel ten goede komen, het zal wel mede de bestuursmetriecken doen bepalen. Als hier rekening mee wordt gehouden, behoort de organisatie hiervan wel bewust te zijn voordat zij hierop gaat sturen. Informatie dient zich vaak aan als een simpel gegeven, maar wanneer je een analytische blik neemt op het gehele proces en de markt waarin het plaatsvindt dan mag je ook kritisch kijken wat we daadwerkelijk willen ontwikkelen.

Naast het definiëren van de metriek speelt ook de communicatie van de metriek een rol in effectiviteit. Zo schreef Darrell Huff, goeroe in statistische representatie, ooit over het intentioneel gebruik van informatievevisualisatie ten behoeve van misinformatie, vaak bedoeld ter bevoordeling van het eigen product. Tegenwoordig zien we juist meer de deïntentionele verspreiding van misinformatie die plaatsvindt doordat de gebruiker of softwareleverancier met hun visualisatie juist niet communiceert wat zij eigenlijk bedoelde. Wanneer we dus visualiseren moeten we achterhalen wat er dient te worden gecommuniceerd met de grafiek, ofwel met welke reden we zo'n grafiek bekijken. Zijn we op zoek om studies onderling te vergelijken, knelpunten te ontdekken of aandachtsgebieden te vinden om op te focussen? Een tal van mogelijkheden die allemaal bepalend kunnen zijn voor het ontwerp van je visualisatie. We kunnen studies naast elkaar plaatsen om te zien welke studies het goed doen, of juist de probleemgevallen tonen. Om nog maar even te zwijgen over de beperkingen die het dashboard ons meegeeft. De Universiteit kent ruim 120 studies, hoe past dat op een dashboard zonder dat we de gebruiker overladen met informatie, een van de meest voorkomende fouten uit de jaren 90 volgens Stephen Few die het fenomeen als "Dashboard Confusion" paradeerde. Het lezen van een goed doordachte, welgevormde grafiek is niet zo moeilijk, maar daar gaan dus wel veel beslissingen ten behoeve van effectieve communicatie aan vooraf. Het gebruik van een aantal vuistregels is dan ook niet onverdienstelijk. Grice's conversational maxims is daarvoor een mooi uitgangspunt. De theorie is overigens heel soft en filosofisch, maar het gedachtengoed kan je helpen als leidraad bij het evalueren van je grafiekontwerp. De theorie deelt zich in vier delen: kwantiteit, kwaliteit, relevantie en wijze.

Kwantiteit

- Maak jouw bijdrage zo informatief als noodzakelijk
- Maak jouw bijdrage niet informatiever dan noodzakelijk

Kwaliteit

- Vertel nooit dat waarvan je denkt dat het mogelijk onwaar is
- Vertel nooit dat waarvoor je onvoldoende bewijs hebt

Relevantie

- Vertel alleen de zaken die betrekking hebben op je gespreksonderwerp

Wijze

- Vermijd de obscuriteit van meningen
- Vermijd ambiguïteit
- Houd het kort
- Zorg voor orde en structuur

De fundamentele uitdagingen liggen zoals eerder genoemd in het vaststellen van je metriecken en correctief gebruik van visualisatie ten behoeve van correcte effectieve communicatie. Echter door de vele ontwikkelingen die nog in alle toepassingsdomeinen plaatsvinden, waardoor nieuwe gegevens beschikbaar komen in combinatie met de kennis die we over effectief visualiseren op doen, besef je pas hoe experimenteel we eigenlijk nog bezig zijn bij de ontwikkeling van informatievevisualisatie.





Science Trends

Rebecca Glans

On this page you will find some brief info on recent scientific

breakthroughs or interesting news. Whether they're big or small, if we

think they might interest you, we will mention them here! Do you miss

a certain trend or want to inform your fellow readers of an interesting

innovation? Feel free to contact us.

Next level healthcare with wearable electronics

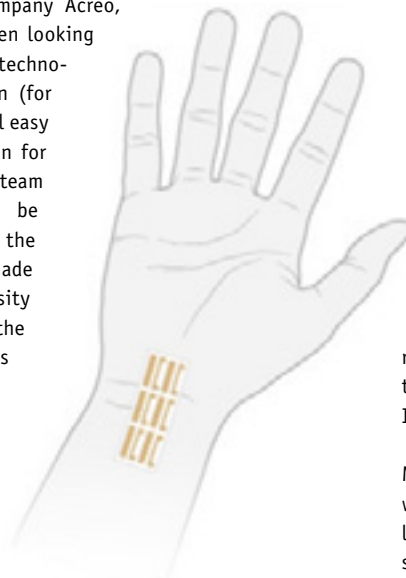
Engineer at Swedish electronics company Acreo, Göran Gustafsson, thinks of cars when looking

at humans. He wonders why current technology can warn us about problems in (for instance) cars, at a point they are still easy to fix, and not have that same vision for our bodies. With that in mind, his team has developed sensors which can be implanted in your body or applied on the skin surface. These sensors were made with researchers at Linköping University in Sweden. Gustafsson's group isn't the only one with this goal. Other groups are developing skin patches that sense arterial stiffening, devices that detect epileptic fits and deliver drugs to the affected areas of the brain, and much more.

These teams and researchers also want to accomplish technology that lives alongside tissue, rather than being isolated from it like pacemakers. This way, the body can be monitored and treated day in and day out.

One of the many challenges to be faced is one for the material scientists. They are in charge of shrinking circuits radically and making flexible electronics which are also imperceptible to tissue. Such a scientist is John Rogers, who also states that the potential to improve healthcare while reducing its cost has drawn both researchers and physicians to developing these human compatible electronics. The first step for the market will be the electronics which can be mounted directly on the skin. The next step will be bringing the sensors inside the body, as that will give access to much more data. [2]

Sensors mounted on the skin are easy to apply and remove, and can obtain high-quality data on breathing, heart rate, blood pressure and other vital signs. But they must be flexible and stretchy enough to follow the natural movement of the body.

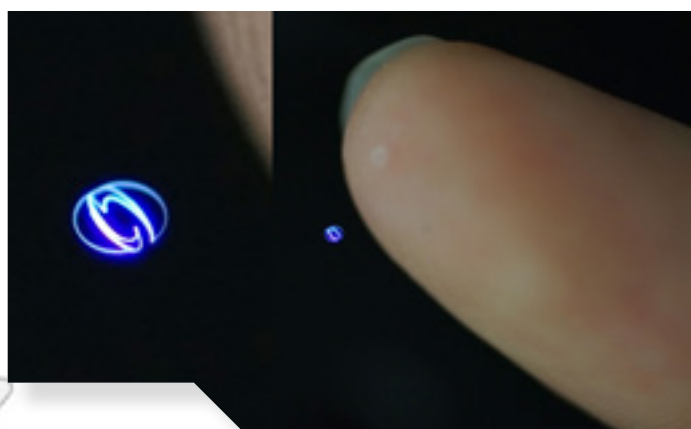


Holograms that can be touched!

Researchers in Japan have made it possible to manipulate holograms by touch. They use Femtosecond lasers, which create pulses of light that last a few tens of a femtosecond. In more general terms, that means one millionth of one billionth of a second (ten to the power of minus fifteen times 1). The lasers induce a light emitting plasma, meaning involvement of any physical matter is not needed. This plasma is created by ionizing molecules in midair, creating bright pixels. In one of their explanation videos they show how daily like applications can be explored; a hologram of a checkbox is shown, which is checked on touch. The reason they address this, is because plasma induced by a femtosecond laser is quieter and safer than one induced by a Nano laser. [3]

A fishy model

In a new study, researchers from Uppsala University implemented a Turing test in the form of an online game to assess how good their models were at



reproducing collective motion of real fish schools. A Turing test is conducted to test a machine's ability to (intelligently) behave identical to a human being. If the tester believes the machine is human, the machine passes the test.

Mathematical models help understand how patterns and processes in the real world are generated and how complex behavior is a result of rules on individual level. The game asked its players, over 1700 online players of the public and a small group of experts, to differentiate between the collective movements of real fish schools and those simulated by a model. The used model matched the statistical properties of real data, but both the experts and members of the public could see the difference. Fortunately, the researchers have been getting feedback from the players. "By putting the game online, and through crowd sourcing this problem, the public have not only become engaged in science, they have also helped our research". [1]

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The Big Data VR Challenge

Bastiaan Grisèl

Delft, woensdag 25 maart 2015. Eindelijk had ik de eerste gadgets van het gadgetlab aan de praat: de Oculus Rift en de Kinect waren aangesloten op de daarvoor bestemde computer en deden wat er van ze verwacht werd. Wat nu? Nu kon ik zelf wat gaan experimenteren en besloot de zojuist vrijgegeven Unreal Engine te downloaden.

Tijdens het downloaden neusde ik wat rond op de site van de Unreal Engine en zag een blogpost getiteld: "The Wellcome Trust and Epic Games launch the Big Data VR Challenge". Aangetrokken door de overweldigende combinatie van bekende buzzwords – waarvan ik de eerste kende door mijn studie Data Science & Technology en volgens de regels van buzzwords (zo lang je er maar vaag over kan praten kan je claimen dat je er wat mee doet) deed ik sinds die middag ook wat met VR – besloot ik het artikel te lezen.

Het ging om een wedstrijd waarin zes teams zouden worden geselecteerd die vervolgens een dataset kregen die ze moesten visualiseren in Virtual Reality. Het resultaat moest worden gepresenteerd op een games-conferentie in Brighton. Als kers op de taart zou elk team \$5000 onkostenvergoeding krijgen. Awesome!

Helaas was de doelgroep "the brightest minds in interactive entertainment" en "game studios that feel that they have innovative and creative technology", niet één waarin ik me noodzakelijkerwijs in zou plaatsen. Aan de andere kant, ik ben dan wel geen game studio maar ik kan wel Big Data en heb ik alle tools om VR te kunnen leren. Deze challenge zou juist een leuk excuus zijn om hier eens in te duiken. Bovendien, what's the worst that could happen? Ik besloot al mijn creative writing skills in de strijd te gooien om een mooi Engels mailtje te sturen waarin ik mijn enthousiasme en ambitie duidelijk maakte.

Tot mijn verbazing kreeg ik een reactie, een lang formulier waarin gevraagd werd naar een biografie van onze game studio, onze ervaring met het maken VR games, het team waarmee ik aan deze challenge zou werken en een reden waarom juist wij mee zouden moeten doen. Een gelopen race zou je zeggen, want ik had op geen van die vragen een goed antwoord. Maar goed, wie A zegt moet ook B zeggen. Ik belde een studiegenoot, Bert Bosch, van wie ik wist dat hij enthousiast werd van Computer Graphics om te vragen of hij zich bij mijn zojuist bedachte game studio wilde voegen. Niet wetend wat hem te wachten stond zei hij toe. Het formulier heb ik met een mooie mix van bescheidenheid en aandikkerij ingevuld.

Delft, vrijdag 2 april 2015. Een paar dagen later kreeg ik een mailtje: "I am delighted to tell you, on behalf of Epic Games and The Wellcome Trust, you have been selected to be one of the six teams to take part in the Challenge. Congratulations! As we mentioned in the previous note, the first workshop will be held on Thursday 9th April at the Wellcome Trust in central London. The day

will commence at 9.30 for registration." Of we over een week even naar Londen wilden komen. Nou zijn wij de beroerdste niet, dus toen we van de schrik bekomen waren hebben we hebben snel vluchten geboekt.


Londen, donderdag 9 april 2015. Na een heerlijk nachtje te hebben geslapen in onze luxe kelderkamer zonder ramen of ventilatie maar wel in hartje Londen, liepen we naar een groot glazen gebouw: The Wellcome Trust. Wellcome bestaat enerzijds uit een kleine club beleggers die op het eigen vermogen van 14 miljard pond elk jaar 700 miljoen pond rendement halen. De overgrote meerderheid van de werknemers probeert dit geld uit te geven aan biomedisch onderzoek aan universiteiten en bij bedrijven.

Nadat de andere teams hun fancy VR demo's hadden laten zien en wij een slap verhaal hadden opgehangen, kregen we een researchteam toegewezen. We moesten gaan werken met data van het Casebooks Project. Dit project heeft als doel om 80.000 bezoeken van patiënten aan 16e eeuwse doktoren vanuit dikke boeken naar XML om te schrijven. Een middag vol presentaties, 30.000 XML bestanden en een ferme handdruk later stonden we weer buiten. Good luck!

Delft, mei-juli 2015. Het contact met Cambridge University, waar het Casebooks Project is ondergebracht, was enorm goed. Unreal bleek best lastig maar met wat gestoei hebben we een simpele maar effectieve koppeling met de data gemaakt. In Mei en Juni zijn er nog twee videoconferenties geweest waarin alle teams hun voortgang laten zien. We deden het gelukkig nog best aardig in vergelijking met de andere teams.

Brighton, 14 juli 2015. De vooravond van de game-developers conferentie. Na een paar maanden beunen in de Unreal Engine hebben we toch een leuke demo weten te fabriceren. Vervelend van demo's is dat ze op het moment-supreme nooit werken. Zo ook die van ons. De van de organisatie geleende computer deed het niet en toen we hem eindelijk aan de praat kregen hebben we nog twee uur alle mogelijke combinaties van drivers voor onze videokaart en VR headset geprobeerd voordat we dezelfde demo hadden als in Delft. We waren er klaar voor.

Brighton, 15 juli 2015. Wonderbaarlijk genoeg bleef onze demo het de hele dag doen en kwam de rare bug waarbij ineens het hele scherm ging spacen niet voor. Na de hele dag staand aan iedereen hetzelfde verhaal te vertellen te hebben waren we helemaal gesloopt. Ik was verrast over de vele positieve reacties. Iedereen vond de demo leuk en meerdere mensen zeiden meermaals vrolijk in de ruimte als ze iets cools wilden aanwijzen. Missie geslaagd dus.

Delft, 16 november 2015. Wij zijn toen in Londen geweest voor de laatste meeting. Ik kan met een voldaan gevoel terugkijken op een enorm vette ervaring. Ik had nooit durven dromen van dit hele avontuur toen ik een half jaar geleden een blog aan het lezen was. Het blijkt maar weer: wie niet waagt, wie niet wint. Mocht je meer willen zien van deze challenge, als je op YouTube zoekt op "Big Data VR Challenge" vind je verschillende voortgangsfilmpjes. 

Department: Mathematical Physics

Prof. dr. ir. A.W. Heemink

The central research theme of the section is the mathematical modeling of physical phenomena using (partial) differential equations. Even more powerful computers are making it possible to couple different models with each other in order to simulate natural phenomena in a more and more realistic way. This, however, demands greater levels of mathematical complexity. The section Mathematical Physics has the ambition to provide the mathematical support necessary for the enhancement of the models used in the technical faculties and research institutes. The research is application driven and includes the modeling phase, analysis of the model and the numerical implementation of the model. The focus is now more and more on the research themes:

Analysis of partial differential equations

Perturbation methods are developed to analyse initial value problems and initial-boundary value problems for partial differential equations. The results provides insight into the stability of the system. The applications are in a variety of fields:

- The rain-wind induced oscillations of bridges and of overhead power transmission lines.
- The vibrations of conveyor belt.
- The vibrations of an elevator cable (see figure 1).

Morphodynamic models are models that describe the dynamic behaviour of sandy bottom patterns of a coastal sea or estuary. These models are based on a hydrodynamic model for the flow of the water, a model for the transport of suspended sediment and a model for the bottom topography. All these models interact with each other in a very complicated way. The research focusses on finding the dominant mechanisms responsible for changes in the bottom topography by analysing the coupled set of partial differential equations.

Data assimilation and Inverse modelling

Data assimilation methods are used to combine the results of a large scale numerical model with the measurement information available in order to obtain an optimal reconstruction of the dynamic behaviour of the model state. A well-known application of data assimilation is weather forecasting. Without data the chaotic meteorological model would produce results that are completely useless. By feeding the model continuously with data, the model can be kept "on track" and can produce accurate short-term forecasts. Inverse

modelling refer to reconstructing model parameters using data. The mathematical algorithms to solve data assimilation problems and inverse problems are very similar.

The goal of advanced data assimilation methods is to improve the model results without violating the conservation laws of the underlying physical processes. These data assimilation methods use the data to correct the specified uncertainties in the model. Model errors that may be due to uncertainties in initial and boundary conditions or imperfectly known model parameters. The most accurate data assimilation schemes are inspired by optimal filtering and control theory: Variational data assimilation and Ensemble Kalman filtering (EnKF). Both approaches require a very large computational burden. The great challenge in data assimilation is therefore to develop accurate and computationally efficient schemes. Key words here are model order reduction and high performance computing.

In a series of projects new mathematical algorithms have been developed and applied to a number of real life applications:

- Real-time forecasting of storm surges along the Dutch coast.
- Air pollution problems: Forecasting volcanic ash concentration in Europe (see Figure 2).
- Oil reservoir modeling: Reconstructing the permeability pattern in a numerical oil reservoir model.

High performance computing and parallel algorithms

The advance in computer technology, such as processor speed, parallel and distributed technologies, has enabled us to simulate and study real world problems, with increasing details and complexity. Here it is the combination of efficient algorithms and parallel and distributed computing is the key to achieve high performance. Domain decomposition and grid partitioning is an effective approach for parallel simulation of models described by partial differential equations. Efficient and scalable parallel algorithms are designed for the storm surge forecasting and pollutant transport problems described above.

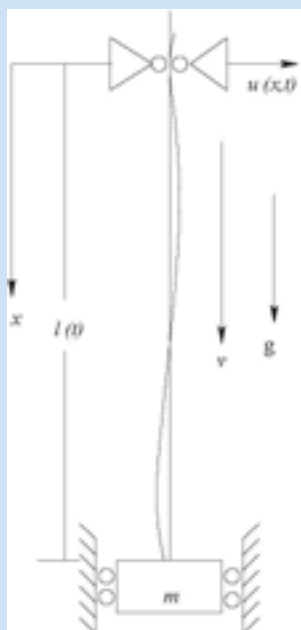


Figure 1: A model for the variable length induced vibration of an elevator cable where $l(t)$ is the length, v is the velocity of the elevator and $u(x,t)$ are excitations at $x=0$.

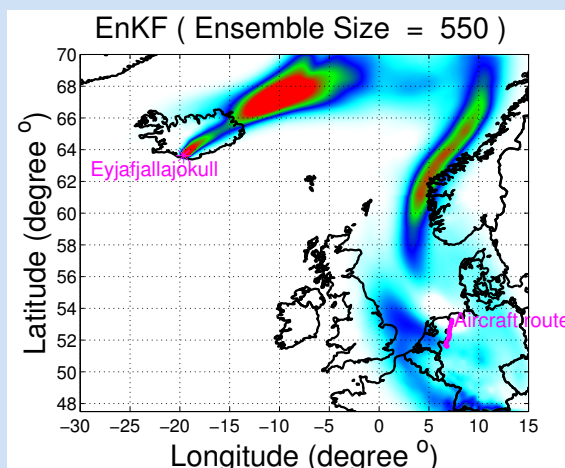


Figure 2: Forecast of the volcanic ash concentration with the EnKF data assimilation algorithm using aircraft measurements.



Department: Mathematics for quantitative biology and agriculture

Dr. N.V. Budko

I discuss some mathematical problems of modern agriculture, the forthcoming Leiden-Delft minor in quantitative biology, and the benefits of SWI workshops.

What strikes me most at applied maths is the freedom of choice one enjoys here. I know, too much choice can be intimidating sometimes, but think about people in other fields who are bound to work on pretty much the same topic during their professional lives.

With freedom comes responsibility - as they say. Responsibility to find an application for your math skills, something "relevant". As usual, mathematicians have thought about that too, and among other things there is a yearly workshop called Study Group *Mathematics With Industry* (SWI - Studiegroep Wiskunde met Industrie) where companies pose problems and academic researchers try to solve them by the end of the week. It is all very diverse and *gezellig*. You meet MSc/PhD students from all over the Netherlands at that stage off their lives when they begin wondering about their eventual employment, eager to demonstrate problem-solving skills and to try something else. Senior researchers are introducing their old industrial partners, guide the brainstorming sessions, and sometimes discover new topics for themselves.

Some of the questions posed at SWI are coming from the booming bio-industry. Mathematical biology used to be all about statistics. This is still true as far as the computational genetics (bioinformatics) is concerned. However, there is an emergent trend towards biophysical and physiological modeling of growth and development processes.

Seeds

In 2013 Linda Wiegman came to our group for her Bachelor Project. I do not remember why exactly, but I suggested to go and pick a topic for her thesis at the SWI-2013 that was about to start in Leiden. I believe Linda was the first ever BSc student to take part in SWI (I hope more will follow in her steps). One of the companies - Fyttagoras BV - was asking the following question: is it possible to come up with such a model of oxygen consumption by germinating seeds that would explain the measured data in terms of biologically meaningful parameters and pinpoint the exact moment of germination? Currently the oxygen level curves are simply fitted with a fifth-degree polynomial and the time of germination is estimated from the geometrical features of these curves.

One of the benefits of teaching the first year calculus is that you recognize the sigma-curve when you see one, and the vast majority of experimental data looked just like inverted sigma-curves. Thus, we hypothesized that the well-known logistic ODE may have something to do with it. In fact, this equation gave perfect fits for all the data with only five tuning parameters. This conclusion and some hand-waving arguments about the main consumers of oxygen - mitochondria - multiplying like rabbits inside the cells was all I could come up with during the SWI week. This was not the end of it, though. The company was interested, we too wanted to see it through. Back at TU Delft Fred Vermolen suggested that I look into the law of mass-action that describes chemical reactions and some time later we had a working model and Linda her


BSc. Now we are planning new experiments at Leiden University to further investigate the behavior of germinating seeds. The oxygen consumption curves provide a unique look into the world of mitochondria - these tiny organelles that were once completely independent bacteria, but have evolved to live in symbiosis with the cells of almost all organisms.

Potatoes

The next SWI-2014 was organized in Delft. The HZPC Holland company posed a funny problem: what is the optimal way to cut a potato into French fries? How could I resist? So, naturally, my friend Fred Vermolen and I immediately joined the brainstorming group. Perhaps, due to my enthusiasm, I was appointed the group leader. The company was measuring the geometry of randomly chosen potato tubers while they were being transported over the sorting band. You can choose to cut your potatoes in thin or thick fries. There will be some short and some long fries, and some inevitable waste. Although well-paying consumers, such as McDonald's prefer the long ones, you can cut your potato only once. Thus, the proverb *measure twice, cut once* applies here as much as in carpenter's business. During the SWI week, applying the techniques of the Finite Element Method, we have developed a prototype software for cutting virtual potatoes into virtual fries based on the provided measurements. This software predicts the distribution of fry lengths and the expected amount of waste for a given crop and allows the producers to estimate their potential profits. Appropriately, we called it the Finite Fry Method. All jokes aside, I heard that our software is already being supplied by HZPC to its customers.

Having earned some respect from the HZPC research department we are now looking into the more challenging of their problems. By the way, this is called *precision agriculture*. It is the future, apparently. Although there exist semi-empirical models of plant growth predicting the biomass as a function of time, suppliers and farmers hardly use them. According to HZPC, one of the reasons is that the total biomass is not really the most important parameter. What one wants to know is the distribution of potato shapes and sizes and the quality of tubers. This means that once again a differential equation describing the growth of a plant needs to be found. Of course, solving an equation for each potato tuber in the field is not really practical. Moreover, the coefficients and initial conditions are not known exactly, only the distributions (or probability density functions) thereof. Recently we have reformulated this problem as a hyperbolic conservation law for a multi-dimensional distribution function. But this is a long story.

New minor

These were just a few examples of problems arising in *quantitative biology*. Notice that the emphasis is not on statistics and big data, but on building bio-physical and physiological models described by differential equations and solving them. Developing your own models is, probably, the hardest and the most exciting part of science. However, mathematical biology has a very steep learning curve. Therefore, Leiden and Delft are working on a new joint minor - hoping to start in 2016 - where mathematicians will be taught some basic facts of biology, biologists will be taught some proper math, but most importantly the two groups will learn to understand and respect each other, and to work together as a team. 

Department: Cyber Security Group

Dr. ir. S.E. Verwer

Cyber security is about securing cyberspace, the 5th domain (next to land, water, air and space) in which we execute all kinds of cyber activities like communicating, searching, transacting, monitoring & surveillance, controlling critical infrastructures, ..., up to committing crimes and making cyber warfare.

CYBER RISK MANAGEMENT

We study how to reduce cyber risks to acceptable levels. This entails three challenges: (i) assessing cyber risks, (ii) defining what are acceptable risk levels, and (iii) taking measures to reduce the identified risks. Science can deal with two of these challenges, namely, the first one and the last one. The other challenge concerns a political or business choice according norms and values of the society we live in. Our research is dealing with issues in both risk assessment and risk mitigation.

Risk assessment entails understanding the relationship between cyber threats, incidents and resulting impact. Typically, you start by analyzing data collected in cyberspace (e.g. from social networks, the dark web, or network traffic) in order to better understand threats from script kiddies, criminals, terrorists and enemy states. Next, by registering all kinds of incidents and their potential impact, you get data-driven insights in cyber risks based on which, for example, insurance companies can define their cyber insurance strategies.



Figure 1 Cyber Risk Management decomposed in two complementary approaches: Data Analytics and Systems of Systems

Complementary to data-driven approaches we also perform risk assessments by making models or by executing scenario-based simulations. This concerns a top-down 'system-of-systems' approach, which is for applied in lab environments such as the (future) electricity grid and the Dutch flood defense systems.

Risk mitigation concerns the determination of a well-balanced set of preventive and repressive measures in order to reduce cyber risks to acceptable levels. In practice, this is more an art than science: society stakeholders still have big difficulties in selecting and applying effective cyber risk reducing measures. The scientific challenges we study here include all kinds of dilemmas, e.g., between privacy and security, between transparency about occurred cyber breaches and reputation loss, and between benefits and costs of cyber security measures.

Team: Jan van den Berg

COMPUTATIONAL PRIVACY

One of the phenomenal developments in the recent years is the wide spread of online, digital services, which are heavily dependent on data generated by people. It is natural that users of such services also feel uncomfortable about their privacy. The common question about privacy is whether the service provider is trustworthy enough or capable of storing such privacy-sensitive data secure against internal and external adversaries. As a societal problem, privacy is attracting significant attention and there are already several guidelines and directives to protect sensitive data in national and European level. However, without scientific and technological solutions, laws and regulations alone would not be sufficient to protect privacy.



Figure 2 Traditional face recognition Figure 3 Privacy preserving face recognition, both the input data and the output signal are encrypted

We develop solutions that protect the privacy of users without hampering services. We achieve this goal by hiding the private data by means of encryption in such a way that without the authorization of the data owner, no one can see the content but still process the encrypted data for the required service. The idea of "processing encrypted data" has been applied to many applications domains ranging from social networks to smart grids, providing a measurable and provable security. The tools we use to design such protocols are known from cryptography such as Homomorphic Encryption and Secure Multiparty Computation techniques.

Team: Zekeriya Erkin, Inald Lagendijk, Majid Nateghizad, Gamze Tillem, and Mingxiao Ma

INFORMATION THEORETIC SECURITY

Claude Shannon (1916-2001) has put the foundations of the current information age. His most famous work is a mathematical theory of communication (1948), but another crucial contribution was the introduction of the concept of information theoretic security, i.e., security that cannot be broken even with unlimited computational resources, there simply is insufficient information.

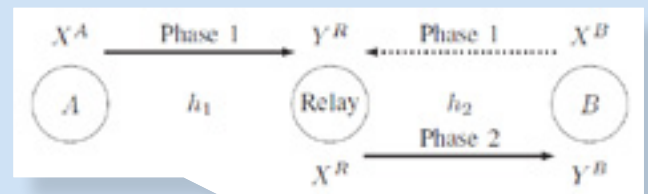


Figure 5 The Relay cannot read A's message due to the noise injected by B, but B can decode it.



We elaborate on this concept in the context of modern communication networks. For example, we consider the situation depicted in the picture, where node A wants to communicate a message to node B via a relay, which is cooperative but untrusted. In order to prevent the relay from getting to know the message, node B sends a signal XB that jams node A's signal XA representing the message. Based on its reception YR the relay sends a signal XR in the next phase, which is received as YB by node B. The emphasis is on developing a coding and transmission scheme, which takes into account the coefficients h_1 and h_2 of the channel between node A and the relay and the channel between the relay and node B, respectively, and which guarantees that node B can reliably decode node A's message (based on the received YB and the knowledge of the jamming signal XB). Meanwhile, the information on node A's message leaked to the relay should be negligible. In order to establish this, novel techniques such as reliable physical layer network coding are used.

Team: Jos Weber, Thijs Veugen, and Zhijie Ren

DYNAMIC COALITIONS

In various collaborative environments such as alliances for joint peacekeeping military operations, or joint emergency responses to the spread of for instance an infectious disease such as Ebola, coalitions are formed to achieve common objectives by sharing resources and joint decision-making. The coalition members may vary from private and non-governmental organisations (like red cross and doctors without borders), to governmental organisations (military defence, hospitals, state and local governments). In general each of the coalition partners have their own policies and will participate in the combined operation for a certain period of time. It is clear that as long as they are participating in the coalition, they should share information as optimal as possible. If a new partner joins the coalition, it should have access to the shared information. If a partner leaves, it should not be able to access the shared information. In other words access control is essential. Users that log on to the combined information network should be authenticated using certified public keys. In general a Certification Authority (CA) does this, which in fact is a Trusted Third Party (TTP). In practice, the main problem with a CA is that the coalition partners do not have one common TTP.

Together with the Maritime Warfare Centre of the Royal Netherlands Navy, we investigate how key management can be organized for dynamic coalitions. Distributed key generation and signature protocols are developed which does not need a TTP, and which still enable secure information exchange between the coalition partners.

Team: Jan van der Lubbe

SOFTWARE TESTING AND MONITORING

Millions of lines of code – written in different languages by different people at different times, and operating on a variety of platforms – drive the systems performing key processes in our society. Software is one of the most complex artifacts built by humans, but complexity is the enemy of correctness. Traditionally, scientists attempt to ensure that software is built to satisfy stringent requirements, specified in standards and requirements documentation. This assumes the one has total control over the production process of all software. In practice, however, one does not have control over all the complexities involved in modern distributed, constantly evolving computer systems.

We study and develop tools for automated software testing and reverse engineering in order to understand the behavior of software, regain this control, and prove correctness. Our methods are based on algorithms from grammatical inference known as state machine learning. Every piece of software reads inputs and produces outputs, the logical ordering of these inputs and outputs can be

thought of as a language, formally specified using a grammatical model such as a finite state machine or automaton. We learn this language by observing thousands of input-output sentences, available for instance in network traffic, call-stack traces, log lines, or by actively probing (aka fuzzing) the software's inputs. The finite state machines that are learned from this data are then used to detect intrusions such as botnet infections, to spot logical (security) flaws



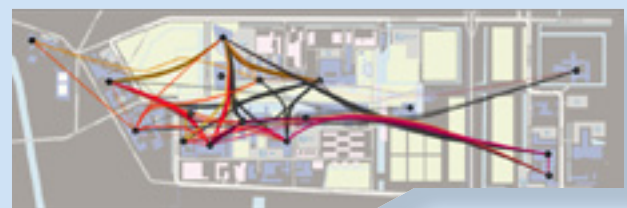
in software implementations, and to analyze obfuscated code.

Figure 6 Learning state machines from network traffic for botnet fingerprinting.

Team: Sicco Verwer, Gaetano Pellegrino, Qin Lin, and Krijn Wijnands

NETWORK SECURITY AND CYBER STATE ANALYSIS

Effective cyber security needs capable defense mechanisms and insight how one is being attacked and what to best do against it. In the CYS group, we work on both aspects of cyber security, developing new self-learning detection and protection schemes and new forms of analytics to find the latest generation of threats. While guarding against “script kiddie”-type attacks is considered a non-issue by now, the advent of StuxNet (and other customized targeted malware) has alerted defenders that they know actually very little about how these new threats operate and spread, leading to a number of very high profile “hacks” in the past. At TU (Figure below), we were able to demonstrate in a one-of-its-kind experiment how such advanced persistent threats churn through an organization, effectively bypassing most state-of-the-art security



measures. These results spawned an entire new research on behavioral intrusion detection systems.

Figure 7 The potential spread of USB malware over the TU network.

As an entry point to the “cat and mouse” game, join us for a short-term study or thesis project. MSC students directly work with our research team on a variety of challenging topics, such as (1) cyber analytics quantifying the skills, size and intention of attackers against TU and other well-known Internet services, (2) advanced intrusion detection systems for computer networks and industrial control systems, (3) TOR attacks and analytics, or (4) new detection and defense strategies against malware.

Team: Christian Doerr, and Norbert Blenn



Jacob Bernoulli

Marjolein Bouwmeester

I think we all know something about it, both Mathematics and Computer Science students. We all had to deal with it during our probability theory and statistics courses. I am talking about a distribution that is a special case of the two-point distribution, for which the two possible outcomes need not to be 0 and 1; I am talking about the Bernoulli distribution. Who is the man this distribution thanks its name to?

This man is Jacob Bernoulli, also known as James or Jacques. He was one of the many prominent mathematicians in the Bernoulli family. Jacob was born on the 27nd of December in 1654 in Basel, Switzerland. He also died there, only fifty years later. Although he did not live as long as most of us do now, we, Mathematics and Computer Science students, will never forget the name Bernoulli. He was an early proponent of Leibnizian calculus and he sided with Leibniz during the Leibniz-Newton controversy. Jacob is known for his numerous contributions to calculus, and along with his brother Johann, he was one of the founders of calculus of the variations. However, the field of probability is where his most important contribution was; he derived the first version of the law of large numbers.


When Jacob was younger, he followed his father's wish: he studied theology and entered the ministry. Next to theology, he also studied mathematics and astronomy, contrary to the desires of his parents. From 1676 on he travelled throughout Europe for six years, learning about the latest discoveries in mathematics and the sciences under leading figures of the time. This included the work of great names: Hooke, Robert Boyle and Robert Hooke. After those six years Bernoulli returned to Switzerland and began teaching at the University in Basel from 1683. The mechanics teacher married Judith Stupanus a year after he started. She and Jacob had two children. Next to his teaching career he began researching a lot. His travels allowed him to establish correspondence with many leading mathematicians and scientists of his era, which he maintained throughout his life. He also began studying the new discoveries in mathematics, including Christiaan Huygens's *De ratiociniis in aleae ludo*, Descartes' *Geometrie* and Frans van Schooten's supplements of it.

In 1687 he was appointed professor of mathematics at the University of Basel. This was the position he remained the rest of his life. Jacob had begun tutoring his brother Johann on mathematical topics and the brothers went on studying calculus together as presented by Leibniz. At that time the publications of Leibniz on the calculus were very obscure to mathematicians. The Bernoulli's were the first to try to understand and apply Leibniz's theories. Jacob collaborated with his brother on various applications of calculus; they worked together. However the atmosphere of collaboration between the two brothers turned into rivalry as Johann's own mathematical genius began to mature. They attacked each other in print and they posed difficult mathematical

challenges to test each other's skills. By 1697 the relationship had completely broken down.

Jacob Bernoulli had published some important work. For example, by 1689 he had published work on infinite series and his law of large numbers in probability theory. Jacob published five treatises on infinite series between 1682 and 1704. The first two of these contained many results, such as the fundamental result that $\sum \frac{1}{n}$ diverges, which Bernoulli believed was new. But actually, Mengoli had proved it forty years earlier. Jacob went on by trying to find a closed form for $\sum \frac{1}{n^2}$, which he could not. But he did show that it converges to a finite limit less than 2.

In May 1690 a paper *Acta Eruditorum* was published by Jacob Bernoulli. In that paper he showed that the problem of determining the isochrones is equivalent to solving a first-order nonlinear differential equation. The isochrones, or curve of constant descent, is the curve along which a particle will descent under gravity from any point to the bottom in exactly the same time, no matter the starting point. It had been studied by Huygens and Leibniz before. After finding the differential equation, Bernoulli then solved it by what we call now separation of variables. The paper showed the first time where the term integral appears with its integration meaning. In 1696 he solved the equation, that is now called the Bernoulli differential equation: $y' = p(x)y + q(x)y^n$. And he discovered and published a lot more.

Jacob Bernoulli died when he was only fifty years old, in 1705. For his gravestone, he chose a figure of a logarithmic spiral and the motto *Eadem mutata resurgo*, which means: *Changed and yet the same, I rise again.* 





Calendar

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