



# MACHAZINE

Volume 23 - Issue 1  
November 2018

Wiskunde  
Informatica  
Studievereniging



'Christiaan  
Huygens'

STUDY VISIT 2019: NEW HORIZONS

## Japan and South Korea

GIJS WETERINGS

## Abroad at Facebook

EMIEL HOEFKENS

## Model selection in Portfolio Management

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CURRENT AFFAIRS | ASSOCIATION | COMPUTER SCIENCE | MATHEMATICS | MISCELLANEOUS



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6<sup>th</sup> of December

Personal Development

17<sup>th</sup> of December

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## MACHAZINE

is a publication of

W.I.S.V. 'Christiaan Huygens'

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## Kilian Buis



The first few weeks of this new academic year flew by quickly. We are halfway through October, meaning unfortunately summer is over now. However, the sun is still shining and sometimes temperatures are exceeding 20 degrees, even with peaks to 25. These high temperatures can be noticed at the TU. Every lunch break, hundreds of students are lying in the grass at the campus, chilling in the sun with some friends and waiting for the next lecture to attend.

Meanwhile, everyone has found their place: freshman have made new friends and a new board is settled in CH. Not to mention the many people leave and join committees. This year, the MaCHazine committee has introduced 4 new members: Louise Leibbrandt, Julian Sanders, Willemijn Tutuarima and myself, Kilian Buis. This year's supervisor is Jeroen Nelen. Unfortunately, there are also a few people who left the committee, but we as MaCHazine would like to thank them wholeheartedly for their hard work: Beryl Sicam, Jamy Mahabier, and Arthur Breurkes, thank you for all that you have done!

With the first exam period behind us, my second year as an Applied Mathematics student has really kicked off. Together with the MaCHazine committee my year has started quite well, also because of some other activities this summer that started off the year. For the freshmen of CH, there was the Freshmen Weekend, which preceded the OWee, the introduction week for all new students in Delft. During this introduction period, the freshmen got to know each other, their studies and also the older students. Second and third year students had the possibility to become mentor at the OWee, which I also did. Together with a friend, I had a mentorgroup of 10 people with whom we did a lot of fun activities in the OWee. All in it was a fantastic week!

During this academic year, there will be even more fun events. In this quarter alone there were two fantastic parties I went to. For all students there was the party organized by the students of Civil Engineering: Civilization in Rotterdam, where I met a lot of my fellow students. There was also the Inter Faculty Party, better known as IFF (InterFacultairFeest), organized by five study associations including Christiaan Huygens. Here, you could meet a lot of other people, among which the international students who now fill the lecture halls of the first year of Computer Science.

The latter is something that I have seen people do a lot in the few first weeks: getting to know people from other countries. Right now, there are a lot of international students in Delft, especially in our faculty of EEMCS. This is mainly since the Delft University of Technology decided to use English as working language in most of the studies in Delft, including Applied Mathematics and Computer Science and Engineering. As a second years student I do not have that many international students in my classes, but within the freshman there are a lot of them, as this is the first year that non-Dutch speakers can be admitted to Computer Science & Engineering. I think it's great that more and more international students choose to study in Delft.

Mainly because of the "internationalisation" in Delft, all the lectures are given in English. This gave me some troubles in understanding the lectures last year, but after two weeks it became easier for me to follow. Right now, I am completely used to it and I don't even know how to formulate some of the definitions for my subjects in Dutch. Even all the exams are written in English now. But enough about the exams, I'm sure you've had enough of them, now it's time to read all the interesting articles that the MaCHazine has to offer!

If you have any questions or suggestions for MaCHazine, I encourage you to send a mail to [machazine@ch.tudelft.nl](mailto:machazine@ch.tudelft.nl). We're always glad to receive input of our readers. I will no longer keep you from reading the rest of this issue, enjoy!





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Cauchy integral theorem

$$\oint_{\gamma} f(z) dz = 0$$

Cauchy integral formula

$$f(z) = \frac{1}{2\pi i} \int_{\gamma} \frac{f(\zeta)}{\zeta - z} d\zeta$$

Cauchy differentiation formula

$$f^{(n)}(z) = \frac{n!}{2\pi i} \int_{\gamma} \frac{f(\zeta)}{(\zeta - z)^{n+1}} d\zeta$$




## From the Board

Rik Westdorp

Chairman

**The trees that line the cycling path of our campus have taken on a red color and the wind blows harshly around the EEMCS faculty building. The latter is of course always the case, but it is clear that we have entered a new season. The days of basking in the sun are over for now and we have returned to a rhythm of activity and productivity. For most of you this takes the form of academic development, but in my case it is different.**

**The past weeks have been centered around my new position as Chairman of W.I.S.V. 'Christiaan Huygens'.**


I knew that it would take some getting used to not studying but spending all of my time doing... what exactly? Being busy for the most part. Busy with all kinds of things. During the day you feel like you'll never check all the boxes on your to-do-list. And at the end of the day, when you have sort of managed to do so, you can't really recall what you were so busy doing! That's basically my experience of the first few weeks. Of course, there were some parts that stood out. It is great to see how, with this huge group of freshmen, the attendance at our activities is higher than ever. At the freshmen weekend reunion, for instance, the /Pub was absolutely packed!

Of course, my fellow board members and I did not start the year off without some preparation. Unlike newborn owlets, who are pushed from their nest into freefall by their mother, we took some flying lessons first! Over the course of the past summer, we came up with a plan on how we want to contribute to the association. Part of this plan is to keep a close eye on the quality of

education with the bachelor undergoing an explosive growth. We're also going to make committee-work more instructive, perform an upgrade of our systems and much more! To me, the highlight of the summer was the freshmen weekend. For us, it was the first encounter with 330 freshmen who are about to take their first steps into the student-life. For the freshmen it was a mixture of strange games (some involving bananas and beer), starting new friendships and hopefully a lot of fun.

Luckily for me, I am not the only one who dedicates his days to the study-association. I am part of a team of seven, the Board. I like to think of us as seven spokes of a wheel, each having a slightly different specialty. From my spot in the CH room, I have a great view of our Secretary. As the days pass he is starting to regrow his blonde coupe while he answers all incoming mail. In the corner to his left sits Yanna, our Treasurer, who is in charge of the financial health of the association. This means she not only pays the bills but also keeps us from spending too much! Near the book counter sits Annemieke, who is in charge of Mathematics Education Affairs, and not far from her right sits Jurriaan, in charge of Computer Science Education Affairs. Annemieke and Jurriaan monitor the quality of education by gathering useful feedback from students and advising the professors in charge. Next to Jurriaan sits Jari, who is in charge of Public Relation Affairs. He dedicates half his time to the contact between our association and the outside world. The other half of his time he spends organizing the biggest technological career event of the Benelux: 'De Delftse Bedrijvendagen' or DDB for short. Last but not least is my neighbor Jeroen, in charge of Career Affairs. Jeroen keeps in touch with our alumni and organizes our helpful Career Colleges. If you haven't attended one yet be sure to check it out sometime!

I hope that for you the start of this academic year has exceeded your expectations, and I wish you joy in both your study and free-time.

See you at one of our upcoming events! 





# TU Delft news

Wouter Versteegh

**The Delft University of Technology is the biggest and oldest public technical university in The Netherlands, established by King Willem II on January 8th, 1842. But what is currently happening in and around the TU Delft? This article will list the most important events of the recent months**

## **Schedule to quantum internet development created by QuTech researchers**

Quantum internet might be the first quantum information technology to become a reality. Researchers at QuTech, an advanced research center for quantum internet, published a comprehensive guide towards quantum internet. This is a type of internet that exploits phenomena from quantum physics, such as entanglement. The researchers are working on technology that allows the transmission of quantum bits between any two points on Earth. These quantum bits can be '0' and '1' at the same time, so they are 'entangled'.

This entanglement allows for two features in particular that are probably impossible for the internet we currently use. Firstly, entanglement allows improved coordination between distant site. This makes it so that we can synchronize clocks very accurately, and can link distant telescopes to obtain better images from outer space. Secondly, entanglement is inherently secure, because if two quantum bits are perfectly entangled, than nothing else can come in between. This makes quantum internet very suitable for things that require security and privacy. The first quantum networks are expected to be realized in the coming years, which could mean the beginning of the quantum internet era.

## **TU Delft to receive grant from Getty Foundation for research into Aula restoration**


Did you know that the our Aula building is a listed monument in the Netherlands? Neither did I, but as for all listed monuments, maintenance is important. In the coming years, the TU Delft will be conducting research into the possible restoration and modernisation of the Aula building. The Getty Foundation in Los Angeles has awarded a grant of 146.000 euros as a part of its Keeping It Modern initiative focused on the preservation of 20th-century architecture around the world. The Aula Building was built in 1966, and it is the venue for the highlights of academic life: PhD ceremonies, symposia, opening of the academic year and lectures. The research will be done in the Architecture Faculty and will be focused on the Aula's history in the context of its functional and spatial positioning on campus.



## **Using aircraft as weather stations**

To fly safely, aircraft need to know the weather on their flight trajectory. But while they are flying high up in the air, aircraft itself can also act as an information source to make weather models and forecasts better, researchers at TU Delft have found.

Wind and temperature data are important parameters in aircraft performance studies. Usually, researchers are forced to use numerical weather prediction models due to a lack of accurate measurements, and numerical methods which are usually applied to larger areas so that local accuracy decreases.

Although not intended for this purpose, aircraft surveillance data contains informations that can be used for weather models. In the paper published, the researchers present a method that can be used to reconstruct a weather field. The researchers answer two main questions: How to accurately derive wind and temperature from aircraft data and how to construct a real-time weather grid efficiently. The aircraft are considered as moving sensors that downlink information. From this information the altitude, ground velocity and airspeed are decoded. The temperature and wind observations follow from aeronautical equations. 

Current Affairs







# Dear Felienne

Dear Felienne,

We are sorry to see you leave as column writer for our MaCHazine. The MaCHazine committee would like to thank you for your inspiring columns throughout the last two years. If you haven't read her work yet, here are some quotes. Thank you Felienne!

*"My similar prediction is that in our future, everyone will be a programmer for 15 minutes."* J21N01

*"Free speech is meant to stand up against the government. Not to bully people."* J22N04

*"We, women in tech, are not being judged neutrally. Meritocracy, my ass."* J23N01

*"Students deserve to be taught by the best teachers we have. And Dutch Felienne will always be the better teacher compared to English Felienne."* J22N01



# New columnist

New column writer wanted!

Are you willing to deliver content to our MaCHazine every quarter?

Are you a teacher or professor at the computer science department of the TU Delft?

Become our new column writer!

Contact us at [machazine@ch.tudelft.nl](mailto:machazine@ch.tudelft.nl)

# Climate Change comes with Opportunities and Challenges

Fred Vermolen, Associate Professor in Numerical Analysis

**Instead of fighting climate change, we should accept climate change and act accordingly.**

Delft, October 10, 2018, the sun is shining, the sky is blue and the forecast says it is 23°C today. For the weekend, temperatures as high as 25°C are to be expected. The beaches are still occupied by many people who are enjoying the sun. We have had a fantastic summer in Europe, with lots of sunshine in The Netherlands, and Britain. Even in Scandinavia, the summer was hot and marvelous. We lost our winters in The Netherlands, winters have been mild and wet over the past years, whereas back in my childhood, winters could be harsh in The Netherlands with possibilities for ice-skating over the big rivers. Many people attribute all these phenomena to *climate change*. This process seems to occur on a global scale. I looked at the statistics for the Dutch winters, and indeed, it can be seen that the winters in The Netherlands have become significantly warmer in a short period of a few decades. In particular after the Millennium change, The Netherlands really lost their coldest winters. I am not afraid to say that the current-day changes with respect to the winters in The Netherlands are significant from a statistical point of view. I compared the statistical distribution of the average winter seasonable temperature to the statistical distributions from earlier spells, and indeed it is striking to see that it is highly probable that the current statistical distribution of the amount of cold weather during winter, as well as the average winter temperature, no longer matches the statistical distributions from the past. Such changes has never occurred earlier in the past three centuries, so there is something going on here, see [1]. Rapid climate change has really taken place and possibly it is still taking place.

According to many international experts, climate change is taking place globally as well. I did not look at the figures myself, but I am willing to believe that this is true. Hence I believe that climate change takes place both locally in The Netherlands and globally. Given that climate change takes place, it means that we have to cope with it, or at least, we have to take some action. I imagine that we can take two kinds of actions (or use a combination of both). One way is to fight climate change, that is, to take measures to prevent further climate change, or even to make the (global) climate recover to its earlier climate if climate change were reversible. The other possible reaction is to accept climate change and to adapt to climate change accordingly.

Since many (international) policies are directed to fighting climate change, I would like to consider the second option in somewhat more depth. Imagine that The Netherlands gets back the climate that we had in my childhood, say in the eighties. We would have rainy summers, cold springs, and cold winters with frequent snow and big freezes. Imagine how the Dutch railway system would operate! Or how many traffic jams we would get in this extremely densely populated country! I think that having the same winters and climate in The Netherlands would be a disaster for the country! So I think that we should not aim at recovering the climate to the state as it used to be (though I like ice-skating; ice-skating has become an indoor activity in The Netherlands). On the other hand, if you look at the past, climate has always been a dynamic process as a result of natural changes. We should also realize that our current climate is recovering from the period with the so-called Maunder minimum,

in which the intensity of the Sun was lower than presently (the 'small ice-age'). Many people agree with this, but then they argue that man is causing climate to change faster than naturally. This could be true, but a solid proof is still lacking as far as I know. And imagine that we could steer the global climate, then, there would be differences in opinion across many countries, which might ignite new wars. I do not believe that we need more wars than we already had or have.

But if climate change cannot be proven to be mankind induced, then it is questionable to direct policies according to this direction. Is it right from an ethical point to make people pay enormous taxes and to force these people to invest a large (more than significant) portion of their income to change their energy sources? An example is the current transition that the Dutch government wants to make in stopping the use of natural gas (which is still gaining more popularity abroad because of its cleanness). If somebody is sentenced to a certain punishment, then we want this conviction to be based on solid evidence. Is the evidence that climate change is mankind-induced sufficiently solid? Is nature not responsible for climate change? To make people pay large amounts of money on the basis of untrue hypotheses could be qualified as doubtful.

Of course, it is good to strive for clean air and to strive for a clean world. I am absolutely in favour of clean energy, clean cars, clean industries. In my perception, we are just borrowing the world from the future generations, so we should treat it right. But for me, it is crucial to use environmentally clean technologies to prevent contaminating the planet as much as possible. However, if it comes to climate change, then I wonder whether mankind is able to prevent this. I think policies should also be directed towards acceptance of climate change. Climate is changing. It is getting warmer in The Netherlands (and possibly colder in other regions). We should take advantage of this. We can grow Mediterranean fruits, crops, vegetables etc. We should grow olives, dates, figs, and so on. Given the rise of sea level, we should raise the dykes. Further, precipitation is going to be divided more spiky, in the sense that we are having longer spells of drought and shorter periods of very intensified precipitation. To cope with this change, we should pump rain water under very high pressure into the subsurface and store it there for later use during periods of drought. I am not claiming that all measures to inhibit climate change should be stopped, but what I am saying is that politicians should also direct their policies and measures according to the preliminary fact that climate is changing. In this sense, it is sometimes better to adapt than to wish to control.

Climate change, warmer summers, milder winters, personally I am very happy with this because it implies that I will be able to enjoy a nice pint of beer on a outdoor terrace during a larger fraction of the year. The more opportunities for drinking cold beer outside, the better!

Skål !



## References

- [1] Fred Vermolen (2018). *Is The Netherlands losing its winters?* Machazine, 22 (2), february, pp: 8-9



# Column Anna Kosiorek

International student CSE

Delft is a small city sandwiched between two larger cities in the Netherlands - Rotterdam and Den Haag. However, contrary to popular belief that small cities are boring, Delft bursts with activity thanks to the presence of a huge student community. The bars at the centre are filled with students even in the middle of the week, and there is no lack of events organised by student associations all around this city. More often than not, one encounters familiar faces of fellow students while biking through the city. Delft is not just a city of students though. It has a rich history in art such as the famous blue pottery as well as being the birthplace of the Dutch artist Vermeer. Delft is also the historical home of the Dutch royal family. The old town ambience along with canals criss-crossing all over the place truly makes Delft a charming town and a popular tourist destination, especially in the summer when there is a lot more sun.

While the university keeps the students constantly on their toes chasing deadlines or preparing for exams, student life here is not all about academics. The Sports and Culture centre offers a plethora of activities with facilities and instructors for a large number of indoor and outdoor sports. At the Culture centre you can learn different styles of dance, musical instruments and art among other things. This allows students to enhance their skills outside of academia or even try something new. Committees such as Christiaan Huygens enable students to bond with colleagues from their own faculty with various academic and social activities. Finally, Dream Teams emulate start-ups and consist of student-run technological projects that compete with the best students from all over the world. Dream Teams are the perfect place to apply what you learn in class to build a successful prototype.

As it is the beginning of the new academic year, I would like to give you some advice that I wish someone had given me when I started out as a master's student here. Academic life is hard, and it is not uncommon to have multiple deadlines simultaneously. Sometimes you will end up submitting assignments that are not good enough just because there won't be enough time to juggle between submissions of all the courses. You will have to find your own middle ground between studies and a social life. A good friend once told me that you can either have a grade of 9 or you can have friends. It is important to strike a healthy balance between the two. The best opportunities to start new friendships are at the beginning of the year when the workload is relatively light, and almost everyone is new and trying to find their own circle of friends. Before it gets any busier, I encourage you to go out to parties, meet new people, have a good time, and maybe meet your future best buddy. Ask your classmates to join you for lunch or even a coffee, or even set up a group study session. If you feel like you are bored, head to the most popular place in Delft - the library. It is as busy as the busiest bar on weekends. However, don't expect anything stronger than an espresso shot or two, or as many as you can handle. The library will most likely be your home as each quarter heads to an end.

If you are unable to find parties happening around Delft because you live under a rock, make the ESN community your new clique. I have attended a fair number of their weekly social drinks as well as parties and trips in and around the Netherlands and have enjoyed myself thoroughly at every one of them. You will get to meet many party animals, and coincidentally, a majority of them are exchange students. They are usually the most outgoing of all. It may seem comfortable to hang out mostly with people from your own place, but there is a lot to learn from meeting people from all over the world. Going out with internationals truly broadened my perspectives on many different aspects of life. I do offer a word of caution about meeting only exchange students. They are here temporarily, and you might end up having to make new friends after six months. Moreover, make sure to account for beer budget in your expenses. If you are not keen to spend too much, make sure to check out /Pub which is our own faculty bar located in the basement of EEMCS. The beer, though being cheap, must be paid by cash.

Last but not least, while living in the Netherlands, you are given a unique opportunity to delve yourself into the Dutch culture. Commuting by bike, eating Gouda cheese and being direct are not the only characteristics of locals. Being here for a year, I have learnt to mind my 8-hour work schedule, pay attention to not to be late and keep an eye on bargains. Although I still have not get used to eating sandwiches for lunch, 'bitterballen' became one of my favourite snacks, that I will truly miss if I leave the country.

TU Delft provides a comprehensive student life experience. Despite the workload being sometimes overwhelming, we are supported by many academic as well as social facilities. This combination makes your stay here unique and unforgettable. I encourage you to push your limits by exploring different areas which you may not have yet developed. And if you are having a bad day, put on your rain jacket, hop onto your bike with a pack of bitterballen, and enjoy the beauty of the sights and sounds of Delft by the canals at the city centre.









# Freshmen weekend as a mentor

Sophie Walboomers

**As every year, the Freshmen weekend was once again filled with integration games, morning gymnastics, bananas, beers, amazing pick-up lines, committee members, mentors and of course, Freshmen! This year the weekend was bigger than ever and presented a new challenge for everyone involved. Looking back, it was certainly once again a huge success. This was thanks to the Wocky who provided the drinks and food, the Filmcrew who captured everything on film, the FaCie who wrote down all the good stories, the WIEWIE who organized it all, and of course board 62!**



As a mentor, the preparation for the weekend included choosing a mentor-buddy and attending an afternoon where we learned our responsibilities for the weekend. During the weekend, we as mentors were mostly responsible for guiding the integration games, and making sure the freshmen were able to get to know each other in a fun way. Integration techniques included many games to get a conversation started, games to learn each other's names and some drinking games (for those over 18 of course).

The weekend started at EEMCS, the faculty of mathematics and computer science. There, the freshmen came in contact with some committees, including the WIEWIE and the Wocky. The board also had a chance to introduce themselves to the students. This allowed the freshmen to familiarize themselves with all the groups that would play an important role during the weekend and also in their first year at CH. Furthermore, the students were given a tour around the faculty that was guided by us, the mentors. After this, the bus trip to the actual destination of the weekend could begin during which the freshmen got to know each other by playing games led by individual board members. These games continued on arrival at the place of destination.

In the evenings there was the opportunity to party. This is, in my opinion, the most fun way in which the freshmen get to know each other. As a mentor, this is also a great opportunity to reconnect with all existing members taking part in the weekend and enjoy a fun night of dancing with each other. The party lasted until the early morning and those who managed to stay until the end got to enjoy a midnight snack provided by the Wocky.

The weekend certainly also had a sporty side; during the all famous sports afternoon, the freshmen visited all sorts of games guided by mentors. These games included soccer, handball, hockey, Twister, "jeu-de-everything" and an obstacle course filled with soap and water. In the mornings, everyone was woken up by the WIEWIE who, as always, employed their loud music to wake the freshmen for morning gymnastics. People who did not really feel like coming out of bed could expect to find their mattresses on top of them in no time. This very effective way of waking up all the hungover freshman made sure everyone got out of bed and had a nice breakfast. As a mentor, we were luckily excused from this ritual and got to enjoy a more peaceful morning.

During the Saturday afternoon, there was an activity where mentors who also participated in a committee last year got the opportunity to introduce their committees. This way, the freshmen are aware that CH has more to offer than only organizing the Freshmen weekend and providing a discount when buying books. The freshmen are able to do a committee too in their first year, so in this way, they learn what possibilities there are. Another way for the freshmen to get to know the committees of CH was by the performances given on Saturday evening. The committees Wocky and WIEWIE, and board 61 and 62 had all prepared a small act and battled against each other in front of the mentors and freshman.

The weekend ended with the forming of groups in which the freshmen would enter the OWee (the introduction week of Delft). The freshmen could join 2 mentors in groups of 10. The challenge was then to come up with a group name and logo which provided the freshman a chance to bond with their group and mentors. After this and some final cleaning up, the weekend had unfortunately come to an end. The buses were filled with sleepy freshmen and mentors as we all headed back to Delft. 🇳🇱



# Freshmen Weekend as a freshman

Merel Steenbergen

**I recieved the honour of writing a small piece about the fresCHmen weekend by Christiaan Huygens. I will try to do my best to give an accurate description, as my memory is still a bit clouded. To summarize, my freshmen weekend meant: a lot of beer, not a lot of sleep and lots and lots of fun.**

From the moment we arrived at the EEMCS building the WIEWIE tried to frighten us: "Here is your booklet for this weekend, don't lose it: It's your soul!" For some freshmen that worked, others had already lost their booklets the moment we started singing. I remember seeing the expression on people's faces trying to hide their nerves and the immediate relaxation the moment someone talked to them and tried to become friends: this will be okay after all. Groups of friends were being formed from the moment we entered the EEMCS building until the moment we entered the buses. From then on, the real freshmen weekend began. Without phones (we had to hand them in earlier) to distract us, talking to each other wasn't that hard. We just started with "Hey, what's your name?" and had a conversation to get to know each other.




What I think is great about the freshmen weekend is that you can find people to bond with easily, because of the variety of activities. If you like to do sports, you could pick the people that were really competitive during the activities and if you don't like sports you could join the people standing a little bit more to the side-lines. This way, you could just make up your own program to make the weekend the most comfortable for yourself. For example, during the sports activities on the second day, me and two of my brand new friends sneaked away to our bedrooms to chill as if it was a slumber party. We were on our beds, just chatting and bonding for over an hour which was one of the best moments of the whole weekend for me.

The best activities from the Freshmen Weekend? The parties! It was just so much fun to dance with all of the people you met during the day and a lot of other people that were just suddenly there. It was also for the crazy parties that I was glad I had a week of rest between the freshmen weekend and the OWee. I met a lot of people and forgot a lot of names the moment I heard them. I am really bad at remembering names, but that could be just me and the beer and parties certainly don't help. The only thing I didn't like about the freshmen weekend was that it only lasted for a weekend. However, I had found a clever solution for that problem: just don't sleep. Luckily, the WIEWIE accidentally skipped our room while waking up the freshmen.



Not only did we have a lot of fun this weekend: we also learned a lot. Rule 1: The WIEWIE is always right. Rule 2: You cannot buy only one beer, because you don't drink beer by yourself. We also learned to stay away from the FilmCrew and the FaCie as they did not let any information slip away, they knew everything about everyone. We were also introduced to some new traditions, like icing, 'VO and not saying that one word you say when you want to be in the front seat of a car. The international students were also taught some of the most important Dutch words.

I had a lot of fun on this weekend and I hope everybody enjoyed the weekend just as much as I did and made a lot of cool friends too. I think we can all say thank you to the WIEWIE for organizing this weekend, thanks to the Wockies for not letting us starve, thanks to the FaCie for making the FaCie booklet to help us remember names, the FilmCrew for making the epic aftermovie and of course the new Board of CH.

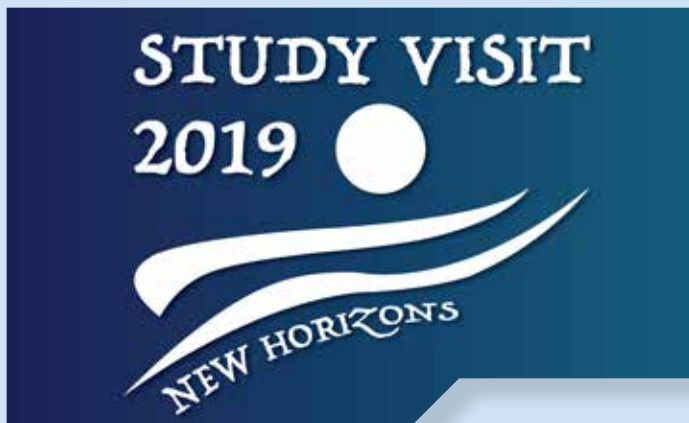
Best regards, Merel Steenbergen 

# Study Visit 2019: New Horizons

The Study Visit Committee

**From the 10th to the 31th of July 2019 , thirty Applied Mathematics, Computer Science/Engineering and Embedded Systems students of W.I.S.V. 'Christiaan Huygens' will embark on the Study Visit New Horizons: A three week long trip through several cities in Japan and South-Korea. During this trip we will try to see all the beautiful nature and cultural hotspots that Japan and South Korea have to offer. Furthermore we will visit plenty of universities and companies.**

Even before setting of to Japan and South Korea, there will be a splendid preliminary program in the Netherlands. Curious what we will do during Study Visit New Horizons? Read on!



As you've undoubtedly noticed, the fields of study that our association represents are more than ever present in modern day society. Mathematics and Computer Science fulfil a very important role in the world, and their influence will only grow in the years to come. The techniques and products that emerge from our growing knowledge and expertise have become essential to our way of life, so it might not come as a surprise that the list of countries making extreme progress in these fields is ever growing.

To give members of W.I.S.V. 'Christiaan Huygens' the opportunity to experience education and business on an international scale, the association organizes a study visit every three years with a destination outside of Europe. The next study visit will take place in the summer of 2019, where 32 enthusiastic participants can emerge themselves in Japan and South Korea. Japan as a country that is emerged regarding technology, full of nature and a culture known nowhere in the western world, and with South Korea as an emerging country regarding technology with beautiful nature and with the same mystical culture. Participants will get the unique opportunity to visit highly ranked universities, multinationals, large and small companies, awe-inspiring cultural hotspots and beautiful landscapes.

Japan and South Korea will give the visiting person an experience they have never felt and seen before. The countries are one of a kind, and the culture is mostly unknown for the people in the West. Let us enlighten you!

Japan, a country stretching 400 thousand square kilometers and numbering some 126 million inhabitants, is one of the most futuristic and well-developed countries of Asia. As the country occupies a vast area divided over almost 7000 islands, it offers a broad range of sights. From old temples still shining like they once did and beautiful maintained nature, to megacities with highly developed technology; the diversity in this country is immense. We are hoping to see this technological development back in the universities we are planning to visit. First off, we are in contact with The University of Tokyo, which is ranked 28th in the QS World University Rankings. Moreover, we are trying to arrange an interesting tour around the different research groups at the Tokyo Institute of Technology. Concerning the companies to be visited in Japan, Oriental Light and Magic Incorporation, animator of Pokémon among other things, is willing to give us a tour around their workstations. Also, Preferred Networks will give us a tour on their research on self-driving car or other research topics. All of this makes for a perfect travel destination, where gaining new experiences plays a central role.

South Korea, a country stretching 100 thousand square kilometers made up of almost 3000 different islands and numbering some 51 million inhabitants, is a country that in the last years has developed itself into a country that's one of the most technologically advanced countries in the world. This can be noticed when looking around on the futuristic campus of the Seoul National University. Concerning companies that have set up some of these technological advancements, contact with Naver is made. They are for South Korea what Google is to the western world. South Korea offers a broad range of sights: from old Korean temples to beautiful hot springs, gardens and wild nature to large metropolises and the fascinating people of South Korea itself, the diversity in this country is immense and seen nowhere else.

The current intention is to visit four cities: Tokyo, Kyoto, Daejeon and Seoul. Each of these cities offers a broad range of possibilities for visits and excursions. Tokyo, Kyoto and Seoul house top universities and a lot of interesting companies. We intend to visit both and expect this to be very educational. Especially to find out the differences between our western way of working at universities and companies and theirs. Luckily, there will also be more than enough time to visit the beautiful nature spots and cultural highlights. One way of trying to see much of the countryside is by traveling around. We will even take a boat to pass many of the islands just on the offshore of Japan. Besides transportation and accommodation during the three weeks, half of the dinners are already included in the participation fee. This way, the group will get together informally as well multiple times throughout the trip.





There is a variety of topics that play a large part in the Japanese and South Korean industry. For Study Visit New Horizons, we chose three of these topics, the so-called 'Topics of Interest': Big Data, Sustainability and Privacy. Each of these topics is closely related to both Mathematics and Computer Science, thus offering plentiful opportunities for participants to enhance their knowledge on these subjects. The program of the study visit will be incorporating these topics to create cohesion between the different activities that will take place in the three weeks that we'll be visiting Japan and South Korea.

Even before we set off to Japan and South-Korea, we will have a marvelous preliminary program in the Netherlands. The preliminary program allows the participants to get in touch with fellow participants and companies inside the Netherlands. The preliminary program takes place during the second semester this year, consisting of in-house days, lectures and workshops. For people who are not familiar with in-house days, during an in-house day we will visit a company on location. The company will give us a presentations about their business or research and will give us a case to work on or play some kind of game. This is a unique and fun opportunity for students and companies to get in touch. Students can meet companies for possible internships, thesis assignments or future careers. Already throughout the preliminary program the three topics are taken into account. We will visit multinational trading companies, to a smaller scale-up grocery distributor and from bankers to researchers. As long as it touches one of the three topics of interest and the company can provide an interesting in-house day, lecture or workshop. The preliminary program is mandatory to take part in if one wants to participate in the study trip. The program will take place during the second semester this year, so keep that in mind when signing up for this amazing experience.


If you want to learn more about the study visit, don't hesitate to talk to one of the committee members. We are eager to tell you more!

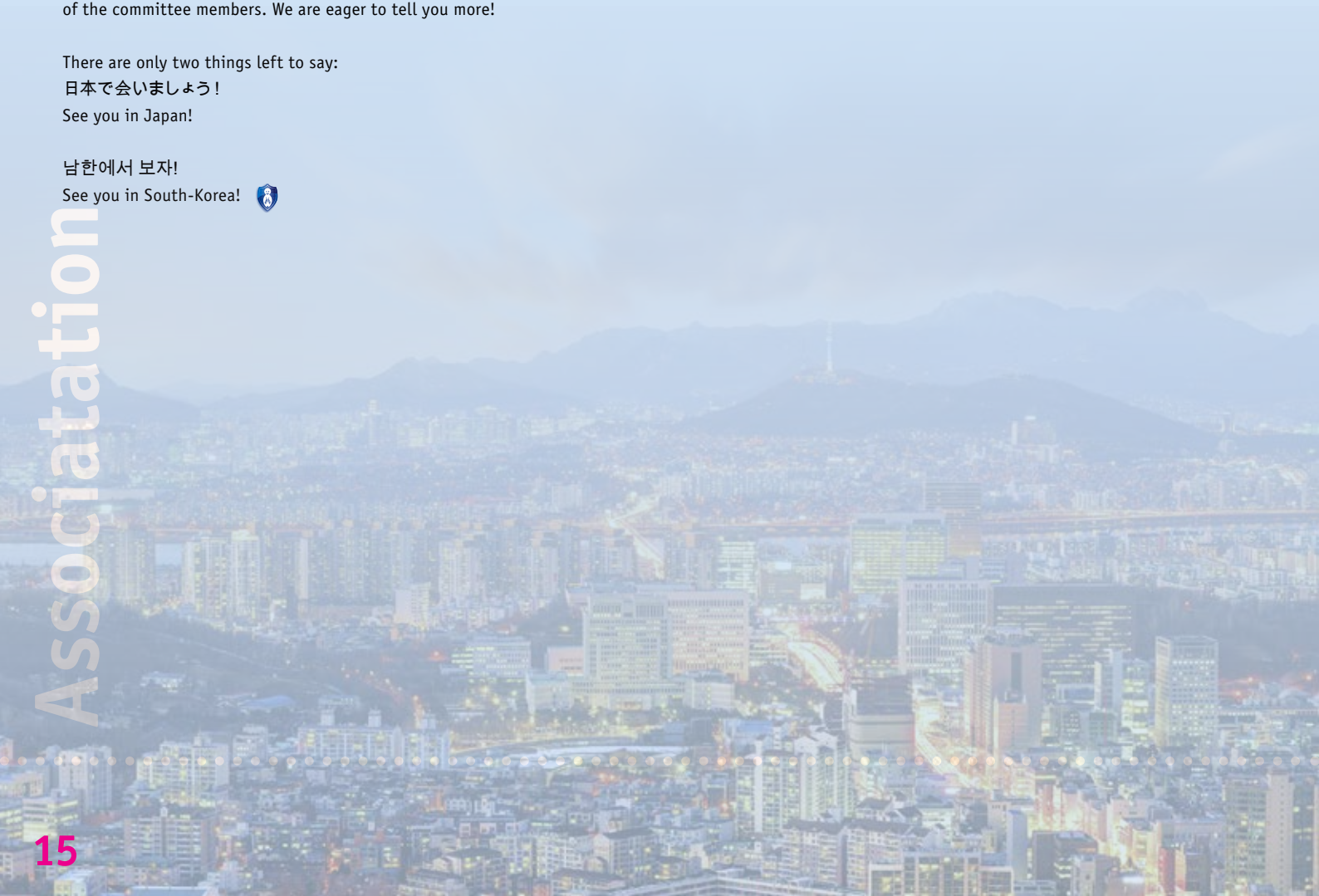
There are only two things left to say:

日本で会いましょう!

See you in Japan!

남한에서 보자!

See you in South-Korea! 



# ComMA, MaPhyA and CoH

David Alderliesten, José Dupont and Rebecca Glans

**W.I.S.V. 'Christiaan Huygens' has various committees on which we sometimes shine a light, no matter how big or how small. In this section we will give you a brief overview of some of the committees that recently organized activities!**

## ComMA

On the 18th of September, the committee for master activities (ComMA) organized the first activity of the year: a game night. During this night, master students of the masters of Computer Science and Mathematics were able to bond over drinks, French fries, some snacks and authentic Dutch and international games. A great attendance of close to 60 students showed up, and the event continued into the night until around midnight. A second round of French fries and snacks were ordered to satisfy the hunger of the attendees.



This was the third activity organized by the ComMA. The ComMA is at the moment of writing looking for new master students who wish to organize two activities throughout the

year to further incorporate international and Dutch master students into the local community. Consider activities such as a pub-quiz, an international food festival, or other similar socially oriented events.

If you are interested in joining the ComMA for the coming year, visit CH and contact Jurriaan der Toonder. All positions, from chairman to secretary still need to be filled.

## MaPhyA

On the 12th of September the MaPhyA (Mathematics and Physics Association) organized the doubleday; a day for the double bachelor Applied Mathematics and Applied Physics students, that gives the students the possibility to get to know both study associations and to meet all the other Doubles.



The doubleday started at six o'clock at the VvTPlein, from where the students set off to the terrifying basement of the TNW building. While philosophizing about the dark MaPhyA

affairs that they would find downstairs, the Doubles arrived at the TPKV, where the board of the VvTP was already waiting for them.

After a double hello, the Doubles were told something about the association and afterwards the bartenders gave them free beer! The time to leave for a walk to EWI came way too fast. During this long walk from TNW to EWI the Doubles had some time to ponder about double integration, double slit experiments and the double pepperoni pizzas that were waiting for them at EWI. Once they arrived at CH the Doubles integrated very well with the board and also the /Pub was visited. There the doubleday was closed successfully with pizzas!

## CoH


Wiskunde en Informatica Alumni Commissie 'Constantijn Huygens' (COH) is a committee devoted to bringing together all Mathematics and Computer Science alumni from Delft University of Technology. If you obtained a bachelor's or master's degree, you can attend our activities free of charge! To make sure alumni have opportunities to catch up with their fellow alumni, to share their real-world experiences and extend their professional networks, we organize several activities throughout the academic year. We kick-off the year with our annual BBQ on the last Friday of August. Our second activity is



the so-called New Year's drink, halfway through January. Further into the academic year we organize a third and final event to make sure you can keep in touch with your fellow alumni throughout the year. Whereas the BBQ always takes place behind the EEMCS building, the other two activities take place

at various locations throughout the Netherlands. To make sure you have enough to talk about during the evening, we often combine drinks with something educational: think of a presentation by a professor, PhD student or a business professional, including a visit to their office.

Don't want to miss our next event on the 18th of January? Make sure you subscribe to the alumni newsletter<sup>1</sup> and keep an eye out on our website: [coh.ewi.tudelft.nl](http://coh.ewi.tudelft.nl)!

COH is constantly improving her activities. Any feedback or tips are thus very appreciated! Please feel free to fill in the form at [wisv.ch/coh](http://wisv.ch/coh). 

[1] <https://www.tudelft.nl/en/eemcs/the-faculty/alumni/>



# FaCie

## A Proof of Awesomeness

**When the MaCHazine asked me to write this piece, my first thought was: "Please, god no more writing about the freshmen weekend!". As a member of the FaCie committee, I had already exhausted all my witty remarks, fun facts and surprising statistics for our (amazing!!!) booklet and literally had nothing more to say about it! However, if true FaCie blood runs through your veins, it is impossible to pass up an opportunity to share the origin stories of the new generation of CHeroes!**

The Freshmen Weekend as a FaCie-member meant three days of speaking to and getting to know 300(!) new freshmen. Quite ironically, I am horrible at remembering names... and faces... But, "integreren kan je leren", and after a weekend full of introductions, re-introductions and re-re-introductions, I am certain of one thing: these new freshmen are really, really cool. I know every FaCie probably says this about their year, but I truly believe that this year was a freshmen weekend unlike any that have been before. Of course, I would not make such a claim without being able to prove it, so here we go.



Firstly, these guys seem to have some eternal source of energy that the rest of us do not know of yet. During the day, these freshmen were inexhaustible. Matrix after matrix, song after song, they kept on giving 1000%. Both nights, the party went on until the morning light, filled with outgoing freshmen. To my amazement, it was the mentors who had the worst hangovers the following day!


Secondly, this was the first freshmen weekend that included international freshman! Once we cleared up the general confusion about "committee" vs. "commission" among the FaCie, there was nothing left to keep us from having the best time ever with these cutie pies. They carelessly mingled with the dutchies day and night, until it was impossible to determine whether to

address anyone on the dance floor in Dutch or English! This new group of CSE students already stole my heart, and I am sure the rest of CH will soon have fallen for them too.



Thirdly, there was an amazing FaCie this year, that taught them well. They came in as simple freshmen, but they truly left as supermen. And last but not least, these guys are the bomb.

Therefore, we can conclude that this was the best freshmen weekend ever.

Q.E.D. - Sterre 



# Symposium: 'Care for the future - Improving health bit by bit'

The Symposium Committee

**As our species grows older and older, our health has become an increasingly important aspect of our lives. We concern ourselves increasingly often with our physical and mental health. On the 22nd of October, various academics and speakers from the industry have shown how they have innovated healthcare technology, improving health bit by bit.**

We realize that many of you are not sure of what you would like to do after your bachelor's or masters. This is why we, the symposium committee, and W.I.S.V. 'Christiaan Huygens' see value in organizing this biyearly symposium to show what the (very exciting) practical applications of the Mathematics- and Computer Science studies are.

The host Bernard Leenstra opened the day by introducing himself. Bernard is a young doctor whose dream was to become a trauma surgeon. Worried by having experienced how little people know about first aid, he took an extraordinary turn in his career and started a concern that offers better and cheaper first aid lessons to various organizations. With both his practical and educational knowledge in the field, he was able to ask critical and informative questions to speakers throughout the day.



The first two lectures had some overlap in the sense that they were both - at least partially - about one of the deadliest disease groups: cancer. Dr. Jeroen de Ridder started and talked about how the Vrije Universiteit (VU) in Amsterdam used big data analysis to predict the efficacy of a cancer treatment.

After this talk, Dr. Ir. Dennis Schaart took the stage. He works at the unique collaboration between Erasmus MC, LUMC, and TU Delft: the Holland Proton Therapy Center. He told us about various aspects of the new technique of curing cancer using proton therapy, an alternative to photon radiation therapy which damages much less of the surrounding tissue. They have even treated their first two patients at their facility in Delft.


After a delicious coffee break, it was time for perspectives from the industry. The first company, LOGEX, spoke about how they used big data from hospitals to improve the cost-efficiency. Then Prodrive told about the challenges they experience in creating the hardware for a control room and how to get a fast and high-resolution image displayed. After these talks, it was time for lunch.



The last half of the day covered a variety of topics, including Alzheimer's, Virtual Reality as a medicine and ethics. Dr. Ir. Stefan Klein started off by revealing his research on the aging of the brain. In this large-scale project, a team worked towards modeling the changes that take place within the human brain while aging and used this model to give an early diagnosis of various neurodegenerative diseases such as Alzheimer's.

Dr. Ir. Willem-Paul Brinkman then gave a very energizing talk on the subject of using virtual reality as a cure for fears and other mental diseases. He showed how various forms of VR already work due to human psychology despite not appearing very 'real'. The audience even got to try a virtual doctor.

In the final talk of the day, Dr. Rik Wehrens of the Erasmus School of Health Policy & Management gave us a different view on developments in health technology. Our natural reaction to new technology is to fantasize about utopian, or more often, dystopian futures. He theorized about where these reactions may come from and how we should treat ethical discussions about new technologies.

This discussion continued during the drinks accompanied by 'bitterballen'. Overall, we were happy to see that the audience was very engaged and asked interesting questions during the entire day. We would like to thank everyone that helped out and attended, and we wholeheartedly recommend anyone who missed this edition to visit the next one! 

Association





# Rituals of Leaving: Predictive Modelling of Conversational Leaving Behaviour

Felix van Doorn

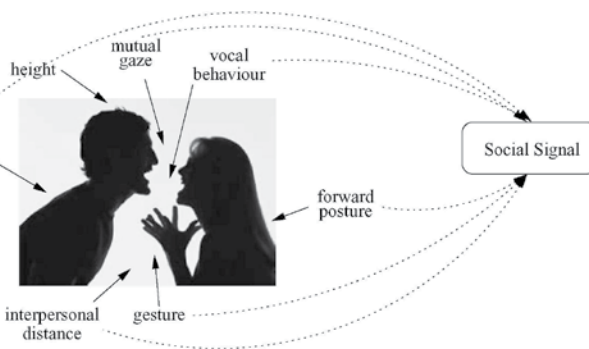
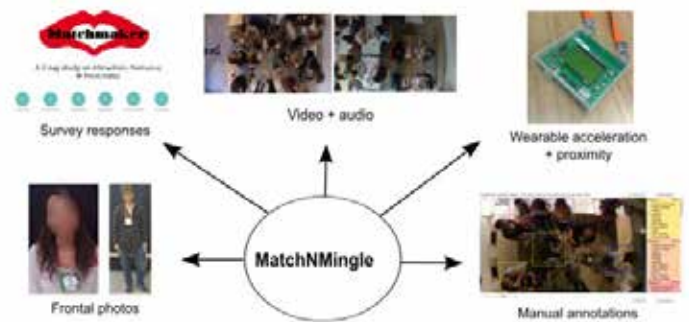
**Have you ever had a conversation with someone at a party that was so much fun, you simply could not walk away? Many of us have also experienced the opposite: a boring group conversation that you attempt to quietly leave, because it's so boring and awkward it almost physically hurts.**

Leaving is a fundamental part of each and every interaction we perform in our daily lives. Understanding of this phenomenon can be applied in a wide variety of fields, such as surveillance and developing emotional intelligence in robots. For my thesis, I was interested in researching whether it was possible to predict whether a person was going to leave the group and when this would happen.

In this article, I would like to give you a high-level overview of my thesis project and also share some lessons in the process of writing a thesis.

At the start of the second year of my Master's, I followed a course called Social Signal Processing. Social Signal Processing (SSP) can be described as the field of study concerned with "modelling, analysis and synthesis of social signals in human-human and human-machine interactions" [1]. A social signal is simply an umbrella term for any physical, machine detectable trace of non-verbal behaviour. I was intrigued by the combination of machine learning and psychology to understand human behaviour, so it was an easy decision for me that I would pursue a project within this field. I contacted one of the lecturers responsible for the SSP course to inform about potential projects and filled out the required paperwork for officially starting a thesis. An overview of all procedures and administrative details can be found on the faculty website, under EEMCS Graduation Policy. I would urge anyone starting a thesis now or in the near future to familiarize oneself with the graduation policy, as it will save you from a bureaucratic nightmare.

ended with a 30 minute mingling session, in which participants could walk freely and speak to whomever they wanted. In this mingling session, I saw how group conversations formed and evolved. The evolution of such conversational groups was driven by people joining and leaving groups. While reviewing state-of-the-art literature, I came to the realization that nobody had ever studied the evolution of conversational groups or the underlying dynamics. In order to limit the scope of the project, I decided to only research leaving behaviour. Before I could start developing any kind of machine learning models, there were two tasks that I needed to complete. The first task was the annotation of group behaviour throughout the MatchNMingle data. As exciting as I find machine learning to be, manual annotation of your data is a boring, mundane, time-consuming and nerve-wracking task that every sane person usually outsources. Unfortunately, prior attempts at this had turned out to be expensive, with less than desirable results. Therefore, I was forced to do this myself. In order to complicate things, the event was not filmed by a single camera but multiple cameras filming different parts of the room. Apart from the extra time required to watch each second of film, there was also additional overhead in the form of consistency checks, handling occlusions and all kinds of grievances. You can probably guess that this was not the most exciting part of my project, but fortunately it resulted in a complete set of annotations that can prove to be very valuable in future projects.



## Problem setting

The research group (Socially Perceptive Computing Lab) had created a complex dataset, known as MatchNMingle, which describes the behaviour of people in a speed-dating event through wearable accelerometer data and video recordings. This event was set up as follows: on three different days a group of 30-32 people (half men, half women) would start with one-on-one speed dates and

## How to model non-verbal behaviour

The second task of these tasks was to find cues indicative of leaving, which in turn was equivalent to a crash course in psychology. This was necessary, because I needed to derive handcrafted features for my model and that requires some domain-knowledge. As no work had been done on leaving behaviour, I chose to find a likely proxy of leaving behaviour on which I could base my models. Eventually, I settled on a concept known as 'involvement' which is defined as the degree to which a person is cognitively and behaviourally engaged [2]. The underlying assumption was that the more involved a person was in a conversation, the less likely they were to walk away from a conversation in the next few seconds. Behavioural cues that are indicative of involvement are hand gesturing, head gesturing, hair touching and turn-taking in conversation. The more involved people are in a given conversation, the more coordinated these behaviours become. Up until this point, most of the work I had been doing was qualitative in nature, but now I was ready to move on



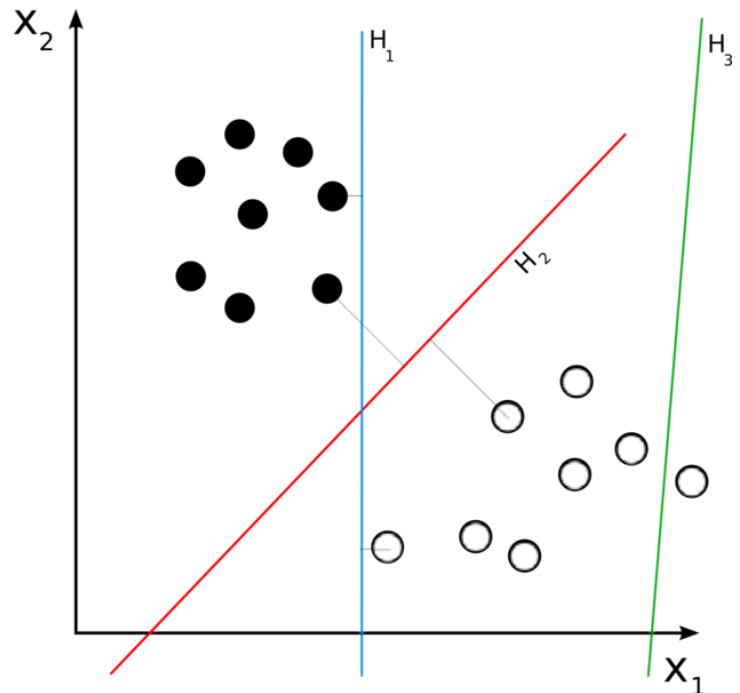
to the quantitative part of my thesis: developing predictive models. Based on earlier work within the group, I had access to a number of methods that could be used for automatic detection of interesting behavioural cues, such as hand gesturing, head gesturing and speaking turns, from either accelerometer data or video data. The output of these algorithms, simply a binary sequence of varying length, serves as the input of the algorithms that I was developing for prediction of leaves. Based on this input, I wanted to perform two types of experiments. The first of these setups was a binary classification setting, predicting if a given feature vector describing a group interaction would result in a leave within the next  $n$ -seconds. In this case  $n$  was a prespecified number between 0 and 30. The second of these setups, was a regression setting. In these experiments, I wanted to see how accurately I could predict the time of leaving. Before I input these sequences into any kind of learning algorithms, I needed to preprocess the data and determine an adequate feature representation. Given that I had determined that there was a link between coordination and leaving, we could compute a number of coordination metrics for each pair present in any conversation. There were a number of issues for which I needed to take adequate measures. First of all, real-world data can be very messy. I was dealing with missing sensor readings and readings that did not make any sense, which later could be explained by participants playing with their wearable accelerometers.


## Performing experiments

Another issue that I had to deal with, was the fact that the groups in my dataset came in all shapes and sizes and the lengths of the respective conversations also differed from group to group. In order to deal with this I chose to aggregate the descriptions of individuals into a group-level description. This boiled down to representing each conversational group using a number of group-level statistics computed using the computed synchrony scores for each pair present in the conversational group. In order to compare conversations of different lengths, I chose to extract fixed length subsequences using a sliding-window approach. While this had the added bonus of giving me more data samples that I could use for training, the resulting dataset was unfortunately imbalanced. In layman's terms, this means that I had many more examples of interaction that did not result in leaves than of those that did result in leaving. This is unfortunate, because it leads to deteriorated prediction performance for almost every known classifier. In my case, most classifiers performed horribly initially. Only an AdaBoost classifier with 50 decision trees managed to consistently beat random performance. On the one hand this was already an interesting result, but I hoped that dealing with the class imbalance could lead to improved performance. Also, I was hoping to also find a model that was also easy to interpret as this makes it more clear what features are important. During the Cyber Data Analytics class (also definitely worth taking!), I had learned of such methods and decided to use the SMOTE algorithm to generate synthetic data samples to use as additional training samples. This is however by no means an absolute guarantee that somehow magically leads to significant increase in performance for every existing classifier. Eventually the combination of SMOTE and K-Nearest Neighbor (KNN) classification turned out to give the highest classification performance (AUC=0.61). Although these models achieved significantly better than random performance, this result should be regarded as mostly a theoretical achievement. The long training time, memory requirements and slow run-time performance of KNN leave much to be desired in case we would want any practical implementation of the developed algorithms. In any real-life setting, you would want to run algorithms of this kind on a wearable device or other computing platform with limited resources.

Unfortunately, I had to conclude that this approach did not lead to any satisfactory results for the regression experiments.

From the results that I obtained from these experiments, I could conclude that



it was possible to predict whether a person would leave a group within the next 0 to 30 seconds. Even though there is still much room for improvement, I am confident that my research will provide a strong foundation for numerous future projects. 

## References

- [1] Burgoon et al. *Social Signal Processing* Cambridge University Press 2017
- [2] D.A. Coker and J.K. Burgoon *The Nature of Conversational Involvement and Nonverbal Encoding Patterns* 1987

# A summer abroad at Facebook

Gijs Weterings

**Over the past summer break, I have been lucky enough to spend my summer doing an internship. And not just at any company; I got the chance to see and experience Facebook London from the inside! In this post, I'd like to take you along in some of my experiences over the summer, and show you what a joke tweet can put in your path.**

## Software Architecture, the course that started it all

This whole experience started a while ago actually, when I took the Software Architecture master course in early 2017. What you do during this course is pick an open source project, analyze it in many different ways (from analyzing technical debt to mapping social structures in the open source community). My group, consisting of Tim van der Lippe, Chris Langhout, Chak Shun Yu and myself, opted to go for Yarn [1], a package manager for JavaScript projects, made in the open by Facebook, as well as external contributors. It was interesting to us, as the project was still very new— just a few months in development— but it had already been picked up by the open source community and was under very active development.

## Tweeting it for fun

At the end of the quarter, we delivered a nice report with all our findings, along with a few pull requests to the project itself. Arie van Deursen, the professor of the course, proceeded with bundling all reports from all groups and published it as a digital book [2]. As a joke, we tweeted a link to Christopher Nakazawa, who's an engineering manager at Facebook. To our surprise, he promptly sent us a private message thanking us for our thorough analysis and asked if we were interested in applying for a summer internship at Facebook. A few days later, Yarn announced their plans for a 1.0 release, and in their blogpost [3] we read:

*"We would specifically like to thank a team from the Delft University of Technology: Tim van der Lippe, Chris Langhout, Gijs Weterings and Chak Shun Yu. The four of them did a fantastic analysis of the Yarn project and sent pull requests to improve it in many areas. They also pointed out gaps in our test coverage, which our new core contributor Simon Vocella has been working on improving."* - Maël Nison in his blog post announcing the roadmap to Yarn 1.0

Over the next few months, I stayed in touch with Facebook, did technical interviews (which were very practical, no "what if" scenarios that lost all touch with reality) and suddenly got a phone call telling me I had been offered a position for a summer internship at Facebook London. I was very surprised, but also very happy.

## England, here I come!

When summer arrived, it was time for me to take the trip to London where I would live and work for 3 months. Just a few weeks before I left, I finally got a message telling me what my team would be. It was called "Workplace

Interfaces", and that didn't help at all. A few emails with my manager later I had a vague idea: I'd be doing front-end development of a "Facebook clone for work", Workplace [4]. If you've never heard of it, think [www.facebook.com](http://www.facebook.com), but everyone on there works at the same company. Facebook also uses Workplace internally, and instead of memes and updates about your personal life, there are groups for all the different teams and organizations within Facebook, providing updates, and a platform for discussion about everything happening in or around Facebook. Okay, and memes, of course ;)

I met my team, a small group of developers supported by a few researchers and a designer. Due to some scheduling conflicts, my project for the internship wasn't quite ready for me to start on, so I spent the first few days doing a few tiny tasks. There, I was a bit overwhelmed with how quick, smart and versatile everyone in my team was. Compared to them, I felt I was back in my first programming lecture, figuring out the most basic of problems.

Turns out, that's super normal. Everyone struggles in the beginning. You don't know the application, the tools and the entire platform around it, so you feel pretty useless. After a few days and a ton of support by the rest of my team, I slowly started to get some work done.



## Culture and work-life balance

These are the two things I think are by far the best about working at Facebook. Even more so than all the awesome tech and code you get to play with. The culture in Facebook is incredible, I quickly discovered. Facebook has gotten a ton of heat because of everything that happened earlier this year. The thing I hadn't expected is how incredibly serious this and a lot of other events are handled internally. From open Q&As with Mark Zuckerberg, who answered every question employees threw at him, to discussions both on- and offline between coworkers. I don't know exactly what I expected, but I was blown away by how professional it all is handled. Trust me, Facebook employees really care about what is happening, and are working hard to make things better, now and in the future. It is perfectly okay for you to be very much





in favor or against anything, and your opinion really is heard and taken into account. Even as an intern, I participated in a few of these discussions and got my point across, which led to further discussion about the topic.

Working hard doesn't mean working super long though. About halfway through my internship, I was in the flow, working on cool new features, and worked a bit late. Suddenly, my manager popped up, asking what I was still doing at the office, and saying I should stop working soon and go enjoy my evening. And not only your manager keeps you in check. At Facebook there is a saying, "Feedback is a Gift", and let's just say everybody is very generous in their gift-giving. I've gotten plenty of advice from my peers over the weeks, not just about the job but about life in general, and I'm very thankful for it.



## Enjoying London

Of course, my summer wasn't all work. We had an amazing group of (over 70!) interns from all over the world, and apart from our daily activities within the office, we also had plenty of time to chill out, party and explore London and its surroundings. From a crazy club (KOKO) in an old theater to go-karting with a bunch of the interns (I won!), to a summer camp and a hackathon with the entire company, and from watching the world cup in English pubs to giving back to charity, we have done it all and become a huge group of friends.




## End of the summer

Way too quickly the end of the summer came near. I was working hard on my project, and everyone I showed it to genuinely seemed to love it, asking for me to enable the beta version for their account. I also felt way more comfortable and productive, especially compared to the first few weeks. Besides my main project, I also took on more and more side projects out of pure interest. Crucially, this wasn't only okay, but heavily encouraged within Facebook.

During the last week of my internship, we all heard if we would get an offer for a full-time position. I never would have expected it before the internship, but I actually got the offer to return to Facebook London after my master, and since I had such an amazing time, I decided to accept! After my master thesis that I've just started, I'll be going back to London full-time, and I'm already excited.

As for my work during the summer: My main project is now slowly rolled out within Facebook for "dogfooding" (internal testing of new features), and will eventually make its way to all (millions of) Workplace users. As for the smaller tasks and side-projects I took on, these are already live and being used today!

This entire internship came across my path, but I've learned so much I would advise everyone to do an internship over the summer, even if you don't get ECTS for it. Don't be afraid to aim high, try to apply for an internship at your dream companies. Wherever you end up, try and soak in as much as possible from the culture, the work and the people. 



Computer Science

[1] <https://yarnpkg.com>

[2] <https://delftswa.gitbooks.io/desosa-2017/content/yarn/chapter.html>

[3] <https://yarnpkg.com/blog/2017/05/12/introducing-yarn/>

[4] <https://www.workplace.com/>

# More than a job

ASML

**Meet Pieter Smorenberg, a 2017 Delft University of Technology graduate who recently found himself back at university, this time explaining to students how technologically fascinating his job is. Originally from Amsterdam, Pieter couldn't have guessed that he would find so many technical and social opportunities in Veldhoven at ASML, the fast-growing tech giant.**

Pieter studied precision and microsystem engineering, and now works as an applications engineer in customer support at ASML. He also spends some of his time as one of over 400 'ASML Ambassadors', giving guest lectures at his alma mater university or promoting STEM among school-aged children in the region.



"The more I tell people about working here, the more things I realize I appreciate about the company," he says. "A lot of people don't realize just how big ASML is in the semiconductor industry. You realize it when you visit the campus in Veldhoven. You see the big tower, the cleanrooms, the huge gardens and parking lots; it's impressive. And then at the complete other end of the scale, almost all of the metrics we work with here are practically at an atom level – no other company is producing such advanced chip-making equipment." ASML is the world's leading provider of semiconductor lithography equipment, in an industry worth \$438 billion. All of the world's top chipmakers are our customers, including Samsung, Intel, and TSMC.

Pieter has certainly found more than he expected in Eindhoven. "Coming from Amsterdam and Delft, I was a bit uncomfortable about moving to Eindhoven. But actually it seems like everyone is moving here. A lot of my friends from university are here, and there's a lot going on that you only discover after you get here. It's not a 'small city'. It's a melting pot – people come from all over the world to live here."

## About ASML – ASML in 100 words

ASML provides chipmakers with everything they need—hardware, software and services—to mass produce patterns on silicon, helping to increase the value and lower the cost of a chip. Our key technology is the lithography system, which brings together high-tech hardware and advanced software to control the chip manufacturing process down to the picometer. All of the world's top chipmakers like Samsung, Intel and TSMC use our technology, enabling the waves of innovation that help tackle the world's toughest challenges. ASML has 19,000 employees worldwide. We are headquartered in Veldhoven (The Netherlands) and have over 60 offices in 16 countries.

# ASML

Be part of progress

Pieter has also found more than a career at ASML. "There's so much going on in our company, technically as well as socially. We have annual technology conferences where you can learn about what's going on in your department, and across the company. This is really unique to ASML. You can develop your network, and learn a lot about what other people are working on, and get ideas for yourself. I'm like a kid in a candy store at these conferences."

Celebrating our technology isn't the only way we have fun at ASML. "I sometimes go for drinks with the 'Young ASML' group for young ASML professionals," Pieter says. "You get to meet colleagues from all kinds of different departments. It's a really open-minded atmosphere, because everybody is there for the same reason: to share a good evening with each other." The ASML campuses are like small cities – more than 12,000 people work just at the Veldhoven campus alone. Young, old, male, female, LGBTI+, living abroad, you name it – it's easy to feel at home at ASML.

As a customer support engineer, Pieter also gets to travel a lot, listening to ASML's customers and helping them to achieve their technology roadmaps. During his travels he experiences other cultures first-hand. "You learn a lot – socially and culturally as well as technically. It's been an eye-opener for me. We're diverse, in terms of education, background, and nationality, but we're all working together as one team because we all have the same goal: make this incredibly complicated technology a reality."

Want to help us make our technology a reality? Find out more at [www.workingatasmil.com/students](http://www.workingatasmil.com/students).

# Mathematics





# Electives in Mathematics

Marcus Schutte, Arian Joyandeh and Frank van der Made

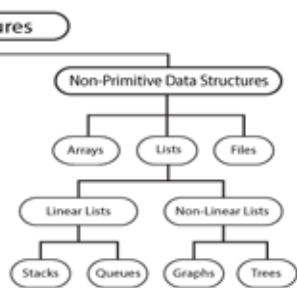
In the bachelor of Applied Mathematics, there are various options to specialize in a certain direction. These are in the form of the electives in the first and second year of the study. In this section, we will shine a light on some of these courses based on student experiences.

## Algorithms and Data Structures

I thought the first year elective courses are great, because after studying math for a half year I liked that we now could choose something different, which gave a good variety to my last half year. I had chosen the Computer Science course: Algorithms and Data Structures. I had chosen this course, because I liked the course Introduction to Programming (a first year Mathematics course) and I wanted to learn more about programming (although I study Mathematics and not Computer Science).

In the course we learned some cool algorithms, and we also learned how to implement them. For instance Dijkstra's algorithm, an algorithm that gives a shortest path between two points. This is nowadays used very often in daily life. I always found it fascinating and wanted to know how it worked. For such algorithms to work it is also important to have a good data structure. Because when you want to find the shortest path from here to say your holiday destination in Italy, there are lots of different routes that needs to be stored into the computer.

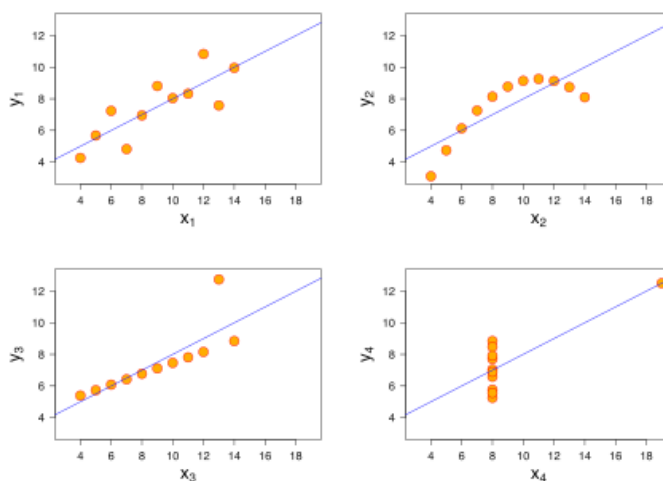
For big data sets we learned different ways how to store data, for instance in lists or arrays. Also, how you can sort your data in an efficient way. Not only did we learned the algorithms itself, but we also learned to reason about the efficiency of the algorithm; to argue about the running time of an algorithm and we learned about space that an algorithm needs. All in all, a very nice course where the things that you learn have a direct application.



## Advanced Statistics

After having finished my first year of the bachelor Applied Mathematics, I was enjoying a well-deserved summer holiday reading a beautiful book about soccer, Soccernomics by Simon Kuper and Stefan Szymanski.

In this book the writers want to answer the question: 'Which European country loves football the most?' This might sound like a difficult question to give an objective answer to, but luckily data exists. Loving football expresses itself in three ways; playing the game, going to the stadium and watching football on TV.



When discussing the issue of TV viewing figures of football games, the writers of the book had found a dataset for all television figures of World Cups and European Championships since 1998. Using this data to compare different nations level of fandom, has a lot of problems. For example; Germany (usually) does well in Championships and therefore they have a lot of viewers. How can you compare the successful Germany to the not-quite-as-successful England? The ratings are not strictly comparable. Is there any way to compare the viewer ratings?

This is where the writers introduce the wonderful method of 'multiple regression analysis'. They explained it as following: 'Quite simply, multiple regression is a mathematical formula (first identified by mathematician Carl Friedrich Gauss in 1801) for finding the closest statistical fit between one thing (in this case TV viewing figures) and any other collection of things (time of matches, who is playing against who and so forth). Using this method, the writers did very interesting observations and the answer to what European nation was the biggest football couch potatoes was Croatia! We came in at a very nice 3rd place.

I was fascinated by how the writers did a lot of cool conclusions based upon this mathematical method that I did not know yet and when I was taking the Introduction to Statistics course and the professor told us that if we were interested in multiple regression analysis, we should take the Advanced Statistics course, I was sold.




I learned a lot of cool things in the Advanced Statistics course. It was based a lot on how to interpret real-life data and manipulate it using the programming language R. The beautiful idea and concept of regression analysis, which we discussed earlier, is what plays a central part in this course.

For anyone that has a similar interest in real-life applications of mathematics, using data to make cool conclusions on problems that seem not so straightforward at first, follow the Advanced Statistics course!

### Applied Algebra: Coding Theory and Cryptosystems

Choosing a elective can be hard. In this article you can read about my experiences with Applied Algebra, a second year elective. This course runs during the third quarter and has about 8 contact hours a week. This course covers a very specific kind of application of algebra namely Codes and Cryptosystems. These specific subjects were also basically the main reason I chose to do this course last year. On high school I did a module on crypto and I found that very interesting, and always wanted to know a bit more about it. By doing this course you do learn a lot more about crypto, but I have to say that the majority of the course is about codes. I'll briefly explain what this means, basically data in computers is stored in zero's and ones. And if you transfer those zero's and ones sometimes a mistake occurs and a zero becomes a one. This is ofcourse something you don't want, and to fix this problem you send a bit of extra data. And with this extra data there can be checked if an error has occurred in the transmission. The way this is checked is called the code. During this course you learn all kinds of ways to make these checking-codes. That really is a big question because of course you don't want to send a lot of extra data, but you do want to detect a lot of errors. And maybe even make a code that can correct errors automatically. During the lectures Joost de Groot uses his own slides and writes a ton of examples on the board. There are assignments that Joost made himself, and there is also a book which covers the content from the lecture well and has useful additional assignments and examples. The only assessment for this course is an exam at the end of the third quarter.

I found this course one of the most interesting and applicable one's I've followed yet. And I can really recommend everyone with a little bit of interest in this topic to follow it as well the coming year. 

# Model Selection in Portfolio Management

Emiel Hoefkens

In portfolio management, it is common to find a combination of stocks such that an objective is optimized. A common risk measure criterion that gets maximized is the Sharpe ratio. Can we maximize the future Sharpe ratio when we only have historical data?

## Portfolio Management

Last July I finished my thesis and with that I completed my Bachelor study in Applied Mathematics. The aim of the project was to apply model selection to portfolio management. In this case, portfolio management is the management of a collection of stocks that are traded on the financial market. These stocks can vary in price, as they are dependent on supply, demand, interest rates etc. It is a portfolio manager's task to increase the value of the portfolio over time. To compose a (good) portfolio containing different stocks, an objective gets optimized. A common investment criterion that gets maximized is the Sharpe ratio. This is a risk adjustment measure of return used to evaluate an investment's performance. It is based on the idea that given two investments that offer the same expected return, investors will prefer the less risky one.

An investment's future performance is often estimated using probabilistic models which has random variables as outcomes. Therefore we can use the standard deviation of the investment's return as a proxy for the risk we take. The Sharpe ratio ( $\rho$ ) of an investment  $P$  is defined as:

$$\rho_P = \frac{\mathbb{E}[R_P - r]}{\sigma_P},$$

where  $R_P$  is the rate of return of  $P$ ,  $r$  the best available risk-free rate and  $\sigma_P$  the standard deviation of  $R_P$ . Using this ratio lets you see how much additional return you are getting for the added volatility of holding a risky position over a risk-free security. Afterwards, it also allows to determine whether a portfolio's returns are due to smart investment decisions or just a higher level of risk. The investment with the highest Sharpe ratio is thus considered the best. A rule of thumb is that an investment with a Sharpe ratio greater than 1 is seen as a good investment. See Figure 1 for an illustrative example. [1]

## Out-of-sample Sharpe Ratio

The Sharpe ratio can be used very well to evaluate a portfolio's historical performance. But how can we make use of the Sharpe ratio and the data to estimate a portfolio's future performance? When we are setting up a (new) portfolio, we would like to combine various stocks to maximize our Sharpe ratio<sup>1</sup>. The ratios between these stocks gets denoted by the vector  $\theta$ . From now on we make the distinction between the in-sample and out-of-sample

<sup>1</sup>A portfolio often contains more than one product. Single products are risky, but combining them can possibly lower the overall risk. This is called hedging and gets used a lot by (almost) every company that deals with financial products.



Figure 1: Showing the development of the value of two portfolios. When only looking at the return over the past few years, Investment 2 would have been the better investment (higher return). However looking at the big changes in value, investing in this portfolio does seem more risky as this can probably happen in the future as well. The Sharpe ratio penalizes this by taking in account the standard deviation of the (monthly) returns. Therefore Investment 1 gives you more return per risk and also considered the better investment.

Sharpe ratio. The in-sample Sharpe ratio is the ratio obtained over historical data. The out-of-sample Sharpe ratio is the future Sharpe ratio we want to maximize (or over another unknown data set). Know that this value cannot be fully determined due to the unpredictability of the financial market. So we are going to try to estimate this.

Because we are in a multidimensional setting in portfolio management, we use the co-variance matrix  $\Sigma$  of the returns as the proxy for the risk<sup>2</sup>. Define  $\hat{\mu}$  as the vector of the in-sample means of the excess returns for the different stocks in the portfolio. Then the in-sample Sharpe ratio is

$$\rho(\theta) = \frac{\hat{\mu}^T \theta}{\sqrt{\theta^T \Sigma \theta}}.$$

This leads to the ability to easily compare the historic performances of portfolios containing different stocks, different ratios between stocks or portfolios of different sizes (in terms of Sharpe ratio). We are mainly interested in the  $\theta$  that maximizes the in-sample Sharpe ratio (we will later see that we need this to maximize our out-of-sample performance), so we define:

$$\hat{\theta} = \arg \max_{\theta \in \Theta} \rho(\theta),$$

where  $\Theta$  is the parameter space over which  $\theta$  gets optimized (which often is just  $\mathbb{R}$ ). Finding this  $\hat{\theta}$  is done by solving  $\hat{\mu} = \Sigma \theta$ . You are able to derive this when setting

$$\frac{d \log(\rho)}{d\theta} = 0$$

and check that it is indeed a maximum. Then  $\rho(\hat{\theta})$  is the maximum in-sample Sharpe ratio. But is the portfolio with the maximum  $\rho(\hat{\theta})$  then the portfolio

<sup>2</sup>The covariance matrix also contains the correlations among all different assets which plays a key role in hedging a portfolio.



we expect to also have the highest out-of-sample Sharpe ratio? Suppose we choose a fixed strategy i.e. fix the ratios among the products ourselves, our expectation for the out-of-sample Sharpe ratio is then the same as the in-sample Sharpe ratio. However, when optimizing the ratios, we have to deal with so-called noise fit and estimation error. The Sharpe Ratio Information Criterion (SRIC) corrects for this. It is an unbiased closed form estimator for the out-of-sample Sharpe ratio when the in-sample Sharpe ratio is optimized over  $k + 1$  products. The SRIC is defined as

$$SRIC = \hat{\rho} - \frac{k}{T\hat{\rho}}$$

where  $\hat{\rho}$  is the in-sample Sharpe ratio maximized over  $(k + 1)$  stocks and  $T$  time of in-sample data. When comparing different sizes of portfolios and data sizes, the *SRIC* will give you the portfolio with the highest expected out-of-sample return per risk. Therefore it can also be applied as a portfolio (model) selection criterion. If you want to know more about the deviation and setup of the SRIC criterion, I refer you to Paulsen & Söhl [2].

### Appliance on the AEX Index

So now that we know the theory to find a best portfolio i.e. find and use  $\hat{\theta}$ , we are going to apply it to the Dutch market. We take into account all the stocks from the companies that are currently listed in the AEX index. Investing in an AEX index fund is considered a relative secure investment, but can we outform this (in terms of Sharpe ratio) when we compose our own portfolio? For later comparison; the Sharpe ratio of the AEX index over the last two years was just 0.058.

In the best case we take all 25 companies at once into account and find our optimal portfolio. Unfortunately, due to the lack of computational power, this is not feasible (the sum of the number of possible combinations is just too high). Therefore we split the 25 stocks into 5 groups,  $G1 / G5$ , containing 5 stocks in alphabetical order. So per group, we are interested in finding  $\hat{\theta}$  for  $k = 0, \dots, 4$ ; finding optimal in-sample portfolios for all possible portfolio sizes. Remember that  $k$  is a parameter and that we have  $k + 1$  stocks in our portfolio. After that we apply the SRIC criterion to the results per group and determine which portfolio composition is estimated to perform the best out-of-sample. We then find 5 optimal portfolios respectively to their groups. See the outcomes for all  $k$  of all 5 groups in Table 1.

**G1 / G5 - Estimated OOS Sharpe Ratios**

k	SRIC Values				
	G1	G2	G3	G4	G5
0	<b>0.1345</b>	0.3699	<b>0.5120</b>	<b>0.2200</b>	0.4549
1	-0.0804	0.3796	0.5016	0.0722	0.6247
2	-0.3031	0.3906	0.4672	-0.0233	0.6639
3	-0.5241	<b>0.4803</b>	0.3984	-0.1657	<b>0.6911</b>
4	-0.7550	0.4202	0.3295	-0.3141	0.6439

Table 1

For Group 1, 3 and 4, the optimal portfolio just consists of just 1 stock. Including any other stock of their group in the portfolio, against any rate whatsoever, is not worth it. It does not contribute enough to the Sharpe ratio to be worth the out-of-sample risk of an extra risky position in the portfolio. It is estimated that a portfolio containing 4 stocks of group 5 will give the highest out-of-sample Sharpe ratio. To approximate the overall optimal portfolio over all stocks, we combine the portfolios that were the best in their group. So we take into account all the concerning stocks and apply our same method; find the optimal portfolio for every possible portfolio size.

This eventually results in a overall optimal portfolio of size 8 and an estimated out-of-sample Sharpe ratio of 1.366. Assuming the AEX will perform the same in the upcoming months as it did the last two years, our newly composed portfolio then estimates a much higher Sharpe ratio. If you want to know about the composition of these constructed portfolios, you can check my full report at the repository of the TU Delft [3].

### Conclusion

Investing can be rewarding, but keep in mind that it is also very risky. The Sharpe ratio is a commonly used risk adjustment measure of return used to evaluate an investment's performance, but can only be calculated over historic data. As a portfolio manager, you are interested in the out-of-sample performance. The SRIC criterion estimates this when a portfolio gets optimized over in-sample data. This criterion can be used to outform indices or just other portfolios.

### References

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# Historical Person: Augustin-Louis Cauchy

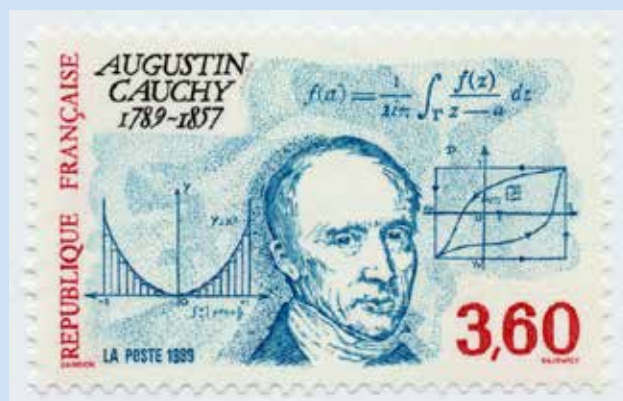
Julian Sanders

If you've been paying attention in your mathematics lectures, odds are that you've come across his name. Actually, it is quite impossible to obtain any Applied Mathematic EC's without studying his theorems. His work permeates the entire field of mathematics. In complex analysis, it even becomes difficult to distinguish between the essential theorems like "the Cauchy-Riemann equations", "the Cauchy-Goursat theorem", "Cauchy's integral theorem", "Cauchy's first and second integral formulas" and "Cauchy's residue theorem", as they are all named after him. When you use one of these theorems on an exam, you should probably just play it safe and write "according to Cauchy" to avoid mixing up their names. However, while Cauchy has quite the mathematical resume, he was not someone you'd want to meet. Regardless of whether you admire his work or not.


According to Hans Freudental, a mathematician from Utrecht University, "more concepts and theorems have been named for Cauchy than for any other mathematician". He has 800 research articles and 5 complete textbooks to his name. Two of his most notable books, "Cours d'Analyse de l'École royale polytechnique" and "Le Calcul différentiel" were so widely used at the Parisian technical universities (l'École Polytechnique), they were close to the equivalent of the TU Delft's big blue calculus book. Cauchy's other writings covered notable topics including: the theory of series, where he developed the notion of convergence and discovered many of the basic formulas for q-series. In the theory of numbers and complex quantities, he was the first to define complex numbers as pairs of real numbers. He also wrote on the theory of groups and substitutions, the theory of functions, differential equations and determinants. Because of his contributions to mathematics, his name is one of the 72 inscribed in the Eiffel tower.



Nonetheless, Cauchy wasn't easy to get along with. Norwegian mathematician Niels Abel said that: "Cauchy is mad and there is nothing that can be done about him, although, right now, he is the only one who knows how mathematics should be done." Why was he so mad? Well, to start off, Cauchy was an extreme



workaholic. In a letter to his family, he once wrote: "I get up at four o'clock each morning and I am busy from then on. ... I do not get tired of working, on the contrary, it invigorates me and I am in perfect health...". With this habit you wouldn't want him as your roommate. Especially if you're already annoyed when your roommates set their alarm too early in the morning when you're hungover and trying to sleep in. Luckily, he wasn't anyone's problem as he lived with his parent's until he was 28 years old. Furthermore, despite his brilliance, you wouldn't want him as your professor. He was a terrible lecturer, way too hard levels of understanding were necessary to follow his lectures, and he crammed way too much material into his allotted time. A student of his reported that he and his peers "were very confused" and that during his lectures, Cauchy was "skipping suddenly from one idea to another, from one formula to the next, with no attempt to give a connection between them." He also remarked that "His presentations were obscure clouds, illuminated from time to time by flashes of pure genius. ... of the thirty who enrolled with me, I was the only one to see it through." When Cauchy was the tutor of the grandson of king Charles X, he would often become annoyed when his pupil showed little interest in mathematics and would start yelling at him. His yelling would go on until the queen would come to calm him down. The final reason for being perceived as mad is that Cauchy was quite a staunch Catholic. He was despised by his peers in the scientific community for being a religious zealot. He would often bring religion into his scientific work. For example, in 1824, when asked to give an academic report on a theory of light he attacked the author for his view that Newton had not believed that people had souls. In a letter to his mother in 1810, he wrote: "So they are claiming that my devotion is causing me to become proud, arrogant and self-infatuated. ... I am now left alone about religion and nobody mentions it to me anymore..." His strong religious views caused him to be rejected for many academic positions.

While Augustin-Louis Cauchy was a great mathematician, he was not a great person. His theorems are your best friend during exams, but you would not actually want to have been his friend in real life. 



# Mathematical puzzles

Kilian Buis

## Problem 1

Suppose 5 pirates find a chest with 100 golden coins. They must divide this according to the pirate code:

As pirate A is the captain, he may propose how to distribute the coins. Then each of the pirates (including pirate A himself) gets to vote yes or no. If the vote passes, or if there is a tie, the coins are divided according to plan. If the majority votes no, then pirate A will walk the plank. Then pirate B becomes captain and he gets to propose a new distribution. All the remaining pirates vote again. If his plan is rejected, he walks the plank too. Then pirate C will take his place. This process repeats with the captain's hat moving to pirate D and then to pirate E until either a proposal is accepted or there is only one pirate left.

Each pirate wants to stay alive with as much gold as possible. None of them trust each other, so they cannot collaborate in advance. Also, being bloodthirsty pirates, if anyone thinks they will end up with the same amount of gold either way, they will vote to make the captain walk the plank. Each pirate is excellent at logical deduction and knows that the others are too.

What distribution should pirate A propose to make sure he lives and he gets as much gold as possible?

## Problem 2

Solve in the next equation for the digits  $A$ ,  $B$  and  $C$ :

$$ABC = A! + B! + C!,$$

where  $A, B, C \in \mathbb{N} > 0$

Interpretation:  $ABC$  is in this case not the product of  $A, B$ , and  $C$ , but the concatenation. For example:  $A = 1$ ,  $B = 2$  and  $C = 3$  is not a solution because  $123 \neq 1! + 2! + 3! = 1 + 2 + 6 = 9$

# Java puzzle: The unwelcome guest

Louise Leibrandt

The program in this puzzle models a system that attempts to read a user ID from its environment, defaulting to a guest user if the attempt fails. The author of the program was faced with a situation whereby the initializing expression for a static field could throw an exception. Because Java doesn't allow static initializers to throw checked exceptions, the initialization must be wrapped in a try-finally block. What does the program print?

```
public class UnwelcomeGuest {
    public static final long GUEST_USER_ID = -1;

    private static final long USER_ID;
    static {
        try {
            USER_ID = getUserIdFromEnvironment();
        } catch (IdUnavailableException e) {
            USER_ID = GUEST_USER_ID;
            System.out.println("Logging in as guest");
        }
    }

    private static long getUserIdFromEnvironment()
        throws IdUnavailableException {
        throw new IdUnavailableException(); // Simulate an error
    }

    public static void main(String[] args) {
        System.out.println("User ID: " + USER_ID);
    }
}

class IdUnavailableException extends Exception {
    IdUnavailableException() { }
}
```

#### References:

J. Bloch, N. Gafter (2005). Java Puzzlers. Indiana, USA: Pearson Education.



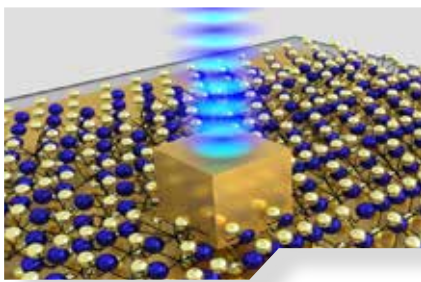
# Science Trends

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.**

## Bitcoins just warm me up

Cryptocurrency, like the other buzz words on this page, represents an ever-growing phenomenon. And if you thought going digital would mean less climate impact, in this case you would be wrong. Researchers from the University of Hawaii discovered that Bitcoin alone could raise global temperatures by 2°C in 2033. Even though the future of Bitcoin is not certain, taking into account the CO<sub>2</sub> emissions it causes today and at what rate new technologies are incorporated, their impact on climate change could be devastating.[3]



*Artist illustration of a gold nanocube emitting a ray of light[2]*

## Wait, light is hackable?

The lightbulbs we all know release trillions of photons that reflect and scatter all over the place. Quantum light sources, on the other hand, fire a single photon each time they are triggered. This enables them to carry hack-proof digital information, beneficial to many industries. For 20 years scientists were searching for a method to produce these quantum emitters in a scalable matter as it would mean computer chips ideal for cryptographic systems and quantum computers. This year, researchers from Stevens Institute of Technology and Columbia University have finally developed such a method. The director of Steven's Nanophotonic Lab and leader of this research, Stefan Strauf, says: "This is the first time anyone has achieved a level of spatial control combined with high efficiency on a chip that is scalable, all of which are needed to realize quantum technologies." To make the production of such emitters scalable, the researchers took an atom-thin film of semiconducting material and stretched it over gold nanocubes. The film acts similarly to the plastic wrap you use to cover your leftovers; it stretches over the nanocubes causing imprints for the light emitters to form. The film was created with self-

grown crystals, which have almost no defects, from the Columbian university. Then, by creating the emitters between the gold nanocubes and so called mirrors, the photons are funneled into a very small gap of five nanometers. This creates a concentrated ray of light to boost the single photons in a desired direction. Through this method they were able to fire 42 million single photons per second: instead of a single photon being fired with 100 triggers like before, only 2 were needed. Their work will be published in the Oct. 29 advance online issue of Nature Nanotechnology.[2]

## AI vs. AI

The existence of Deepfakes, and how they are made, has become more known in the last couple of months. Even though you could eventually conclude you are dealing with a Deepfake image—meaning it was constructed by an artificial intelligence (AI) designed to create fake images and videos as realistically as possible— it's becoming more difficult to beat the ever-learning AI. To counter this growing threat to our understanding of reality, a team of researchers from the University of Albany are developing a method to expose Deepfakes through machine learning: meaning another AI. This will probably mean a never-ending war. The Albany researchers keep finding so-called fingerprints which you can use to identify Deepfakes. But once these characteristics are known, developers behind the Deepfakes can just issue a fix. This happened when the team of researchers wanted to publish their paper holding their method of successfully identifying many Deepfakes: shortly after the draft was released some "errors" in the Deepfake creation were fixed. Many scientists argue that this battle between Deepfake creators and Deepfake developers will not be enough. We could have a future "where video are either trusted too much or not trusted at all and valuable, real evidence is thrown out." Proper education will thus have to play its role as well. Proper awareness about Deepfakes and being more skeptical towards information in general are things to be learned and practiced.[1]

## References:

- [1] Artificial Intelligence Being Trained To Combat DeepFakes (2018, October 19). Retrieved October 10, 2018, from <https://sciencetrends.com/artificial-intelligence-being-trained-to-combat-deepfakes>
- [2] Stevens Institute of Technology. (2018, October 29). Scalable platform for on-chip quantum emitters. ScienceDaily. Retrieved October 30, 2018 from [www.sciencedaily.com/releases/2018/10/181029130942.htm](http://www.sciencedaily.com/releases/2018/10/181029130942.htm)
- [3] University of Hawaii at Manoa. (2018, October 29). Bitcoin can push global warming above 2 degrees C in a couple decades: It alone could reduce enough emissions to raise global temperatures as soon as 2033. ScienceDaily. Retrieved October 31, 2018 from [www.sciencedaily.com/releases/2018/10/181029130951.htm](http://www.sciencedaily.com/releases/2018/10/181029130951.htm)





# Calendar



## ADSL

The annual Teach-Student Lounge (Adolescenten Docenten Studenten Lounge) will take place this month. The AkCie will organize a drink in the /Pub that is perfect for integrating with your teachers. Getting to know them better is not only beneficial for yourself, but also for your wallet, as their drinks are free!



## Christmas holidays

At the end of December, the Christmas holidays will begin! We wish you all a merry Christmas and a happy new year. We hope to see you again at CH in 2019!



## Dinner with Companies

This is your opportunity to have dinner with companies. During this dinner, you get the chance to learn something about the companies and the companies get to know you. Broaden your network during this dinner for free.

## November

- 20 T.U.E.S.Day Lecture: Mathematics
- 20 ADSL
- 21 WiFi Party
- 27 T.U.E.S.Day Lecture by TNO

## December

- 3 Sinterklaas member lunch
- 4 T.U.E.S.Day Lecture
- 5 MatCH activity
- 17 General Assembly 3
- 18 T.U.E.S.Day Lecture
- 20 Board information lunch

## January

- 8 T.U.E.S.Day lecture
- 9 Freshmen dinner
- 14 Dinner with companies
- 15 T.U.E.S.Day lecture: Computer Science
- 15 Pre-Ski trip drinks
- 17 Career College 2.2: Graduation Panel
- 18 New Year Drink for Alumni
- 21 MeisCie activity
- 22 T.U.E.S.Day lecture by Deltares

