I/O magazine

PAUL KLINT

Fake Science

Fake news is on the rise. Will science follow?

Misinformation in science is as old as science itself: over-optimistic researchers claim fake results such as cold fusion or room-temperature superconductivity. Fortunately, the self-cleaning mechanisms of science will correct them.

Apocalyptic predictions about the impact of generative AI can be read everywhere: the truth will disappear, elections will be manipulated, the end of creative work is here, and many more. Keep in mind that impact is determined more by the senders and receivers than by the fake news itself. Some people are just more willing to believe conspiracies and 'news' that matches their preconceptions.

The real world is already being inundated by research papers on AI written by legitimate and talented researchers who are finding it harder and harder to publish their results. Market mechanisms may soon start to reduce publication volumes because researchers are dropping out. Now imagine a world in which research proposals in any discipline are written by AI, the selection of proposals is automated, research is supported by software that is partially written using AI-assistants like Co-pilot, research papers are generated by AI, and even the reviewing is done by AI. Such a development would lead to an ecosystem of fake science where the quality and reliability of research results is very hard to assess, let alone control. Expect an arms race between fake science generators and fake science detectors.

Fake science may not take the extreme form sketched here, but it will come, and we should brace ourselves to limit its impact. Let's explore how to better educate ourselves, from primary school to university, to recognise what's real and what's not. This will make us less susceptible to results that are either too good or too scary to be true.

NATIONAL RECOGNITIONS FOR SOFTWARE ENGINEERS

Ivano Malavolta, pioneer in the field of green robotics software, is this year's winner of the Dutch Prize for ICT Research. A previous winner of that prize and an expert in software verification, Marieke Huisman, was recently awarded the Athena Award for outstanding female researchers. They will both receive their awards at the ICT.OPEN conference, which will be held on 10 and 11 April in Utrecht.

By Bennie Mols Images iStock, UT, VU

Marieke Huisman:

'My dream is that commercial software developers will consider this type of verification tool as an integral part of their software development'

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A recent development that Huisman is also keen to research is the use of generative AI, such as ChatGPT, by computer programmers, something that is booming. 'Using generative AI to write computer code can introduce extra risks, and I would like to investigate how we can still provide certain guarantees for software that is partly generated automatically.'

Though she does not know exactly yet what she will do with the majority of the 50,000 euro prize money, Marieke Huisman has already spent some of it on hoodies with the logo of VerCors, the software verification tool that she is developing with her group. 'When group members go to a conference, they can radiate a bit of the VerCors vibe', says Huisman. This year, she was announced to be the winner of the 2023 Athena Award for outstanding female scientists who have also demonstrated themselves to be excellent role models for young female researchers.

Huisman is Professor of Software Reliability and leads the Formal Methods and Tools Group at the University of Twente. The VerCors software verification tool is the flagship product of Huisman's research. Most of the prize money from the Athena Award will therefore go toward the further development of VerCors. VerCors is specifically focused on so-called concurrent software, that is software in which multiple processes run simultaneously.

Adding money

'The standard example of concurrency in software', says Huisman, 'is a bank account into which a certain amount of money is deposited simultaneously from two other accounts. Suppose there is 100 euros in it, and 100 euros is transferred from two different accounts at the same time. You then want there to be 300 euros in the account in the end. But if the software is not programmed properly, the system may only add 100 euros once, so you'll end up with 200 euros instead of 300.'
When VerCors was started, it was focused on Java software. But modern software often consists of different layers, which might even have been written in different languages. If you want to provide guarantees for this kind of software, the tool must be able to support multiple programming languages. Therefore, Huisman wants to make VerCors more generic. 'My dream is that commer-

Research diversity

Huisman's work builds on that of computer pioneer and only Dutch Turing Award winner Edsger Dijkstra. Dijkstra was one of the first to work on verifying concurrent software back in the 1970s. He was also known as someone who could be rather harsh and blunt, not always socially adept, and rather single-minded in what he considered the right approach for computer science. Not a textbook example of someone who stands for research diversity, you might say.

But one of the things that Huisman, who is also part of the IPN Equity, Diversity and Inclusion work group, has come to realise over the past few years is that diversity is broader than just hiring more women. It's also about inclusivity – that people feel they are at the right place, valued and respected. It's also about people of colour and different socioeconomic classes. And it is also about people whose behaviour sometimes might be a bit awkward. 'In the IPN work group we have recently discussed neurodiversity a lot', says Huisman. 'Computer science has quite a few students who are also more at the edge of the neurodiversity spectrum. Then it is good to discuss how we constructively deal with that.'

Huisman considers it important to show that as a woman, you can be successful as a researcher as well as have a family: 'That you don't have to stop having a career if you want children.' She is very aware of how important it is for young female researchers to have role models. 'I try to play that role consciously', she says. 'My students often tell me they are grateful that they can always come to me with their questions.'

The Dutch Prize for ICT Research, coincidentally won by Marieke Huisman in 2013, was awarded to Ivano Malavolta, associate professor in Software Engineering in the Software and Sustainability research group at VU Amsterdam,

for his groundbreaking work on making software more energy efficient. In particular, he opened up the field of green robotics software. Another similarity between Huisman and Malavolta is that they are both active members of Versen, the Dutch Association for Software Engineering. And like Huisman, Malavolta receives 50,000 euros to be freely spent on his research.

'Self-driving cars, drones and even industrial one-arm robots are becoming software heavy products', Malavolta says. 'There is a long history of making robots more energy efficient from the mechanical and electronic side. But today, if I'm going into a robotics lab of one hundred people, twenty people might be working on the hardware, while the other eighty are all working on software. So, the energy efficiency of robots is increasingly becoming a software problem.'

Malavolta has been pioneering an experimental approach to making software more energy-efficient. Recently, he did an experiment with a moving robot that would normally run two hours on its battery. 'By applying some tactics to improve the energy consumption of the software, we saved ten minutes of battery time', he says. 'That's over eight percent.'

Ivano Malavolta:

'The energy efficiency of robots is becoming more and more of a software problem'

Energy can often be saved by being smarter about where calculations are done: locally, by the robot itself, or in the cloud, for which the robot must send data via the internet. Malavolta: 'Object recognition can, in general, better be done in the cloud. Then, you compute less, but at the cost of having to wait for the results to come back from the cloud. But this is not always true. It also depends on how you configure the object recognition module and the actual network conditions. You need experiments to determine exactly which way is the best.'

Energy can also be saved by using knowledge about the environment. Malavolta: 'For example, if the robot sees that there are no obstacles in its proximity, it might use a more coarse-grained navigation algorithm.'

Motivations

Malavolta's main motivation is to make a societal impact with his research. 'For example, the automotive industry in the US spends about 2.4 billion dollars on electric energy annually. Industrial robots in the automotive industry consume, on average, eight percent of the total electrical energy used by assembly lines. Improving the energy efficiency of these types of robotic systems, also by software, would therefore have a direct impact on the global energy consumption of our society.'

The impact might come unexpectedly quickly, Malavolta says. When he first mentioned his guidelines for designing

robotic systems on an online platform, they were viewed thousands of times and led to a big discussion among practitioners and researchers. 'I was invited to give a lecture to a group of professionals, which in turn led to those guidelines being improved.'

A second strong motivation in his work is his students. At VU Amsterdam, Malavolta is the coordinator of the master track in Software Engineering and Green IT, a combination that is unique in the Netherlands. 'This year, we had one hundred students. For many of them, it was the first time they were thinking about making software greener and experimenting on the software itself. So, for them, it was really a change in mindset.'

Like Huisman, Malavolta is also considering a new line of research involving generative AI. 'The question is whether we can use a ChatGPT type of system to help us build more energy-efficient software', says Malavolta. 'Imagine you have a drone with a fifteen-minute lifetime. Then I would like to ask an AI system: 'Do you see modules in the software where I can improve the architecture in order to save energy? The system might then answer: "You might restructure this sub-part in such a way." Then, a mini-experiment would be triggered to see if the suggestion actually works. I imagine a continuous feedback dialogue between software engineers and the AI system.'

Malavolta would like to spend the prize money on hiring a young researcher specialised in green robotics software. 'At the moment, I am working on two proposals for grants financed by the European Union. In both cases, the EU requires a maximum project duration of three years, meaning that if I hire a PhD student on the project, their fourth year would not be covered. If possible, I would like to use the prize money to support the fourth year of a PhD student working on one of these EU projects, if they get granted, of course.'

Toward a national computing facility for AI

By Sonja Knols
Image iStock

To unlock the potential of generative AI and remain autonomous, we urgently need to invest in a dedicated national computing infrastructure, state Geert-Jan Houben and Cees Snoek. The two professors argue why they think the Dutch computer science community should come together and lobby for a national GPU-based supercomputing facility.

Over the past decade, the Dutch government has made large investments in AI research and development, for example, through the AiNed Growth Fund and ROBUST programmes. In addition to that, extensive open data collections have been established, for example at the Netherlands Institute for Sound & Vision and the National Library of the Netherlands. 'But we're far from champions when it comes to computing infrastructure to process all of these data', observes Cees Snoek, Professor of Intelligent Sensory Information Systems at the University of Amsterdam.

'What we need to capitalise on previous investments and become independent from American big tech companies is a national computing facility tailored to generative AI applications', says Geert-Jan Houben, Professor of Web Information Systems at TU Delft. Where the current CPU-based supercomputers at SURF are great for simulations, for the data processing required for generative AI, large-scale GPU-based computing facilities are needed.

Snoek: 'At the moment, American-based big tech is announcing large-scale generative AI models like ChatGPT for texts, Copilot for software and DALL-E 2 for images. In the past, we have learned some bitter lessons on what it means to leave novel technological developments to big tech companies alone. We can take over the steering wheel by establishing our own state-of-the-art computing facility.'

BOOST FOR BUSINESS

Such an infrastructure is important not only to advance science but also to boost Dutch companies' capacity to innovate and retain autonomy in developing critical applications that protect our public values, says Houben. 'Generative AI will prove to be crucial in solving societal challenges regarding healthcare, the energy transition, mobility, or security, to name a few.' 'Everything we simulate now can also be done with generative AI', Snoek adds. 'For example, Google Deep Mind is already working on climate modelling applications. We can use this technology for the better in many areas. But in the Netherlands, we simply lack the computational power to do this.'

Over the past couple of months, the two scientists have been creating awareness of the need to invest in this. 'Our message is starting to resonate, not only amongst fellow scientists but also in industry and government', says Snoek. The next step is to build a strong alliance of partners involving AiNed, SURF ICAI, and TNO to come up with a concrete joint investment plan.

Establishing the said infrastructure is important not only for the AI community but also for Dutch computer science as a whole, Houben stresses. 'To build and maintain such a facility, we need expertise from the entire field, ranging from collecting and processing the data to high-performance computing and algorithmics. The entire Dutch computer science community can contribute to and profit from such a new national infrastructure. So let's join forces and make this happen!'

ROUND TABLE UPDATE

The Round Table Computer Science advised the NWO Board to take a good look at suggestions to improve the current proposal for the so-called "Evidence-based CV", which plays an important role in the Talent Scheme.

The Table was informed that the NWO/AiNed call for the next round of ELSA is delayed but will be executed later this year. The Knowledge and Innovation Agenda Digitalisation was discussed. For 2024, this agenda will focus on the role of trust in digitalisation processes.

Inald Lagendijk (TU Delft) and Josien Pluim (TU/e) stepped back as members of the Table. New members are Kerstin Bunte (RUG) and Nava Tintarev (UM). Table member Marieke Huisman was congratulated for winning the NWO's yearly Athena Award.

FIRST NGF AINED XS EUROPE GRANTS

AiNed and NWO recently granted the first ten groundbreaking research projects in the NGF AiNed XS Europe scheme. The 80,000 euro grants are intended to facilitate innovative and more speculative initiatives that focus on the challenges outlined in the national AI research agenda AIREA-NL, which are designed in collaboration with at least one European collaborative partner organisation.

The topics of the projects vary from describing the behaviour of single-layer materials, such as graphene, with advanced machine learning and the use of artificial intelligence to discover new fungal strains for application to the biobased economy, to the research of new dimensions in the relationship between stress and reading.

MARIEKE MARTENS JOINS NWO AES BOARD

NWO's Executive Board has appointed Marieke Martens, Professor at Eindhoven University of Technology and Principal Scientist at TNO, to the board of the NWO domain Applied and Engineering Sciences (AES) with effect from 1 January 2024. Since 2019, Martens has been Professor of Automated Vehicles and Human Interaction at Eindhoven University of Technology. From 2018 to 2023, she acted as Director of Science for Traffic and Transport at TNO.

KEES SCHOUHAMER IMMINK PRIJS FOR SUJAY NARAYANA

The KHMW Kees Schouhamer Immink Dissertation Prize 2024 has been awarded to Sujay Narayana for his thesis on the Space Internet of Things, which he defended in May 2023 at TU Delft. The prize is handed out every two years to a younger researcher and is made possible by a donation from Kees Schouhamer Immink, who is well known for his pioneering contributions to video, audio, and data recording technology.

In his thesis, Sujay Narayana introduces the Space Internet of Things, which consists of a new generation of satellites. The laureate describes this new field in an appealing manner, illustrates it with examples and also explains the technical challenges.

The laureate will receive his prize at this year's ICT.OPEN conference.

SURFING THE TIDE OF AI DEVELOPMENT

Human language has long been a hard nut to crack for computers. But since the introduction of large language models, such as ChatGPT, phenomenal developments have taken place. Using natural language processing techniques, Textmetrics offers tailor-made writing support tools for large organisations.

By Leendert van der Ent Image iStock

Textmetrics develops and implements software applications that support employees with writing high-quality, readable texts with consistent branding and tone of voice. This involves writing correctly according to corporate rules. Textmetrics analyses written texts and provides suggestions that for example eliminate gender bias and age discrimination. The products are mostly configured and incorporated in the Software-as-a-Service solutions of large companies. Kyrill Poelmans, co-founder of Textmetrics: 'Text generation, summarising and other AI-powered capabilities have also recently been included.'

The software is being developed by around twenty ICT specialists in collaboration with partnering language specialists and is now capable of checking thirteen languages, including Japanese.

RAPIDLY EVOLVING FIELD

After its start in 2014, the company invested a couple of years in product development on the basis of natural language processing as an interdisciplinary sub-field of computer science and linguistics. An early example of such an NLP model is Google's BERT family of models. Poelmans: 'Language is notoriously nuanced and complex. Computers, for instance, have difficulties with words with multiple meanings, such as bank – does this refer to a river bank, a piece of furniture or a financial institution? A computer has no clue. Improvements have, however, been impressive – which was conditional for our operation.'

A model with 80 percent effectiveness in word recognition will not do; it must be in the high nineties. Some five years ago, Textmetrics was ready for launch. Poelmans: 'Since then, the technology has been constantly upgraded and refined, thanks to larger data sets and faster hardware. These developments are absorbed in our products as quickly as possible.'

STRATEGIC CHALLENGE

The present speed of development clearly poses a challenge. Poelmans: 'We constantly have to make the right choices. We continuously improve our specific applications and invest heavily in them, while at the same time, out of the blue, they could be overtaken by generic solutions. Remember, ChatGTP

SEO EDITOR

Textmetrics developed a Search Engine Optimisation editor that is dedicated to smaller organisations that don't have the proper resources to invest in their own SEO specialists and capabilities. 'To our surprise, this elementary tool became especially popular in large organisations.
It saves their SEO specialists effort, as the basics are already covered', says Poelmans.

was only launched about a year ago. Overnight, it created a nightmare for parties with high stakes in their own language model. You cannot wait and see, but you cannot predict the future either. Maintaining a laser focus on developments is the only remedy.'

ChatGTP is not a direct threat to Textmetrics' activities. 'Its users still have to develop their own prompts. It doesn't offer the corporate rules and made-to-measure checks that we offer', Poelmans says. 'Our text generation based on job seeker's preferences and templates for job ad creation is easier to use than ChatGTP. But even more importantly, large companies are keen on GDPR issues and refuse to use a black box application that runs at OpenAI.'

SOLID TRAINING

Fast market developments make knowledge management vital for Textmetrics. Poelmans sums up: 'We constantly monitor how we can build on, for instance, Microsoft Azure, Amazon Web Services and OpenAI. We closely follow the go-to online fora on new AI and language model developments, such as developments by TNO and Dutch universities. We are keen on European initiatives for open-source AI development. It is not yet good enough, but give it time. The Hugging Face AI community is important to us for new developments, data sets, models and benchmarks. And we organise webinars to share knowledge about new opportunities with our customers.'

Textmetrics cherishes its links with the Radboud University. 'They are excellent in AI, machine learning and data science. That is why we almost continuously have two interns working with us. It's great to tutor them, as they are educated to think for themselves and have the theoretical and practical knowledge to fix things. We understand that it is hard for universities to keep up with market developments. That's okay, as long as students get a solid training in useful competences. The market is a lot about hypes with little proof. University students go for proven technology and insights into underlying mechanisms. They don't accept black boxes but want to know how things work. That's very useful and hard to find outside of universities.'

'IT'S GREAT TO TUTOR STUDENTS, AS THEY ARE EDUCATED TO THINK FOR THEMSELVES AND HAVE THE THEORETICAL AND PRACTICAL KNOWLEDGE TO FIX THINGS'

Kyrill Poelmans

Innovative AI methods for medical imaging

By Bennie Mols Images Ivar Pel

GROUP PASSPORT

RESEARCH FIELD

Medical image analysis, machine learning, image reconstruction, quantitative imaging biomarkers, image-guided interventions

INSTITUTION

Department of Radiology & Nuclear Medicine of Erasmus MC

EMPLOYEES (as of March 2024)

1 professor, 3 associate professors, 5 assistant professors, 7 postdocs, 7 software engineers and 26 PhD students

WEBSITE

www.bigr.nl

The Biomedical Imaging Group Rotterdam develops AI methods to improve the analysis, reconstruction and quantification of medical images. Close collaboration with clinicians is one of the group's hallmarks.

Stefan Klein

Luisa Sanchez

Since the invention of X-ray photography in 1895, the toolbox of medical imaging has grown impressively to include ultrasound, computed tomography and magnetic resonance imaging. The Biomedical Imaging Group Rotterdam (BIGR) aims to improve the efficiency and quality of state-of-the-art medical imaging by developing innovative AI methods. The group is part of the Erasmus MC, and chaired by associate professor Stefan Klein.

'In essence, we develop AI-based software to help physicians interpret medical images', says Klein. 'We are a group of technical researchers. Whether it's an image of the eye, the heart or the brain, ultimately, every image is a collection of pixels. So there's a lot of overlap in the methods to analyse, reconstruct and quantify all these different image types.'

BIGR has over forty group members, including principal investigators, postdocs, PhD students, bachelor's and master's students and research software engineers. The group has a close link with the radiologists and other clinicians at the Erasmus MC. Klein: 'We have a low-key cooperation, so we hear exactly what doctors need in practice. That helps us get clear on where

'Ultimately, every image is a collection of pixels'

to focus our AI models. For example, we might think that we should always be able to pinpoint exactly what kind of tumour is in an image. But sometimes doctors tell us it is not important in a specific case because it would not matter for treatment. However, in other cases, the precise differential diagnosis is crucial for clinical decision-making. The embedding within the Department of Radiology & Nuclear Medicine also gives us easier access to data and to scanning equipment, and we are closely collaborating with the MRI acquisition experts to improve image quality and reduce scan time.'

Klein has been working in the group since 2008. As one of the research highlights, he mentions the organisation of several Grand Challenges. Klein: 'The first Grand Challenge I organised with my team in 2014 aimed to diagnose dementia early using MRI images. Fifteen international research teams participated in that challenge with 29 different methods. The accuracy

turned out to be 63 percent, and the conclusion was that it should be a lot better. Still, that Grand Challenge had a lot of impact in determining exactly where the research field stood. In 2020, we organised a similar Grand Challenge for the diagnosis of osteoarthritis. Bringing people together in such challenges helps to push the field forward.'

Eye on the clinic

Luisa Sanchez is one of the two principal investigators of the eye image analysis research line of BIGR. She joined the group in 2018 after completing a PhD in computer vision. 'What attracted me was the fact that it was a technical group in a hospital setting', she says. 'We are guided by what the clinic needs.' Sanchez mainly focuses on image analysis of the retina. 'In one of our projects, we are trying to find imaging biomarkers that can help clinicians track the progress of inherited retinal diseases. And as treatments for these diseases begin to emerge, we are also interested in seeing if these biomarkers can track the effect of treatment.'

Although the research group is large and works on a variety of medical applications, Sanchez says there are many advantages to functioning as a single research group. 'Sometimes we want to link different organs and different technologies, like when we want to link brain biomarkers with retina biomarkers. Then, my collaborators and I can provide the expertise on retinal biomarkers and easily combine it with the brain biomarker expertise of the neuroimaging experts in BIGR. We encourage internal collaboration through group-wide activities, such as seminars and work groups on specific techniques that cut across different lines of research.'

Collaborating PhDs

Another way to best align BIGR's technical-scientific research with clinical practice needs is to have a technical PhD student and a clinical PhD student working together on a project. 'I see that yields many benefits in practice', says Theo van Walsum, computer scientist and leader of the BIGR research line 'Image guidance in interventions and therapy'.

'Navigation is currently mainly used in the clinic in neurosurgery and orthopaedic surgery', says Van Walsum about the research line. 'There, you have the advantage that there hardly is any

Abdullah Thabit & Theo van Walsum

patient motion. Current navigation systems cannot handle changes in anatomy during the intervention. We are developing AI-based techniques that track instrument and patient motion. That way, physicians can use our technology in real-time to get their instruments to the right place in the best possible way. The aim is to integrate the 3D scan taken for diagnosis with the image taken live during the procedure. AI has given us a much more powerful toolbox that allows physicians to guide medical instruments faster and more effectively.'

Franciska de Jong is full professor of e-Research for the Humanities at Utrecht University. She was a full professor of Language Technology at the University of Twente from 1992 -2022. She was also affiliated to the Erasmus University Rotterdam for 15 years and acted as a board member for NWO and the eScience Center, among others.

BRIDGING ROLES

How many researchers have worked for three universities simultaneously? And that on the borders of science and humanities? Emeritus professor Franciska de Jong has. She has laid down her tasks at University of Twente and Erasmus University Rotterdam but continues her tenure at Utrecht University in a senior advisory role for the European research infrastructure CLARIN.

By Leendert van der Ent
Image Ivar Pel

You had science and humanities roles within three universities at once. How did that happen?

'I studied Dutch Language, did a minor in programming and got my PhD in theoretical linguistics. In the 1980s, I got a job at the Philips NatLab, focusing on fundamental research on automated translation. We designed a nice methodological approach to translation technology based on a symbolic representation of the language system. Practical applications were only imaginable back then but not feasible, while statistics-based methods could not start flourishing without digital text collections. The experience at the NatLab allowed me to develop a bridging role between informatics and linguistics. I got a full professorship in language technology at University of Twente in 1992, where we first focused on cross-lingual search. Around 2007, I was also appointed at the Erasmus University Rotterdam as the director of an institute for e-research. And as a liaison between different scientific cultures, the role of director of the European Common LAnguage Resources and technology INfrastructure fitted me well.'

Looking back, what are you most proud of?

'Connecting people and parties from different disciplinary backgrounds was particularly satisfying. I experienced that satisfaction in research teams and also in various roles in governing bodies at, for instance, NWO and the National Library of the Netherlands.'

What were the most significant changes you witnessed during your career?

'Profound changes occurred in the research culture as well as the technology. Scientific results increasingly became a team effort. Machine learning and AI replaced symbolic processing, and growing volumes of digital language data became available for research. Social media emerged, creating new research fields for the social sciences and humanities, such as computational socio-linguistics. Psychologists can now, for instance, study verbal interaction, including not only patterns in vocabulary use but also silences, sighing and laughter. This leads to interesting new insights. What used to be purely qualitative has now also become quantitative research. Text analytics allows for the comparative study of heritage material. Historical texts allow us to define an author's writing DNA, which can be compared with other texts from the same period. A totally different application, but rooted in similar methods, is to teach robots near human interaction.'

What new developments do you think are the most significant for the future?

'It is widely recognised that bias in training data pollutes the outcomes of AI-based models and that this can have disruptive effects in various societal contexts. It makes research ethics and responsible data science very important. Data scientists are working on more reliable models and training AI with quality-approved language. Academia prioritises this responsibility more than big tech does. It's discomforting that pollution and bias cannot even be quantified at present. I am happy that the EU has at least made a start with policy and legislation on this hugely important matter.'

HOW CAN SOCIAL MEDIA PLATFORMS RESPONSIBLY CONNECT PEOPLE?

By Bennie Mols Image iStock

In the ERC project RE-LINK, Fernando P. Santos and his research team examine the social effects of the specific social media algorithms that recommend news connections and groups to people.

Social media platforms like Facebook, X (formerly Twitter) and LinkedIn give their users suggestions for new people to connect with, new people to follow and new groups to join. The algorithms that make all these suggestions are called link-recommendation algorithms. In September 2023, Fernando P. Santos, assistant professor at the Informatics Institute of the University of Amsterdam (UvA), received a 1.5 million euro ERC Starting Grant to study these algorithms in a project called *Responsible Link-Recommendations in Dynamic Environments* (RE-LINK).

'Social media companies have so far mainly focused on studying the growth of their networks to ascertain how successful their recommendations are', says Santos. 'But little research has been done on the impact of the underlying algorithms in social dynamics. How are the recommendation algorithms changing the propensity of users to act pro-socially and help others, the propensity to discriminate based on group identity or the propensity to spread false or malicious information?'

Studying such questions and contributing to the development of an algorithm that leads to responsible link recommendations is the primary goal of the RE-LINK project. Santos: 'By responsible, I mean that algorithms don't, for example, undermine the propensity of people to help each other, don't increase bias or discrimination, or don't disincentivise people to report malicious content.' Instead, he wants to design new link-recommenders that contribute to positive social behaviours such as cooperation, collective action, and misinformation debunking.

Original combination

RE-LINK officially started on 1 March 2024. Besides Santos, the team will consist of three PhD students and one postdoc who will study link-recommendation algorithms for the five-year duration of the project. The team will collaborate with other UvA professors and researchers at Carnegie Mellon University in the USA.

'What is quite original in our project', says Santos, 'is the combination of simulating the social dynamics occurring on social networks and testing how link recommenders work in practice. For the social dynamics simulation, we will use methods inspired by population dynamics models and evolutionary game theory. We will model a population of users connected in a social network and then follow over time how the network evolves based on the principles of algorithmic link recommendations.'

As of February 2024, social media companies operating in the EU have to comply with the Digital Services Act (DSA). The DSA is meant to regulate online intermediaries and platforms and will impact the content moderation practices of social media platforms. Santos hopes his research will contribute to building tools that help social media companies understand how their algorithms affect society, thereby reducing the systemic risk they pose and complying with the DSA. 'If I can show that there is a way of tuning the link-recommendation algorithms to have both high short-term performance and a long-term positive effect on society, I would be very happy.'

More information **cordis.europa.eu/project/id/101116987**

USING ICT TO HELP KEEP OLDER PERSONS HEALTHY AND HAPPY

By Marysa van den Berg
Images WAT ontwerpers,
iStock

Older adults tend to be less active and less engaging in contact than other people. The European project PHArA-ON hopes to change this by utilising a range of digital tools. In the Netherlands, the University of Twente leads one of the pilots.

'People in Europe are getting older than elsewhere, but that does not necessarily mean that the quality of life of these individuals is higher', says Angelique Tinga, project manager at the University of Twente and leader of the Dutch pilot within PHArA-ON (Pilots for Healthy and Active Ageing) project. 'Chronic illnesses arise at an earlier age. This is an increasing burden for healthcare professionals.'

And there is also the fact that half of older persons in the Netherlands feel lonely. Both illnesses and loneliness among this group arise partly because of the lack of activity and contact with family and friends. Tinga and her European colleagues think that digital tools could be part of the solution.
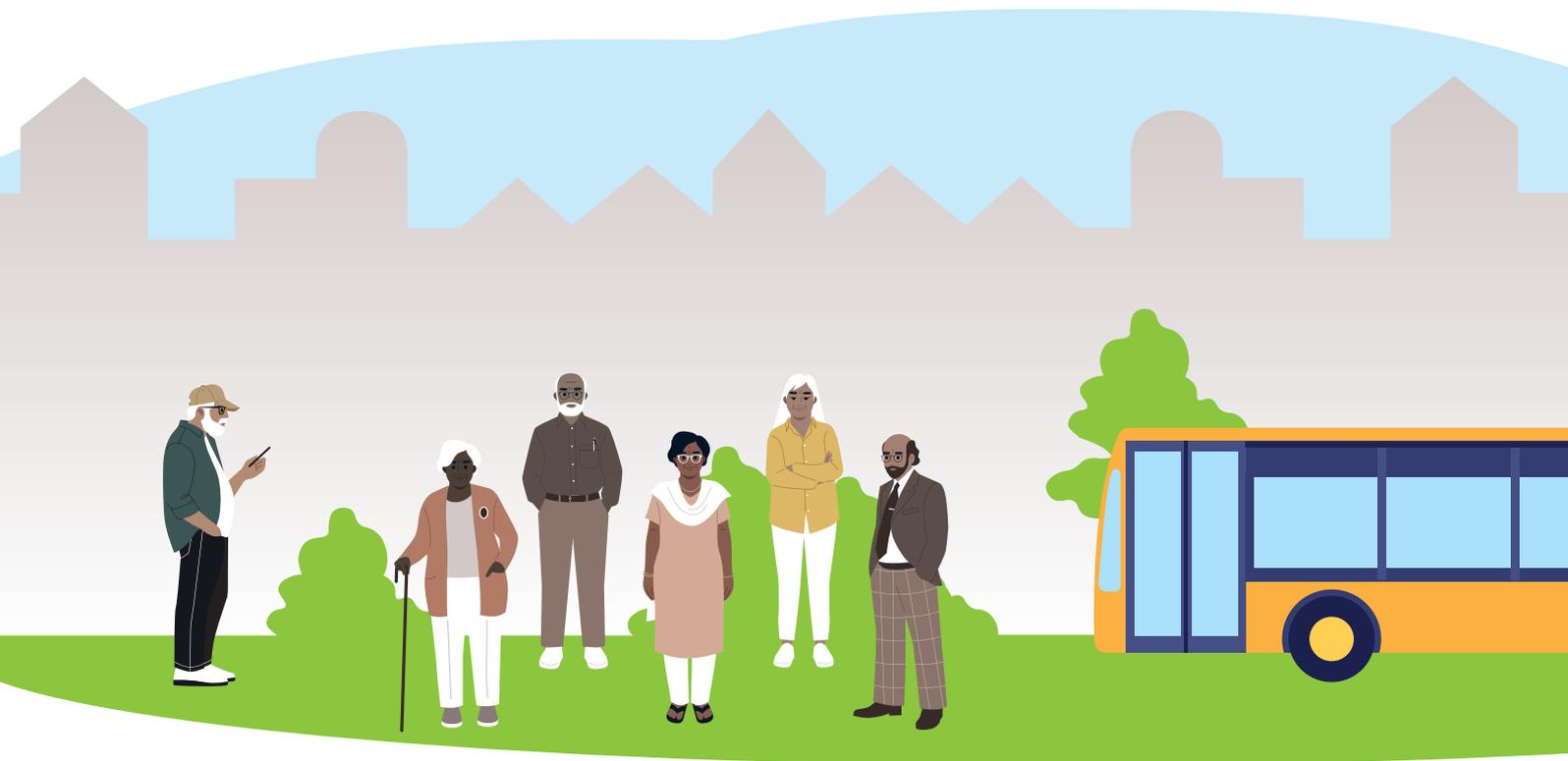
BUS TRIPS

The PHArA-ON programme consists of six pilots running in five countries: Spain (two pilots), Portugal, Slovenia, Italy, and the Netherlands. The technologies involved vary from the Internet of Things, artificial intelligence, robotics, cloud/edge computing, and smart wearables to monitor health to engaging apps for smartphone or tablet.

The Dutch pilot took place at several locations in the Netherlands. Here, Tinga and her team worked with the Plus Bus, an

'WHAT WAS MOST IMPORTANT FOR US WERE THE REASONS BEHIND USING OR NOT USING THE OFFERED TECHNOLOGIES'
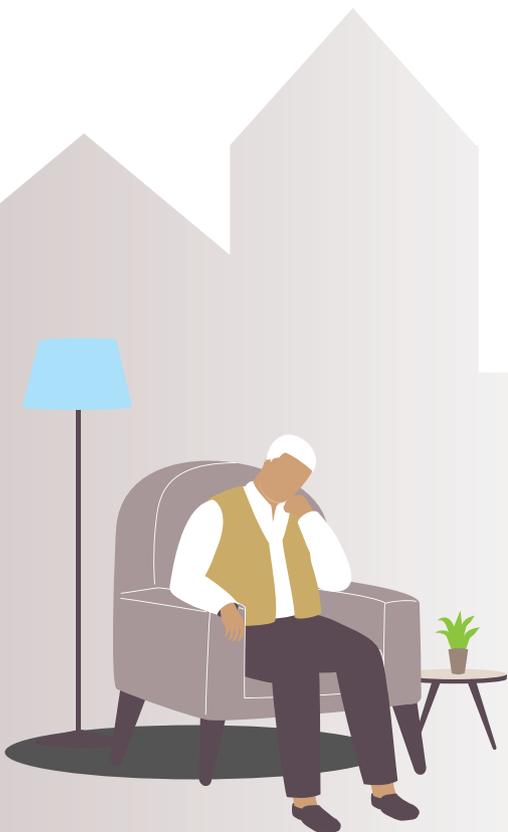
initiative of the National Foundation for Elderly. The Plus Bus takes older persons on trips to activities. 'Our idea was to bring them together not only on these adventures but also when they are at home to counteract loneliness. We also wanted to stimulate activity and healthy eating. For this, we used apps that were specially adjusted for these goals.'

But first they had to recruit the participants, which was not an easy task back in 2021, in the middle of the COVID-19 pandemic. 'There were fewer bus trips and, of course, the Plus Bus locations had other things on their mind than helping to find older persons willing to participate. But eventually, we managed to include 119 older persons.'

TRACKING MOVEMENTS

The participants were divided into two groups. In one group, older persons had the choice to make use of the technology, whereas the control group did not get access to the tools. Both groups regularly completed questionnaires to assess their feelings about using the apps and their health and mental state.

There were three apps that the participants could use. The first one is the MISS Activity app, made by Maastricht Instruments. 'This app uses a sensor that keeps track of movement', Tinga says. 'This technology is specifically fitted to the way older adults are active. For example, it is adjusted to the way a rollator is used. And it can be worn in a pocket.'
A second app is PACO, a virtual eating and cooking coach designed by RDD. According to Tinga, 'it gives meal plans and

overall it helps to keep a healthy diet, which is specially designed for the daily activities of older persons.'

Both apps can be accessed within the RegiCare customer portal from AdSysCo. RegiCare itself also forms an online community platform. 'With this, you can come into contact with other participants and share pictures and stories, for example about the bus trip you just had.'

STRIKING RESULTS

The results of the pilot, which ended in November 2023, were very striking, according to Tinga. 'About 27 percent of the participating older persons chose to make use of the apps. What was most important for us were the reasons behind using or not using the technologies offered.'

According to the responses from participants and the local coordinators, many older people in the experimental group still found it difficult to use the apps. 'This could especially be true when someone is already a bit insecure about using technology. If they then face a challenge, like logging in too many times, this will enhance the idea that tech is not for them.'

Moreover, some of the apps were not as useful as Tinga and colleagues thought they would be. For instance, take the food app PACO. 'Some of the participating older persons were already eating healthily or they were used to cooking only for themselves whereas some of the recipes are meant for four persons.'
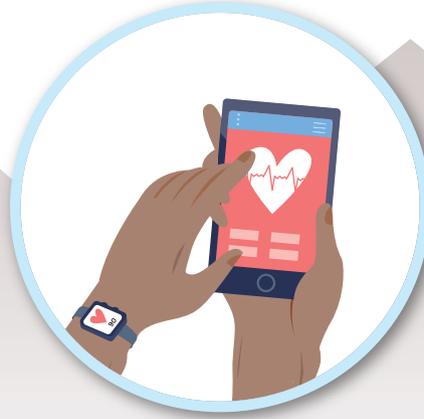
'USING THE APP WAS A FANTASTIC WAY FOR ME TO STIMULATE ME TO WALK OR USE THE STAIRS MORE'

NEED TO ATTRACT LONELY PEOPLE

Still, there were also participants who were pleased with the apps. Like Maritza Velsma (77), who made a lot of use of the MISS Activity technology. 'I am a very busy person, and it was great to keep track of all my movements using this app. It was a fantastic way for me to stimulate me to walk or use the stairs more.' According to her, using ICT solutions to keep older persons healthy and happy is a very good idea.

Another participant, Carine Toet (73), begs to disagree on this. 'I do not mind that I was in the control group, as I do not need all of that technology. Some younger people are always so busy with their phones. Just visiting each other and spending time together is a better way to keep in contact.' And lastly, she ponders: 'The truly lonely people that could benefit from these apps are probably very difficult to reach with these kinds of projects.'

That thought is also shared by Tinga. 'We used the bus trips as a way to recruit the participants, but we acknowledge that the older persons we attract here were already more active and socially engaged than most lonely people. So, in the future, we must find ways to also attract this group.'

One of these ways is to also develop non-technical solutions. 'That is what some participants indicated as well', Tinga says. 'Maybe we should even combine these with digital tools. Eventually, we hope to come up with recommendations for future projects and policymakers. Lessons learned from PHArA-ON can be taken into account to eventually enhance happy and healthy ageing.'

PHARA-ON PROJECT

AIM
To make smart and active living for Europe's ageing population a reality by creating a set of integrated, highly customisable, and interoperable open platforms with advanced services, devices, and tools.

DURATION
The programme started in December 2019 and will finish in November 2024.

BUDGET
€ 21,319,813

PARTICIPATING COUNTRIES
Spain (two pilots), Portugal, Slovenia, Italy and the Netherlands.

www.pharaon.eu

EVOLVING TOGETHER

By Sonja Knols Images TU/e

Johan Lukkien

former Dean of the Department of Mathematics and Computer Science
at Eindhoven University of Technology

'When the first round of sector plan funding was announced in 2018, I was dean of the department and, as such, very concerned about the workload of the research staff. We had adopted data science as a developing research field at a relatively early stage and defined both bachelor's and master's programmes together with Tilburg University. The educational burden on our staff in that field was way too high – they barely got to conduct their own research. Student numbers in computer science and these newly developed data science programmes had increased rapidly: bachelor's intake in computer science had tripled, and master's intake had doubled since 2012. On top of that, the overall increase in student numbers in Eindhoven added to the workload of our staff, as the department provides quite some general bachelor courses.

At the moment the sector plans were submitted in 2019, we had already created a broad hiring for 4 positions in computer science and data science. The additional 8 positions for these fields that we could finance from the first sector plan round restored the balance somewhat. Computer science and data science growth continued, leading to a second round in 2021. I found the fluent and productive cooperation among the different universities and the leadership of IPN in developing the plans remarkable.

In addition to providing the research staff with some more freedom to operate, the sector plan funds also enabled us to strategically establish new connections between the individual research themes by appointing people at the intersections, for example between data science and security. The funding of joint positions with Utrecht University in the first round was special and strengthened the collaboration.

All in all, together with the new hires we had planned ourselves already, both rounds of the sector plans have resulted in a substantial influx of new people, both in junior and in more senior positions. This has done the department a lot of good. It has been very stimulating to bring in new people with their own, often international, backgrounds, networks, ideas and visions, like Jacob. Computer science as a field is young and rapidly changing. The new positions we have managed to create over the past six years enabled us to contribute to fascinating new developments.'

The two successive sector plans have resulted in a significant number of new hires at various Dutch universities. Johan Lukkien, former Dean of the Mathematics and Computer Science Department at Eindhoven University of Technology, explains how the sector plan hires have boosted both the research and the department as a whole, and Jacob Krüger tells how his research interlinks different themes within the group he joined.

Jacob Krüger

assistant professor of software engineering at Eindhoven University of Technology since September 2022

'After obtaining my Master in Business Informatics from the Otto-von-Guericke University of Magdeburg, I pursued a PhD on the implementation of large, customisable software platforms at the same university. One factor that is vital for the quality of the final software solutions turned out to be the knowledge of the developers involved. For me, that human factor was the most interesting part of the work. That is how I got hooked on the topic of human aspects in software evolution.

Through my PhD research, I got to know people from the Software Engineering and Technology group at Eindhoven University of Technology. This is a very diverse group that conducts research very close to my interests. So when they heard that I was looking for an exchange project, they notified me about a job opening at their group, which I successfully applied for.

The common thread in my research is software evolution and how that impacts the humans involved. I focus on developing variant-rich systems, such as fork-based software platforms, where forks arise when developers take a copy of the source code and start independent development on it. These systems typically become very complex, containing hundreds to thousands of forks. This makes it hard to get an overview of how individual forks evolve and to determine how and when to synchronise them. My research focuses on questions like: How can developers understand what is happening? What do they need to know to successfully evolve the software and maintain a high overall quality? How do they interact with each other and with external stakeholders to translate requirements into implementations? Though my primary focus is scientific, we also develop tools to simplify workflows or help automate the integration of individual forks.

My ambition here is to establish my own line of research on the role of developers' cognition in software evolution, intersecting with and adding to the other research lines in the group. For example, together with Loek Cleophas, I am currently looking into possibilities of using visualisations that can help compare forks or groups of forks. And the studies by Alexander Serebrenik into social aspects of software engineering and by Michel Chaudron into software architecture are great sources of inspiration for my work.'

EMBRACING
NEURODIVERSITY

By Marysa van den Berg Image Bram Saeys

Autism-inclusive education and workspaces could benefit us all, thinks Sylvia Stuurman, assistant professor of Informatics at Open University. She wrote guidelines for teachers that could help so-called neurodiverse people. At ICT.OPEN, she will give a keynote on this topic.

'I was sixty-one when I was diagnosed with autism spectrum disorder (ASS). It was very strange to suddenly hear I had a disorder. And somehow, it did not click because I had been functioning well for all those years. Of course, I noticed that other people with my intelligence could do things more easily and cooperate more efficiently, but it did not feel right that I was suddenly "a person with a disorder".

So, I started to study the subject of autism for myself and I eventually wrote a book to show that autism can be explained. But the struggles of being neurodiverse – as thinking differently than the standard is currently called – are real.

During my biology studies at a regular university, I had difficulty, for example, understanding what was expected of me. Especially with assignments and oral exams. I also noticed that many teachers and students work top-down during research. But often, the initial idea behind the research is rather vague. A bottom-up approach would suit me and many other neurodiverse people better.'

RECOGNISING THE STRENGTHS

'All of this got me thinking that education should be more autism-inclusive. I did a project to further investigate that idea. Feedback from autistic students helped me to write a series of guidelines, like be explicit in what you expect, take notice of difficulties that neurodiverse people encounter and offer them support. As a bonus, I think other students could also benefit greatly from having more clarity within a course.

I think we should all embrace the strengths of neurodiversity. People with ASS can truly stimulate the growth of a field. They work in a structured way, have a great eye for detail, and think outside the box compared to typical people. Companies like ASML and Microsoft already recognise this and use this to their advantage. Now, it is time for universities to do the same.

It would be good if more of my colleagues would be open about their neurodiversity, which also includes ADHD and being dyslexic. They often keep this to themselves because they are afraid of being labelled unfit for the job. But the more people share their uniqueness, the more easily it would be accepted, and then neurodiversity could be fully integrated into our already diverse society.'

Sylvia Stuurman is an assistant professor of Informatics at Open University of the Netherlands. Her research focuses on design patterns, software architecture and web development. She also worked at TU Delft as a system engineer and programmer. Her book on autism (Autisme is geen puzzel [Autism is not a puzzle]) appeared in 2021. Recently, her new book "De kanarie in de schoolbanken, een gids voor aurisme-inclusief onderwijs" [The canary in the classroom, a guide to autism-inclusive education] was published.