Peter M.A. Sloot (1956) was a research professor at the University of Amsterdam and a full professor and director of the Complexity Institute at NTU, Singapore. In 2016, he became the founding scientific director of the Institute of Advanced Study at the University of Amsterdam. He has supervised 57 PhD students and published over 450 research papers.

A REMARKABLE CAREER IN A TOUGH FIELD

After forty years of research on complex adaptive systems, Peter Sloot retired last April. Here, he shares not only a highlight of his career but also his worries about the current hype of using AI for almost every application possible.

By Marysa van den Berg
Image Ivar Pel

How did the research field of complex systems computing emerge?

'Before becoming a professor at the university, I did my PhD at the Netherlands Cancer Institute. There I got interested in complex systems and how to model them. I went to the Santa Fe Institute of Complex Systems in New Mexico (USA), where a lot of the original ideas come from. I think that is the place and time where my colleagues and I kick-started the field of large-scale computing of complex systems.'

You focused on how nature and society process information. Why this topic?

'From all the molecules in your body up to all the people in the world, everything is connected and interacting and thereby processing information. The challenge is that these processes act in non-linear ways. Take the brain as an example. It has billions of neurons interacting. At some point, a thought emerges from all those interactions. There is still no good theory to explain this kind of emerging properties in complex systems. It is both difficult and mind-blowing.'

What are you most proud of?

'I am especially happy with the work we did on HIV infections. It took over a decade, but we managed to build multiscale models that capture many different layers of the disease, from genetic and cellular interactions to transmissions across populations, which allowed us to predict outbursts

Where will this kind of research go?

'Predicting the outcome of interventions in complex systems is becoming increasingly important. Think about climate change, geopolitical stress, or the consequences of social inequality. We desperately need to develop tools to study this. I see two main developments. The first is the rise in using AI. There are now top groups that can learn partial differential equations from a black box of data. That is pretty spectacular. Second, there are novel developments in algorithms for individual-based models, that can incorporate elements of human psychology and social behaviour. The merging of the two is the future, I think.'

Do you think the use of AI could also become problematic?

'I am indeed worried about this. In machine learning, one works, by definition, with data about processes that have already happened. But data is only a predictor for the future if the dynamics of the past are predominantly the same as those of the future. This is definitely not the case for interventions in complex systems. Also, most complex systems are open and scale-free systems, meaning they may have infinite variance and zero or infinite averages. So how are you going to train your machine model, then? This is but one of the many challenges ahead that require careful and conscientious research.'