WAGENINGEN
UNIVERSITY & RESEARCH

Research and education at the Information Technology Group

Be smart!

How IT can boost your future and improve our world

“Smart information technology will help us overcome future challenges”

Professor Bedir Tekinerdogan, chair of the Information Technology Group

“Over the last decades computing performance has substantially increased and we can observe a massive digitalization of the society. With the developments in IT we are now able to develop smart products that can take over or support human beings in performing intelligent tasks. Computing is now not only in computers but can be everywhere. Computing is pervasive. Ordinary things become ‘thinking things’, systems become smart systems. Smart home, smart office, smart hospital, smart factory and smart farming are not just ideas but have become reality. Surely, this trend of developing smart systems will only further increase in the near future and we need to be prepared.

The developments in IT not only have a supportive role in society but will also be necessary to cope with the grand societal challenges that we need to face in the future. By 2050 the world will be inhabited by 9 billion people from which 70 percent will be urban, compared to 49 percent today. To feed this large urban population, the food production must increase by 70 percent. And all this must be achieved despite the limited availability of arable lands, the increasing need for fresh water and the impact of climate change.

The Information Technology Group contributes to the state-of-the-art of smart systems and aims to support innovations in the life sciences. We focus on direct collaboration with partners within and outside of Wageningen University. There are so many opportunities and research challenges for which we need smart people. We need to work together, and we need to work smart.”

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EDUCATION AT THE INFORMATION TECHNOLOGY GROUP

Our group integrates knowledge and skills. Forward-looking students from different bachelor and master programmes profit greatly from our courses. We can teach you how to manage (big) data, program, develop software and create agent-based models. Our courses will make you an educated partner in dialogues about IT solutions, while also being an expert in your life sciences domain. If you want to take it one step further and become an IT specialist in your own league, you can do a graduation subject at our group.

"It is great to write a program and then see it working."

Gert Sterenborg

Gert Sterenborg from the Netherlands, master Geo-Information Science at Wageningen University

"The logic behind programming is interesting and it is really great to write a program and then see it working. It can be useful too, for example when using weather models. For this reason I took the course *Programming in Python* during my bachelor study. The ability to automatically run scripts still comes in handy, for example to make maps and perform calculations on spatial objects. I also took the course *Software Engineering*. We worked on the same piece of code and learned how to document it in an orderly fashion and keep it understandable for others. We also learned the programming language Java so we could build apps in Android. Nowadays I assist the course *Programming in Python* and have become a freelance programmer. For example I have developed the script that visualizes the availability of computers on screens in the university's education buildings, and made a script that processes raw soil data into hundreds of soil maps."

"It is so useful for managers to get an idea of all the possibilities that IT offers."

Willemijn Bikker

Willemijn Bikker from the Netherlands, master Management, Economics and Consumer Studies at Wageningen University

"There was a lot of room for creative ideas in the course *Applied Information Technology.* We developed business models for supermarkets by using information systems. I liked it so much that I decided afterwards to take the course *Information Systems for Managers and Engineers*. Together with a Biosystems Engineering student I developed a mobile phone app for the information platform of a Dutch flower auction and also a customer's app. Both courses were really accessible and the teaching approach was very personal. We were actively discussing everybody's ideas and brainstorming a lot. In the last course I was the only management student, even though it is so useful for managers to get an idea of all the possibilities that IT offers. In the future it will be so convenient to understand the information technologists in my working environment and to deliver my own input."

> *I learned how to build a database that other people can understand."*
>
> *Diana Pastrana Cervantes*

Diana Pastrana Cervantes from Mexico, master Plant Sciences at Wageningen University

"It is very important to organize information and to make it more useful. I am doing a specialization in plant breeding and I am very interested in research. In the future I would like to do something meaningful for the people in Mexico concerning the protection of genetic resources and participative plant breeding programs. Therefore I wanted to learn how to build a good database which is also accessible and easy to understand for other people. That is why I took the course *Data Management*. I really liked it. We also learned how to deal with data which are difficult to organise or summarise. The data you collect are not always ideal, but we learned how to analyse different information and make it uniform."

A graduate talking:

"You cannot gain this kind of knowledge by reading a book"

Mebrate T. Woldegebreal from Ethiopia, IT project manager at De Heus Animal Nutrition since 2010
Study: MSc Agricultural and Bioresource Engineering at Wageningen University 2008-2010

"At my department we work on the improvement, redesign and integration of IT related processes and systems. I also evaluate the designs and applications that our suppliers are providing us with. Thanks to my study I have programming skills and a good understanding of database structures and of data and process modelling and flow. During my master I specialized in information technology, for example in programming and database management. Some courses, such as *Project Planning and Organising*, were also relevant for social sciences students. In the course *Information Systems for Managers and Engineers* we learned quite a lot of process modelling and automation. Most of the courses are interactive and we worked together in teams with students from different cultures. We had a lot of practical discussions and shared our experiences. We learned to communicate and explain our ideas to each other. This is very important. You cannot gain this kind of knowledge by reading a book."

Wageningen Hackers Organisation (Whacko)

Are you into programming, informatics or computers in general? And would you like to apply your knowledge to cases within the life sciences? The Wageningen Hackers Organisation, or Whacko, organises hackathons for WUR students from every discipline. Please feel free to contact us at oberon.berlage@wur.nl or martin.colee@wur.nl if you are interested in participating in future hackathons. We'll get in touch when we have an event coming up!

RESEARCH AT THE INFORMATION TECHNOLOGY GROUP

Big data, the integration of smart systems, internet of things, social simulation and smart precision agriculture offer new and fascinating research fields. A growing number of talented PhD candidates are contributing to our knowledge of the enveloping possibilities of information technology. In our research we deliver an invaluable contribution to state-of-the-art smart systems engineering. We focus in particular on the life sciences domain and collaborate with several research institutes and departments. We have PhD candidates in Social Sciences, but also together with Plant Sciences, Animal Sciences, Environmental Sciences, Agrotechnology and Food Sciences.

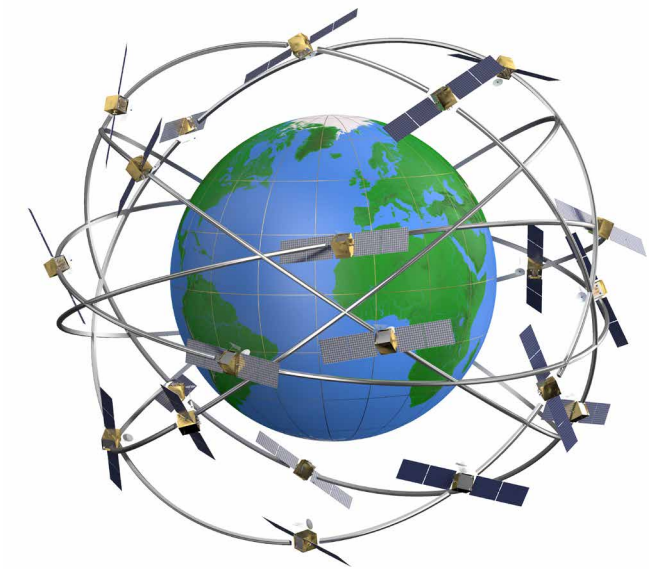
BIG DATA

"Research on resilient big data systems is really fascinating."

Cigdem Avci Salma

Cigdem Avci Salma from Turkey, software engineer at European Space Agency (ESA) and PhD candidate at the Information Technology Group
Study: MSc Computer Engineering at the Middle East Technical University (METU) in Ankara 2010-2013

"The space industry gathers big data. ESA works on earth observation for example. We extract information from satellite images of earth about the climate, the oceans, land use and so forth. To store, process and analyse these data we use various data systems. Since 2015 I am working at the quality control and management department of ESA. I help to construct the information technology infrastructure, standardise processes and solve problems. I also started working on my PhD research on resilient big data systems, which have security and other quality aspects. We analysed the differences between current architectures of big data software and extracted models of these architectures. I will also look into the practical applications and probably be able to use some outcomes in ESA projects. It is a really fascinating research field because it is new. The quality aspects of big data systems architecture have not been deeply investigated yet and the technology is developing as we speak."



SMART PRECISION FARMING

"People with knowledge of agriculture and IT have plenty of job opportunities."

Jan Willem Kruize

Jan Willem Kruize from the Netherlands, researcher at Wageningen Economic Research and PhD candidate at the Information Technology Group.
Study: MSc Agricultural and Bioresource Engineering at Wageningen University 2003-2009

"Agribusinesses invest more and more in software to make farms 'smart'. To optimize the yields farmers need to gather and analyse data about the soil, crops and weather conditions. Developing the necessary advanced software for drones, small robots, soils sensors, smartphone apps and other devices, requires people with knowledge of both agriculture and information technology. People who combine this knowledge have plenty of job opportunities. As a researcher I am involved in several EU projects about smart agriculture and software development. In my work I still use the knowledge from the IT courses I took. My graduation subject was about precision fertilization. Now, as a PhD candidate, I am researching how to connect different software systems and devices. Besides the technical part it is also important to organise cooperation between the companies that develop software, sensors, tractors and drones. A technical solution can be found in Software Ecosystems, a platform similar to Android for example, on which apps from third parties can be placed."

AGENT-BASED MODELLING

"The model shows the effects of the strategies of potato farmers."

Francine Pacilly

Francine Pacilly from the Netherlands, PhD candidate Farming Systems Ecology at Wageningen University
Study: MSc Biology at Wageningen University 2010-2012

"My research focuses on the ecological and social aspects of the control of potato disease late blight. The disease is spread by the wind and can cause a lot of damage, especially in rainy years. Conventional farmers use fungicides to diminish the risk of infection. Organic farmers can use resistant potato varieties. I made an agent-based model that simulates the interaction between the agents and their environment. The agents are farmers in a potato-growing area. The farmers can change their management strategy after a bad harvest or in response to the actions of neighbouring farmers. The model demonstrates the effects of their strategies on the dissemination of late blight. It shows that the use of resistant varieties can really make a difference. However, good management is required to prevent resistance breakdown. I did a workshop with potato farmers to show the model and they thought it represented the reality well. I am organising more workshops with farmers, trading companies and policy makers. The model is very helpful in these meetings."

EDUCATION: COURSES IN THE SPOTLIGHT

DATA MANAGEMENT

"Designing data structures is a skill for a lifetime"

"Data can be found everywhere, in research and in business. That is why we are teaching our students how to organise and manage data, in order to enable them to extract value from the data," says Ioannis Athanasiadis, Assistant Professor at the Information Technology Group, dubbed the 'Data Doctor'. The course offers a good insight in data modelling, covering both the theory and practice behind it. Also, there are theme lectures about big data, analytics, geographical data, time series, genomics or social network data. In Data Management, we focus on design principles and applications. The students actually build databases for their own field of study. "It is all rooted in reality, using contemporary tools. If at some point in your study you need to do some data scrambling then this course is for you. Designing data structures is a skill for a lifetime," Athanasiadis concludes.

SOFTWARE ENGINEERING

"Practice is the best way to learn about software development"

For research you often need to develop special software, for example mapping applications, data collection and visualisation software and apps for participatory research. "Even if you don't want to be a software developer nowadays it is still relevant to know how it works. Developing software in a team is a major challenge because software is abstract and collaboration can be very troublesome," explains Ioannis Athanasiadis. Students will learn to work in teams, developing and testing their own software product in very small steps. This way they experience how to deal with problems which are difficult to sort out, by 'divide and conquer'. Students also learn to estimate their capabilities and efforts. "Practice is the best way to learn about software development. This is what we do in this course: hacking code for a whole period!" says Athanasiadis.

AGENT-BASED MODELLING

"Insight in behaviour helps us improve complex systems"

Behaviour of complex systems is not under central control. This is true for animals when they form flocks or plagues and for people who work together. "Their behaviour depends on the rules and on local circumstances in the community. This creates a unique dynamic, making it difficult to predict what will happen," says Gert Jan Hofstede, Associate Professor. An agent-based model will let the individuals interact and generate emergent behaviour. "These social simulation models offer insight into mechanisms and processes of complex systems. This helps us to solve problems, design new systems or improve existing ones," Hofstede explains. "Our course is for social, technical and biological students alike. We enable students to simulate amongst others the possible effects of policy measures, marketing campaigns, social media hypes, disease outbreaks, social network structures and social learning," says Hofstede.

INFORMATION SYSTEMS FOR MANAGERS AND ENGINEERS

“Managers need an insight in management information systems”

“Nowadays, information systems form indispensable and business critical assets of organizations and managers need an insight in the current management information systems,” says Professor Bedir Tekinerdogan. The proper engineering and management of information systems often has a direct impact on the overall success of the organization. Current information systems, however, are complex and include a plethora of modern information technology and trends. This can easily lead to the misalignment between the organization business processes and the information systems. Our course targets both future IT managers and engineers and will provide the appropriate knowledge level to design, manage, and align business management and information systems in the agriculture and food domain. In addition, we provide hands-on-experience and teach the important activities of business process modelling, requirements engineering, domain modelling, and high-level architecture design.

BIG DATA

“You will gain hands-on experience with big data ecosystem tools”

The term big data usually refers to data sets with sizes which commonly used software tools cannot capture, curate, manage and process within a tolerable elapsed time. “The realization of big data relies on disruptive technologies such as cloud computing, internet of things and data analytics. Big data has become an important driver for innovation and growth,” explains Professor Bedir Tekinerdogan. Big data provides relevant insight and value creation for organisations and businesses. Storing and analyzing petabytes of data are becoming increasingly common in various sectors such as health, administration, agriculture, defense and education. “Our Big Data course covers both theoretical and practical aspects for developing and using big data systems. Besides discussing big data concepts students will gain hands-on experience with big data ecosystem tools,” says Tekinerdogan. The course is accessible for students of a diverse range of disciplines.

Thesis opportunities for MSc students

The INF group offers important and relevant thesis opportunities for students of different programs. The thesis assignments are defined based on the current INF research, and the background and interest of the student. Contact us to define an interesting thesis assignment!

For more information please contact education coordinator Maarten Zijp:

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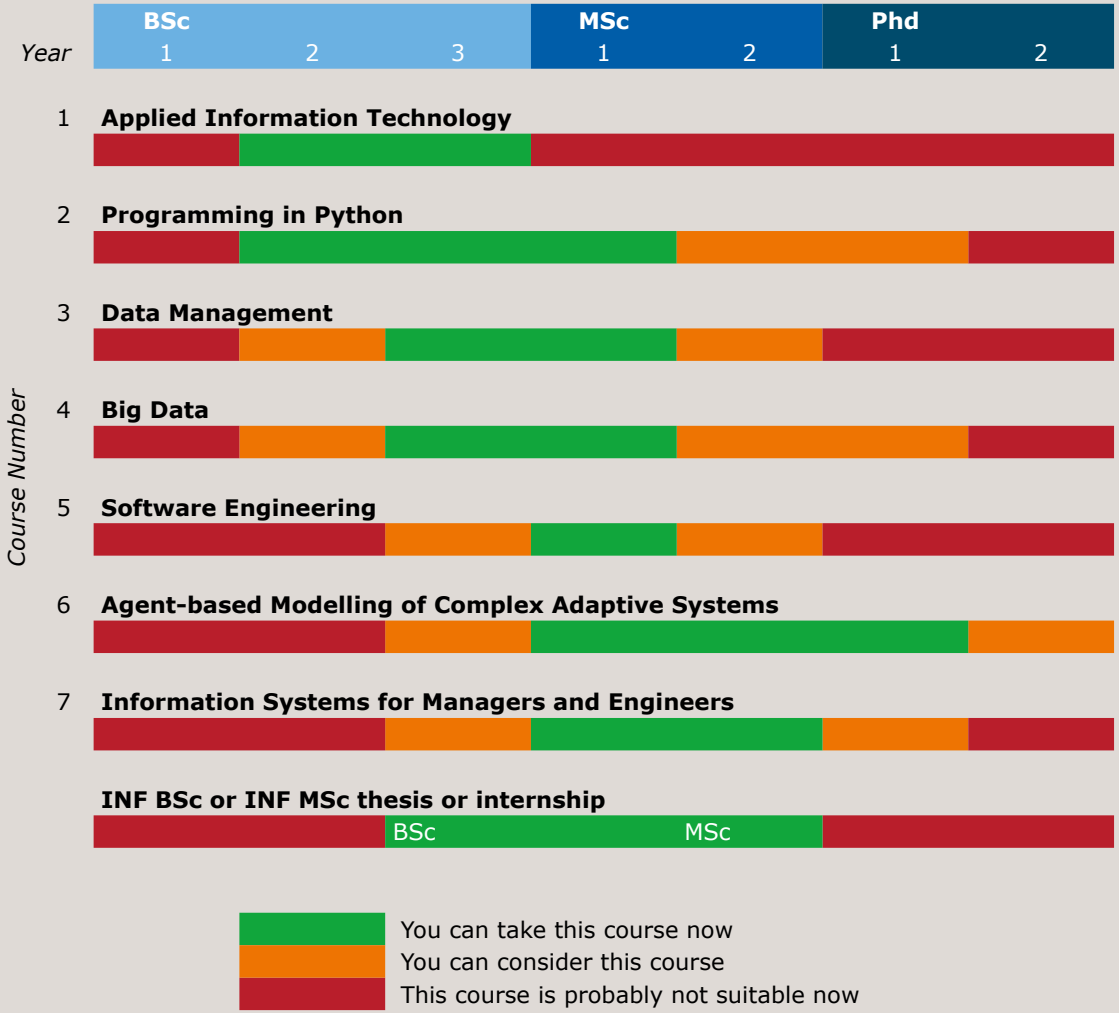
W www.wur.nl/inf

TIMELINE OF THE KEY INF COURSES



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