UNIVERSITY OF INFINITE AMBITIONS.

MASTER
OF SCIENCE
COMPUTER SCIENCE
DATA SCIENCE AND SMART SERVICES

UNIVERSITY OF TWENTE.

MASTER'S PROGRAMME COMPUTER SCIENCE - DATA SCIENCE AND SMART SERVICES (DS3)

This is a specialization of the University of Twente's Master's programme Computer Science.

Information technology is becoming increasingly embedded in our society. This also means that it is getting easier to collect more data about ourselves and our environment. The science concerned with the 'discovery' of information from large volumes of unstructured data is called 'data science'. It has high practical relevance, as the generation and application of information is an important economic activity. Data science techniques can be used in information systems to maintain an information model of the dynamic environment, e.g. based on real-time sensor data. These information models, in turn, can be used to offer tailored services to the users in the environment. Isn't that smart?

The Data science and smart services specialization at the University of Twente provides basic courses for understanding data science, smart services, and how these fields are related through modern information systems. It also offers advanced courses that address the challenges of this cross-disciplinary field, including big data processing, real-time analytics, information quality, and information system and service design.

WHAT IS DATA SCIENCE AND SMART SERVICES?

Services are a powerful abstraction of technical and business systems that facilitate the use of such systems without knowledge of their internal workings. The service concept is widely used for understanding and building complex technical systems in many areas.

An important class of services is that of information systems. Information systems capture, transmit, store, retrieve and display information. They support processes in business organizations and daily activities of human users. These information systems may comprise many subsystems that are geographically distributed and without centralized control. As such, they can be considered as a network of loosely coupled services, each corresponding to a subsystem and contributing to some target composite service. Information systems in today's organizations deal with large volumes of data, including structured data, sensor data, multimedia data, and geographic data. Managing these large volumes,

aggregating data from different sources and extracting useful information are increasingly strategic capabilities for these organizations. Such capabilities have only become possible with the development of new techniques and tools. These techniques and tools are produced by what nowadays is known as the data science field.

Data science tackles the challenges of big data, real-time analytics, data modeling and smart information use. Scientific and economic progress is increasingly powered by our capabilities to explore big data sets. A key challenge of data science is to use big data sets of varying quality that are readily available, instead of small datasets that require careful, manual work. As a student participating in the DS3 track, you will work with data created every hour, minute, second and millisecond, rather than data that require (laborious) manual annotation and manual cleaning. These big data sets are typically acquired by the unobtrusive monitoring of large populations of users in an everyday setting – rather than by monitoring small groups of carefully selected subjects in a laboratory setting. Data acquired by unobtrusive monitoring can be used in information systems to make a variety of smart services possible, based on real-time data analytics, complex event processing and context-aware process adaptation. The methodological challenges of big data analysis and smart services come with a number of technical challenges, and the need for developing new methods, models and tools. The challenges are:

1. To process datasets that are too big to be handled by a single machine or by traditional tools within a reasonable amount of time;
2. To process streaming data for real-time monitoring and tracking of events and real-time identification of trends;
3. To extract reliable conclusions and models from unreliable data, and from data integrated from multiple sources of varying quality;
4. To combine the above in smart services that bring added value to end users at the right time and at the right place.

COMBINATION OF SCIENTIFIC FIELDS

The DS3 Master's specialization at the University of Twente connects the important fields of data science and smart services via information systems. With data science, you will learn how to dig for value in data by analyzing various data sources. With smart service engineering, you will learn how to design services that effectively use system capabilities to satisfy dynamic user needs and requirements. Information systems that can use the results of data science to get more value out of data may turn current services into smart services. Already, we can see many applications of this in pervasive health, well-being, compliance management, intelligent transportation, logistics, business intelligence etc.

DIFFERENT THAN OTHER PROGRAMMES

The DS3 Master's specialization at the University of Twente distinguishes itself from similar specializations at other universities by offering:
A unique combination of expertise in computer science, data science, and service science;
Collaboration with leading international companies, like Google, Twitter and Yahoo;
A local infrastructure for the analysis of very large datasets, accessible to students;
Challenging big data and data analytics applications in smart services for pervasive health, logistics, and other areas.
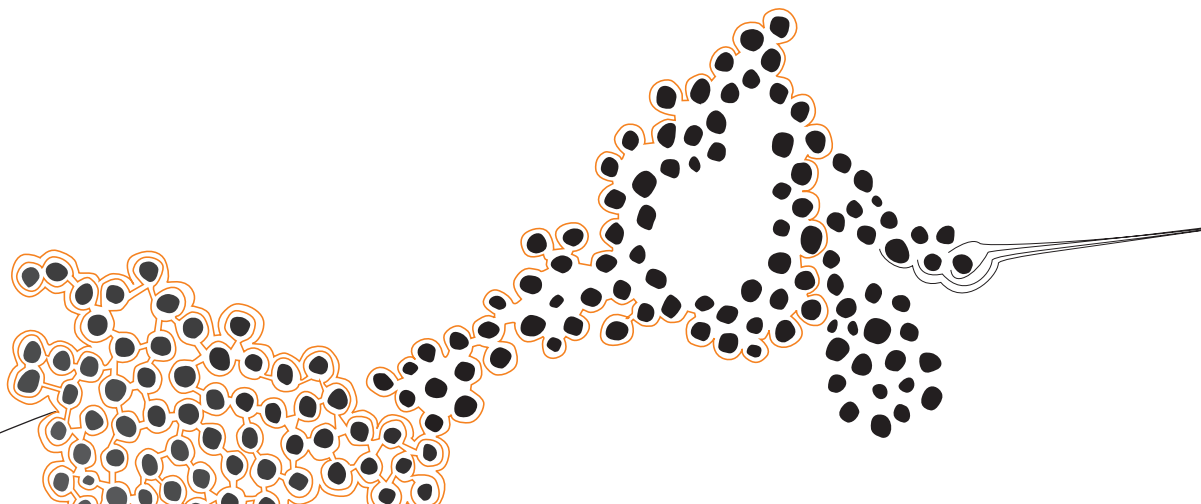
QUICK FACTS

Starting date	**1 September or 1 February**
Degree	**Master of Science**
Language	**English**
Duration	**2 years, 120 credits**
Website	**www.utwente.nl/go/csc**

PROGRAMME DATA SCIENCE AND SMART SYSTEMS

A typical first-year timetable includes five required courses (25 credits), electives related to the DS3 specialization (25 credits) and a number of electives in other disciplines (10 credits). In the second year, you will either take additional specialization courses or do an internship (20 credits). The remaining 40 credits in the second year are devoted to the graduation project, which involves a preliminary research exploration and literature study, called Research Topics, and the Master's thesis.

COURSES

CORE (25 CREDITS)
All participants in the DS3 specialization within the University of Twente's Master's programme Computer Science will take the following courses:
• Computer Ethics
• Architecture of Information Systems
• Service-oriented architecture with web services
• Managing Big Data
• Data Science

CHOICE (25 TO 45 CREDITS)
As a DS3 track participant, you can also choose 5 to 9 courses from the following list:
• Graph Theory
• Empirical Research & Data Analysis
• Advanced Database systems
• Secure Data management
• Model Driven Engineering
• Information Retrieval
• Machine Learning
• Advanced Architecture of Information Systems
• Electronic Commerce
• Design Science Methodology
• Advanced requirements engineering
• Specification of information systems
• Software Management
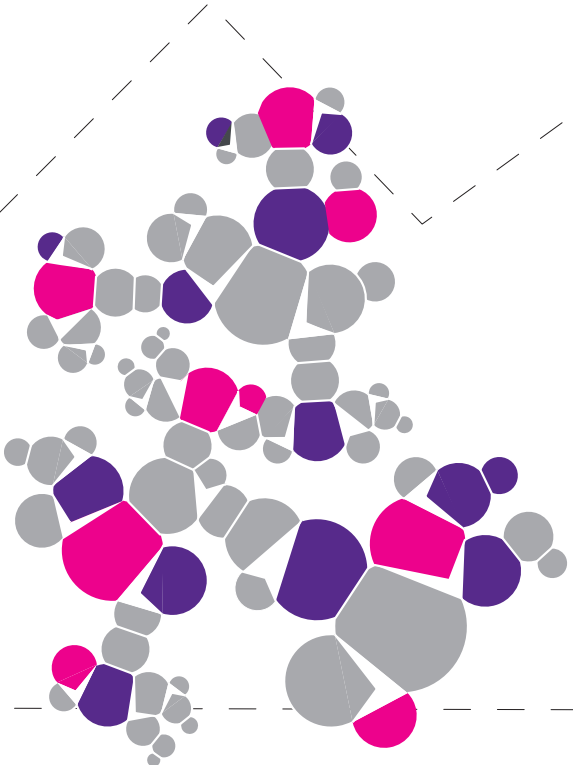• Research Experiments with Data and Information Retrieval
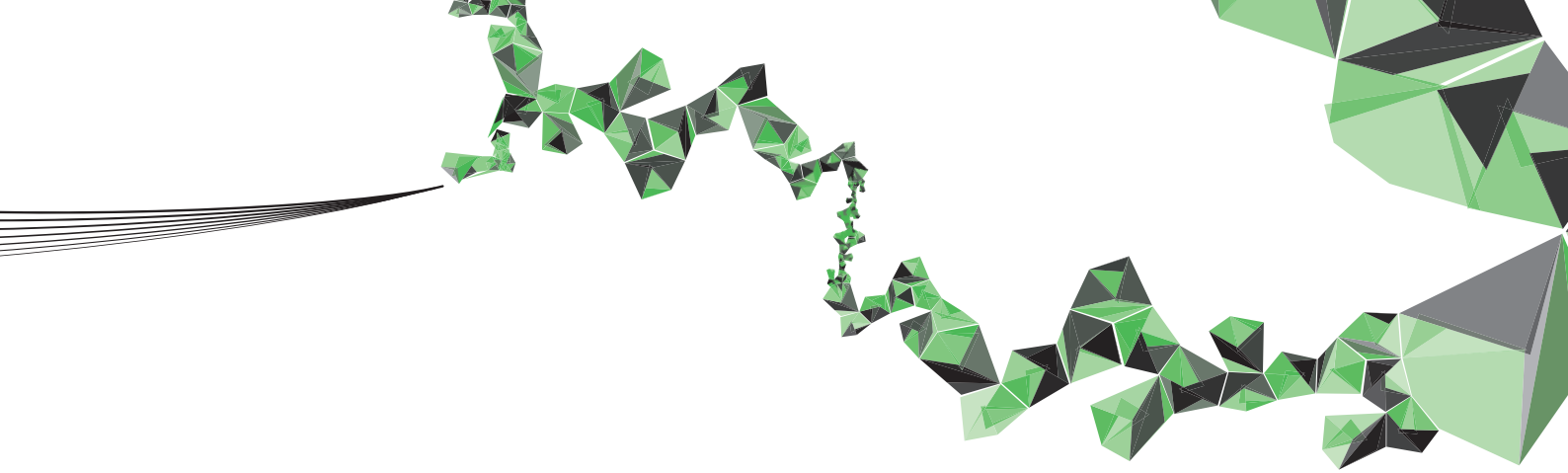
FREE CHOICE (10 TO 30 CREDITS)
As a track participant, you can choose course from any Master's programme at the University of Twente. The following two courses are especially recommended:
• International Study Tour
• Internship

FINAL (40 CREDITS)
The following courses are done by all track participants:
• Research Topics
• Final Project

CAREER OPPORTUNITIES

Data scientists are the driving force behind the successful innovation of Internet companies like Google, Twitter, and Yahoo. Likewise, service scientists are the key professionals responsible for service innovations in many domains. There is an increasing call for data scientists, data analysts and web service engineers in job advertisements.

This Master's degree will offer you employment opportunities in research, development and operations in any organization that uses information and technology-enabled business processes, and that uses the analysis of data underlying those processes to improve its organizational performance. Such organizations, and the need for data scientists, data analysts, and web service engineers, can be found in all sectors, particularly in finance, insurance, health care, manufacturing, construction, transportation, logistics, and public administration.

ELIGIBILITY CHECK

Our eligibility check is designed to assist you as a student holding a non-Dutch diploma. It will give you an indication of your eligibility to be admitted to the Master's programme Computer Science. The check will take about five minutes to complete. Please note that this is not part of the official admission procedure. No rights can be obtained from the outcome of the eligibility check.

Check your eligibility: **https://www.utwente.nl/go/csc/eligibility-check**