

# Master of Statistical Data Analysis

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## Dear potential applicant,

It is a pleasure to introduce you to the discipline of statistical science and welcome you to a quick tour of our unique one year postgraduate Master program in Statistical Data Analysis at Ghent University.

With a diploma in (bio-)engineering, psychology, (bio-)medical sciences, economics, educational sciences,... you are ready for a promising professional career. But those of you with a special aptitude for numbers and the logic of the scientific method may have become fascinated with new discoveries that lie hidden in observation, ready for reaping by dedicated, well trained professionals. Asking the right questions, a targeted gathering of data and then the extraction of valuable information, is becoming an exceedingly important and rewarding part of professional as well as scientific life.

Today's increasing computer power has led to the creation of complex databases in many domains. Simultaneously, statistical science has developed into a discipline with established methods and techniques for a wide range of data structures. Insights obtained from appropriate data analysis allow to predict, adjust and optimize processes. On the other hand, inefficient or ill structured data collection and analysis can lead to inferior, costly and misguided conclusions with possibly far-reaching consequences. No wonder then, that international professional and research standards in various fields demand high quality data analysis, performed by well-trained statisticians.

Our Master program offers intensive training by experts in modern statistical methods and data analysis to scientists from a wide range of fields, including biology, mathematics, bio-informatics, genetics, marketing, econometrics, environmetrics, psychometrics... It is designed to sharpen problem-solving skills and build experience in evidence-based decision making, to train scientists to become leaders in this field. It will be the start of life long learning in an exciting and fast evolving discipline.

Our dedicated teachers have vast practical experience, both locally and internationally, in a range of domains. They offer a truly multi-disciplinary experience. The Centre for Statistics of Ghent University established a research valorisation consortium, Stat-Gent, which fosters special relationships with partners in industry and society and works with their applied problems. We hope you will be able to enjoy the full benefits of this environment and look forward to welcoming you as members of our international student body.

On behalf of the curriculum committee,  
Prof. dr. Els Goetghebeur, chair



## About the Master training in Statistical Data Analysis

### Aim?

To offer excellent training in the design, analysis and reporting of empirical research.

### Who is it for?

The program is open to mature students, who earned a master degree in any field that required some statistical basis and sufficient mathematical background. In September a refresher course on Mathematics is offered to brush up basic mathematical skills.

### Career perspectives!

Students who successfully complete the Master program have acquired an advanced level of statistical knowledge and data analytic skills. They are ready to contribute as independent experts to a multidisciplinary team that designs, performs, analyses and reports on applied scientific research. Our masters are trained to handle practical problems in an objective scientific manner and to gain insight into the structure of data and an underlying model. Computing skills, flexibility, efficiency, common sense and an attitude towards continuous learning are important qualities that this program brings. These masters are much sought after and find rewarding careers in the pharmaceutical and other private industries, in banking, research institutions, government, ... Many of our students also go on to train as PhD's and guide the next generation of statistical professionals.

### Who is teaching?

The program is oriented towards a wide range of fields of application. It benefits from an interdisciplinary team of instructors, experts in statistics with teaching experience both locally and internationally at the graduate, postgraduate and professional level. They offer a truly well connected environment and allow students to acquire more extensive knowledge in a specific field of their choice such as biostatistics, behavioural sciences, economics or biotechnology-genetics.

## Structure of the program

The program consists of five mandatory courses, four elective courses and a master dissertation. Three elective courses are chosen from a predefined list. Throughout the program, lectures are supported by project work and take home assignments, which help develop skills of practical data analysis and provide experience with real data handling. The program can be taken as a **one year full-time program** or it can be spread over **two or more years**. Many courses are taught in the evening to facilitate work and study combinations.

The precise sequence of offered courses may vary from year to year. We refer to our website "<http://www.mastat.ugent.be>" for the latest information. In a typical year, four mandatory courses are taught in the first semester. The program starts with *Principles of Statistical Data Analysis*, which provides a solid background in basic statistical concepts and techniques, from a theoretical as well as practical perspective. It sets the tone for rigorous work and in depth understanding in a practical context. This course takes place in the first half of the semester. We build on it when developing models for a univariate outcome in the courses *Analysis of Continuous Data* and *Categorical Data Analysis*. The course on *Statistical Computing* runs through the entire semester and provides necessary skills to work with databases and statistical software, concentrating on SAS and R. In addition, a small number of elective courses are offered in the first semester. Full time students and part time students in their last year decide on the specific problem they wish to solve in their master thesis. As far as a possible topic goes, the sky is the limit. Professors propose a range of topics each year, but students are also encouraged to bring their own problem or data. Collaboration with professionals and researchers adds extra value to this process. During the first semester, students start exploring the relevant literature and choose a thesis supervisor under whose close tutorship they will work towards a solution.

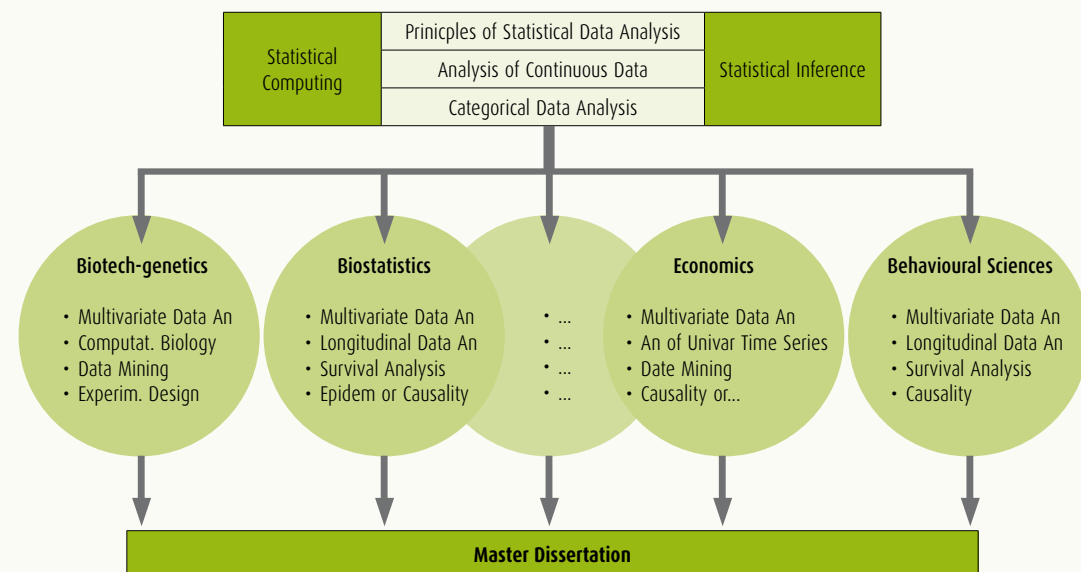
The second semester includes the mandatory course on *Statistical Inference*, which provides a more general and unified methodological basis for the statistical design and analysis of empirical studies. The majority of elective courses are further offered in this semester, for instance *Causality and Missing Data*, *Experimental Design*, *Longitudinal Data Analysis*, and *Monte Carlo and Computer Intensive Methods in Statistics*. The course *Capita Selecta* presents a different subject each year and may be taught by visiting faculty, specialized in a particularly exciting topic. While we believe the program in Ghent is very attractive, we also encourage students to discover the world and possibly take one or more courses in a European program of high quality. We are for instance partners in a Nordic Biostatistics Master Course Network. Students in their final year may finish their master dissertation in this semester and report both orally and in writing about the problem studied, the approach taken, and the results obtained. Close mentoring during the thesis process provides students with the unique opportunity to learn first hand from an experienced statistician how the statistical method gets applied to solve real world problems.

An overview of typical courses and their workload according to the number of credits (ECTS = European Credit Transfer System) follows for quick reference:

Mandatory courses:			
	Theory	Practice	ECTS
Principles of Statistical Data Analysis	22.5	40	5
Statistical Computing	22.5	40	5
Analysis of Continuous Data	22.5	40	5
Categorical Data Analysis	22.5	40	5
Statistical Inference	30	15	5
Master Dissertation			15
A list of elective courses:			
Analysis of Univariate Time Series	22.5	40	5
Capita Selecta	22.5	40	5
Causality and Missing Data	22.5	40	5
Computational Biology	22.5	40	5
Data Mining	22.5	40	5
Epidemiology	30	30	5
Experimental Design	22.5	40	5
Longitudinal Data Analysis	22.5	40	5
Monte Carlo and Computer Intensive Methods in Statistics	15	40	5
Multivariate Data Analysis	22.5	40	5
Spatial Statistics	30	30	5
Survival Analysis	22.5	40	5

Elective courses have to be chosen for a total of 20 credit points – a minimum of three courses are chosen from the list above, the final course can come from any study program at Ghent University or other institutions of higher education, subject to the faculty's approval. Students wishing to spend (part of) the second semester abroad are encouraged to explore the possibilities.

For students with a specific focus, we recommend trajectories of elective courses, corresponding to modules *Biotechnology-genetics*, *Biostatistics*, *Economics* and *Behavioural Sciences*. The order in which the courses appear in each module below indicates the recommended order in which part-time students may take these courses



For more details and the latest information on program contents and lecturers, please see the program section of our website, <http://www.mastat.ugent.be>



## International mobility

Our program is anchored in an international environment of research and education. We encourage exchange of lecturers and students. The international dimension of the training shows up in many ways:

- International experts are invited to teach specialized courses.
- Our own lecturers teach regularly at international institutes.
- The English program draws a rich group of foreign students.
- We participate in a network of statistical master programs which involves the universities of Stockholm, Oslo, Helsinki, Copenhagen and Newcastle. Students are offered the opportunity to follow a course in one of the collaborating universities.
- Credits earned for equivalent subjects may be recognized between different institutes.



**Below are some excerpts of what (former) students as well as leaders in the field wished to say about how they value this program and statistical data analysis more generally.**

**Full testimonies and more can be found on our website:**

[http://www.mastat.ugent.be.](http://www.mastat.ugent.be)

## Our students and alumni testify...

**David Mwakazanga**, *Degree in Demography and Statistics, was Trainee Data Analyst, Tropical Diseases Research Centre, Zambia:*

“As a student who spent a considerable time searching the world for a statistical program that would suit my personal and job requirements and a scholarship, I think it’s essential that the Master is offered as a one year full-time program. The content is flexible enough to accommodate career needs and all sorts of student backgrounds. [...] Additionally, potential scholarship funds are not very willing to sponsor a student for more than a year to get a master qualification.”

**Karel Spitaels**, *Civil Engineer, at ‘Transport & Mobility Leuven’:*

“Before attending the Master program, I studied civil engineering. There I gained a great deal of theoretical knowledge, but little experience with practical application. The Master program developed my skills and insight in model building, in the meaning of data and in causality, making me much more versatile as a researcher and teaching me how to put theory into practice. I now work at the research firm ‘Transport & Mobility Leuven’, where I am responsible for data preparation, statistical data-analysis and model building.”

**Katrien Verschueren**, *Bio-engineer, at Ablynx (biopharmaceutical company, Ghent):*

"I have spread the Master over two years as I combined it with a full-time work assignment. It was a tough combination; however a very interesting balance between theory (in class) and practice (at work). [...] Most importantly the Master program delivered the fundamental basics to understand the concepts and at the same time the tools and the information about how to tackle everyday statistical problems encountered at work."

**Marijke Welvaert**, *Master in psychology, teaching assistant and PhD student in Psychology, Ghent University:*

"During the Master a whole new exciting world opened up and slowly I became part of it. [...] The skills and knowledge I achieved in the Master help me now to anticipate the problems that my students have and make it a lot easier to explain what statistics are about. [...] But not only in teaching I can rely on the Master, also for my PhD the practice I received will be indispensable."

**Mieke Van Hemelrijck**, *Master in Biomedical Sciences (UGent) and International Health (Harvard School of Public Health), PhD student Epidemiology, Kings College London:*

"This year of statistical theories, programming, analyses, and applications was a huge challenge for me. [...] Nevertheless, I enjoyed it very much as it was an excellent opportunity to learn from classmates and professors from across the University applying statistics in different fields. [...] The Master degree in Statistical Data Analysis provided me with much practical statistical knowledge, which has helped me throughout the course of my studies in Public Health."



...as do leaders in health care and finance.

**Prof. Dr. Marleen Temmerman**, *Department of Obstetrics and Gynaecology, Ghent University; Director International Centre for Reproductive Health:*

"Appropriate and reliable data are much-needed for anyone involved in health care, whether at the level of planning, execution, research or practical implementation. Within the framework of clinical and operational research, the importance of a thorough experimental design, accurate data collection and a professional statistical analysis cannot be stressed enough. [...] Especially in international research the quality of information is extremely important, and this requires knowledge which we as doctors do not sufficiently have. For this reason, I took a course in epidemiology and statistics, in order to understand the basics and to be able to think in a more goal-oriented manner with regard to certain research questions. But what this course especially made me realize, is how important the role of a professional statistician can be. Since then, in all our projects, whether epidemiological, clinical, sociological or in the laboratory, we cooperate with statisticians, preferably with knowledge of and interest in health. [...] I am convinced that this Master gives an answer to an enormous need from field workers, where the important health problems cry out for a well-considered evidence-based approach."



**Prof. Dr. Herman Verwilt**, *Chairman of the Board of Directors of Fortis Bank:*

"Data analysis forms, and has always formed, one of the most prominent activities within the financial sector and its development has been an important factor in the expansion of financial institutions. [...] The recent directives of the Basel Committee aim for a more economic approach of the various financial risks, in particular the counterparty risks. A parallel policy applies in the insurance world where Solvency II clearly also opts for the more economic point of view. This new regulation not surprisingly works as a catalyst for change in many fields, and data analysis is one of these. Indeed, statistics is a science which is heavily called upon in this context. As some examples we cite a number of traditional methods: linear and logistic regression, discriminant analysis, decision trees. More advanced technologies are also making their way up (kernel methods...) and are usually combined with other procedures such as descriptive analysis, sampling and simulation (Monte Carlo)."



## Why study in Ghent?

### Ghent, a crossroad of statistical activity

*Historically.* The study of statistics at Ghent University has a long history. Indeed, the very first doctorate that was completed at this university was that of the famous Adolphe Quetelet (1796-1864). His more than 300 scientific publications reflect the many contributions he made to the discipline of statistics. He was especially influential in two areas: the introduction of the concept of 'the average man' ('l'homme moyen'), and the work around different statistical distributions<sup>1)</sup>.



*Today.* Ghent University is one of the most important institutions of higher education and research in the Low Countries. The university yearly attracts over 30,000 students, with a foreign student population of over 2,200 EU and non-EU citizens. The Center for Statistics of Ghent University covers a critical mass of statistical experts from various scientific domains. Its members are at the forefront, nationally and internationally, in research, education and consulting. They are experienced in practically oriented postgraduate teaching through the continuing education of PhD students, academic researchers and professionals from outside the university. More information about the members and activities of the Center for Statistics can be found on <http://www.cvstat.ugent.be>

<sup>1)</sup> For more details we refer to Stigler (1986), *The History of Statistics*, p.161-220, Harvard University Press, Cambridge.



### Ghent, sparkling city

Ghent prides itself in a rich history. In medieval times, particularly during the 11<sup>th</sup> and 12<sup>th</sup> century, the city became a prominent trade centre in North-West-Europe. Charles V, one of Europe's great rulers, was born here in the year 1500. Later the city suffered from religious troubles, like most cities in the Low Countries, but from 1800 on, peace and prosperity were restored thanks to new factories such as the successful cotton mills. The 19<sup>th</sup> century brought continuing industrial growth and the number of inhabitants exploded.

Today, Ghent is a flourishing, lively cultural city, with a friendly atmosphere, a diverse population and fascinating architecture. It is also home to many students, making up a considerable part of the 250,000 inhabitants, who give the city an ever-young character.



## Interested?

With specific questions, you are welcome in the various faculties:

### Medicine and Health Sciences:

Prof. Dr. Georges Van Maele (tel 09/332.29.59 • Georges.VanMaele@UGent.be)

### Bioscience Engineering:

Prof. Dr. Olivier Thas (tel 09/264.59.33 • Olivier.Thas@UGent.be)

### Economics and Business Administration:

Prof. Dr. Dirk Van den Poel (tel 09/264.89.80 • Dirk.VandenPoel@UGent.be)

### Engineering:

Prof. Dr. René Boel (tel 09/264.56.58 • Rene.Boel@UGent.be)

### Political and Social Sciences:

Prof. Dr. Ronan Van Rossem (tel 09/264.84.57 • Ronan.VanRossem@UGent.be)

### Psychology & Educational Sciences:

Prof. Dr. Yves Rosseel (tel 09/264.63.74 • Yves.Rosseel@UGent.be)

### Sciences:

Prof. Dr. Els Goetghebeur (tel 09/264.48.11 • Els.Goetghebeur@UGent.be)

Prof. Dr. Stijn Vansteelandt (tel 09/264.47.76 • Stijn.Vansteelandt@UGent.be)

### University colleges (Hogescholen):

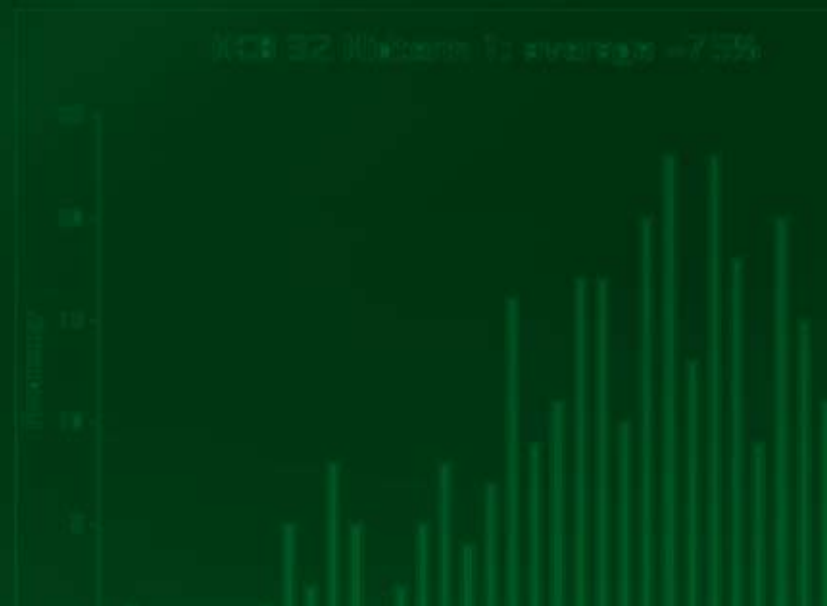
Prof. Dr. Patrick Calders (tel 09/332.69.15 • Patrick.Calders@Arteveldehs.be)

### Veterinary Medicine:

Prof. Dr. Luc Duchateau (tel 09/264.73.32 • Luc.Duchateau@UGent.be)

Further up-to-date information, instructions for enrolment and pointers to grants and scholarships, are available on the website of the Master of Statistical Data Analysis:  
<http://www.mastat.ugent.be>

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<http://www.mastat.ugent.be> - <http://www.cvstat.ugent.be>

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