



DATS2M - Introduction

Introduction

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The digitalization is at the origin of the considerable increase of available data. From then on, most of the actors of the society rely on an analysis of these data to objectify their decision-making and develop their disciplinary axes. From these specific needs, we attend to the emergence of new jobs oriented to "data".

The Master's degree in Data Science proposes a training in scientific methods and technological tools to answer societal or scientific questions by processing data that are often massive ("Big Data"). This discipline requires associating a model structured by the problem of interest, with computer sciences, statistics and mathematics to bring a rigorous, quantitative and operational solution to the asked question. An IT infrastructure and algorithms of complex calculations also complement these scientific methods to allow the data structuring and processing.

The fields of application of data sciences are extremely varied: the political and security decision taking, the real time on-line advertising, the e-commerce, the data processing of network, the processing of financial data or industrial production, the biomedical research based on o-mics data or of imaging.

Your profile

You hold an undergraduate diploma or a Master's degree and you have acquired solid skills and the taste for the three pillars of the sciences of the data: the mathematics, the statistics and the computing as well as a curiosity for the fields of application of these disciplines.

You master technical English and are capable of attending class, reading scientific documents, to draft reports and to express you orally in this language. You have general skills and necessary personal qualities to approach a diploma of scientific Master's degree such as of the autonomy, a critical mind, the rigor, a capacity of auto-apprenticeship and to look for or to deal with the information.

A block of additional courses (of maximum 60 credits) is proposed to students having no all these skills.

Your future job

Your diploma of Master's degree in Data Science, statistical orientation, prepares you for positions of "data scientist", "data analyst", "data and analytics manager" or simply "statistician" and prepares to set of responsibility in these domains.

Your programme

The Master's degree in Data Science, declined in two orientations, leans on the following four common pillars:

- Statistical inference and modelling.
- Learning theory, Data mining and visualization of large-dimension data.
- The industrial aspects and the business of data sciences and data analytics.

The "Statistical" orientation offered by the LSBA (Louvain School in statistics, biostatistics and actuarial sciences) proposes, in complement to these four common pillars, a training more specialized in useful statistical methods for data sciences and a strong opening towards the implementation of tools in various fields of application, in management, finance and human sciences.

The Louvain School of Engineering (EPL) offers a second orientation, which complements the four common pillars with a [specialization in "Information technology" via two options in "Computer systems" and "Digital methods and optimization"](#).

Your parcours

You will develop firstly interdisciplinary fundamental skills, solid and deepened to be capable of approaching a wide spectrum of problems in data science. You will also be able to bring to a successful conclusion projects or of to develop research in the domain.

Your program will offer you opportunities to discover, via projects, internships or applied courses, extremely varied scopes of data sciences: political and security decision-making, the real time online advertising, the e-commerce, the data processing of network, the data processing financiers or of industrial production, the biomedical research based on –omics data or of imaging...

DATS2M - Teaching profile

Learning outcomes

Acquire robust methodological bases in analysis and data processing and apply them in varied domains such as human sciences, engineering, marketing, finance, insurance, or scientific research.

After completing the training, the student will master the fundamental concepts in statistics, algorithmic, data mining, and machine learning that are necessary for the job of «data scientist». He will develop skills in communication and will be capable of analyzing a complex problem, of collaborating in a research project. According to the objectives aimed by the student, several elective modules are proposed: applied data, dated sciences in linguistics, algorithmic and computing, statistics and sampling, dated sciences applied to management.

On successful completion of this programme, each student is able to :

1.

Demonstrate the control of a robust corpus of knowledge in data sciences, allowing him(her) to solve the problems which are a matter of his(her) discipline

1.1

The structures of data and algorithms for the analysis of data.

1.2

The theories of the learning, the data mining and the visualization of large-dimension data.

1.3

The statistical inference, the modelling and statistical computing. The student in the orientation information technologies specializes via compulsory or electives courses.

1.4

The industrial and entrepreneurial aspects of data sciences.

1.5

The computer systems, including parallel computing, the networks and the safety(security).

1.6

Numerical methods and optimization, constrained optimization included, operational research, identification and applied mathematics.

2.

Organize and to lead to its term an initiative of development of a data operating system, fulfilling to complex needs of a customer.

2.1

Analyze the problem or solving the functional needs and to formulate the corresponding specifications.

2.2

Formalize and model the problem and design one or several original technical solutions answering these specifications.

2.3

Estimate, justify and classify the solutions with regard to all the criteria appearing in technical specifications: efficiency, feasibility, quality, relevance and security.

2.4

Implement, test and validate the selected solution and interpret the results.

2.5

To contribute in team to the conduct of a project of data exploitation and to lead it to its term by taking into account objectives, assigned resources and constraints that characterize it.

4.1

To center and clarify the objectives of a project (by associating it performance indicators) considering the stakes and the constraints that characterize the environment of the project.

4.2

To be collectively committed on a work plan, a schedule and roles.

4.3

Work in a multidisciplinary environment, together with other actors having various points of view: manage points of disagreement or conflicts.

4.4

To make decisions in team when there are choices: whether it is on the technical solutions or on the organization of the work to run the project successfully.

5.

Communicate effectively orally and in writing to bring to a successful conclusion the projects which are entrusted to him (her) in his (her) working environment (in particular in English).

5.1

Identify clearly the needs for the "customer" or for the user: question, listen and understand all the dimensions of his request and not only the technical aspects.

5.2

Argue and to convince by adapting itself to the language of his (her) interlocutors: technicians, colleagues, customers, managers.

5.3

Communicate under graphic and schematic shape; interpret a plan, present the results of a work, structure information.

5.4

Read, to analyze and to exploit technical documents (diagrams, textbooks, projects specifications).

5.5

Draft written documents by taking into account contextual requirements and social conventions on the subject.

5.6

Make a convincing oral presentation by using the modern techniques of communication.

6.

Show at the same time rigorous, open, critical mind and ethics in its work.

6.1

Apply existing standards in the disciplines of data sciences (terminology, quality measures).

6.2

Find solutions which go beyond the strictly technical issues, by integrating the stakes in ethical dimension of a project (including the data privacy and the protection of the private life) and of sustainable development.

6.3

Show critical mind towards a technical solution to verify the robustness and to minimize the risks that a solution presents with regard to its implementation.

6.4

Make a self-assessment and to develop in an autonomous way the necessary knowledge to remain competent in his (her) domain.

Programme structure

The program of 120 credits of the Master's degree in Data Science, statistical orientation, consists of:

- A common core syllabus from 52 to 90 credits including courses of
 - statistical modelling,
 - Machine learning and data mining,
 - Computational statistics, structuring of data and algorithmic for data sciences,
 - Philosophy (elective course),
 - Modules to complete if needed, the skills of the student in IT, statistics and mathematics.
- A specialized orientation of 30 credits, including the master thesis and a specific course in the orientation.
- credits for proposed elective courses.
- Maximum 10 credits for courses that are not included in the program, to be made approved by the program committee of the master.

To the program of 120 credits, a module of additional teachings can be added for the student not possessing all the prerequisites of the Master's degree. This module is selected with the advisor of the program.

DATS2M Programme

Detailed programme by subject

CORE COURSES

- Mandatory
- ⊗ Optional
- △ Not offered in 2024-2025
- ⊖ Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🚫 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Year

1 2

● Statistical modelling

● LSTAT2120	Linear models	Christian Hafner	EN [q1] [30h+7.5h] [5 Credits] 🌐 > French-friendly	X	
● LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	EN [q2] [22.5h+7.5h] [5 Credits] 🌐	X	
● LSTAT2150	Nonparametric statistics: smoothings methods	Rainer von Sachs	EN [q1] [15h+5h] [4 Credits] 🌐	X	X

● Cours au choix

At least 2 courses among the 5 following.

⊗ LSTAT2100	Discrete data analysis.	Anouar El Ghouch	FR [q2] [30h+7.5h] [5 Credits] 🌐	X	
⊗ LSTAT2170	Times series	Rainer von Sachs	EN [q2] [30h+7.5h] [5 Credits] 🌐	X	X
⊗ LSTAT2210	Mixed linear models	Catherine Legrand	FR [q1] [15h+7.5h] [4 Credits] 🌐	X	X

Year

1 2

o Statistical computing, data structures and algorithms for data analysis

<input checked="" type="radio"/> LSTAT2020	Statistical softwares and basic statistical programming	Céline Bugli	PS [q1] [15h+15h] [4 Credits]		X
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PROFESSIONAL FOCUS [30.0]

- Mandatory
- ⊗ Optional
- △ Not offered in 2024-2025
- ⊙ Not offered in 2024-2025 but offered the following year
- ⊕ Offered in 2024-2025 but not the following year
- △ ⊕ Not offered in 2024-2025 or the following year
- Activity with requisites
- 🌐 Open to incoming exchange students
- 🌐 Not open to incoming exchange students
- [FR] Teaching language (FR, EN, ES, NL, DE, ...)

Click on the course title to see detailed informations (objectives, methods, evaluation...)

Year

1 2

o Content:

○ LDATS2840	Master thesis in data analytics		FR [q1 or q2] [] [20 Credits] 🌐		x
○ LDATS2350	Data Mining	Robin Van Oirbeek	EN [q2] [15h+15h] [5 Credits] 🌐	x	

o Optionnal course

Choose 1 course among the 2 following.

⊗ LDATA2010	Information visualisation	
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o Content:

⌘ LDATS2310	Deep learning for Insurance and Finance	Donatien Hainaut	100 [q2] [15h] [3 Credits]  > English-friendly		x
⌘ LSTAT2200	Survey and Sampling	Séverine Guisset			

o

Year

1 2

⌘ MLSMM2153	Web Mining	François Fouss Corentin Vande Kerckhove	PR
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DATS2M - Information

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the higher education landscape and the academic organisation of courses.

General and specific admission requirements for this programme must be satisfied at the time of enrolling at the university.

Unless explicitly mentioned, the bachelor's, master's and licentiate degrees listed in this table or on this page are to be understood as those issued by an institution of the French, Flemish or German-speaking Community, or by the Royal Military Academy.

In the event of the divergence between the different linguistic versions of the present conditions, the French version shall prevail.

SUMMARY

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- > [Specific access requirements](#)
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- > [Holders of a non-University 2nd cycle degree](#)
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Specific access requirements

In addition to the access conditions described below, candidates will have to provide proof of a sufficient command of the French language (level B1 of the CEFR, Common European Framework of Reference for Languages).

Students who wish to be admitted on the basis of a dossier (see tables below) are invited to consult the [criteria for the evaluation of application](#).

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Engineering		Direct access	
Bachelor : Business Engineering (Louvain-la-Neuve)		Direct access	
Bachelor : Business Engineering (Mons)		Direct access	
Bachelor : Business Engineering (Bruxelles Saint-Louis)		Direct access	
Bachelor : Business Engineering (French-English) (Bruxelles Saint-Louis)		Direct access	
Bachelor : Business Engineering (French-Dutch-English) (Bruxelles Saint-Louis)		Direct access	
Bachelor of Science in Business Engineering (Bruxelles Saint-Louis)		Direct access	
Bachelor in Computer Science (Louvain-la-Neuve)		Direct access	
Bachelor in Computer Science (Charleroi)		Direct access	
Bachelor in Mathematics		Direct access	
Bachelor in Physics		Direct access	
Other Bachelor	with Minor in Computer Sciences or Minor in Statistics, Actuarial Sciences and Data Sciences	Direct access	In some cases, the UCLouvain Enrolment Office, after reviewing their online enrolment or re-enrolment application, will ask the students concerned to provide an enrolment

		authorisation from the faculty/school.
Bachelor in Economics and Management Bachelor in Bioengineering Bachelor in Management	Access with additional training	Straight access, but the program is completed with an additional training of maximum 10C
Other Bachelor	if no minor in computer sciences / statistics and data sciences Access based on application	
Others Bachelors of the French speaking Community of Belgium		
Engineer in management Engineering, orientation « civil engineer » Computer sciences Mathematical sciences Physical sciences	Direct access	
Bachelor in economics or management Engineering orientation bio-engineering	Access with additional training	Straight access, but the program is completed with an additional training of maximum 10C
Other Bachelor	Access based on application	
Bachelors of the Dutch speaking Community of Belgium		
Bachelor in de ingenieurswetenschappen Bachelor in de informatica Bachelor in de wiskunde Bachelor in de fysica Bachelor in de economische wetenschappen Bachelor in de bio-ingenieurswetenschappen	Access based on application	
Foreign Bachelors		
All degree	Access based on application	

Non university Bachelors

> Find out more about [links](#) to the university

Diploma	Access	Remarks
BA en informatique de gestion - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation informatique industrielle - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation réseaux et télécommunications - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation sécurité des systèmes - crédits supplémentaires entre 30 et 60 BA en informatique et systèmes, orientation technologie de l'informatique - crédits supplémentaires entre 30 et 60 BA en informatique, orientation développement d'applications - crédits supplémentaires entre 30 et 60 BA en informatique, orientation informatique industrielle - crédits supplémentaires entre 30 et 60 BA en informatique, orientation réseaux et télécommunications - crédits supplémentaires entre 30 et 60 BA en informatique, orientation sécurité des systèmes - crédits supplémentaires entre 30 et 60 BA en informatique, orientation technologies de l'informatique - crédits supplémentaires entre 30 et 60	Les enseignements supplémentaires éventuels peuvent être consultés dans le module complémentaire .	Type court

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			

Masters		
Master degree from the French community of Belgium: Civil engineer Computer sciences Engineer in management Actuarial sciences Mathematical sciences Statistics Biostatistics Physical sciences	Direct access	Subject to the acceptance of the file by the jury, a student can be exempted from maximum 60 credits of activity and possibly realize the Master's degree in sciences of the data in a single year.
Other master degrees	Access based on application	Subject to the acceptance of the file by the jury, a student can be exempted from maximum 60 credits of activity and possibly realize the Master's degree in sciences of the data in a single year

Holders of a non-University 2nd cycle degree

Access based on validation of professional experience

> It is possible, under certain conditions, to use one's personal and professional experience to enter a university course without having the required qualifications. However, validation of prior experience does not automatically apply to all courses. Find out more about [Validation of priori experience](#).

Teaching method

By its professional vocation, the teaching is completed by numerous practical class having for objective the implementation of methods of analysis on real data. On the other hand, the student also has the possibility of including in his program, a company internship to develop the methodological aspects of the report there. Certain projects will also require working in multidisciplinary teams, what contributes to the development of a stimulating and friendly spirit of collaboration among the students of the program.

The majority of the courses distributed by the teachers are accompanied by an intranet site on the platform "moodle". These sites propose tools of e-learning and serve as forum to the students.

Certain specialized modules are taught by professors coming from the industry.

Finally, the program includes compulsory courses in English and in French. Thus, the student must be capable of attending class in both languages. The report can be made in English and the student can also individual ask to take his examinations in English. The choice of English aims at favoring international attraction of this training and at perfecting the skills of our own local students. Opportunities will be offered to students who do not know French and wish for a complete cycle in English.

Evaluation

The evaluation methods comply with the [regulations concerning studies and exams](#). More detailed explanation of the modalities specific to each learning unit are available on their description sheets under the heading "Learning outcomes evaluation method".

Assessment methods are in accordance with the regulation of studies and examinations. More information about the modalities appropriate to every credit is available in their descriptive index card, in the column "Assessment mode of learning outcomes of students".

Every EU of the program contains an oral examination or a written examination often completed by a project completed by a report, taken into account in the assessment. The (optional) internship and the master thesis each involve the writing of a document being the object of an oral defense in front of a jury.

The total mark is an average of marks for each course, weighted by their respective credits.

If a student registered to an examination in January was not able to attend for duly justified reasons of force majeure, he can ask to the foreman of jury for the authorization to present the examination in June. The foreman of jury judges the relevance of the request and, if the professor of the course agrees, the student can retake the examination in June.

Mobility and/or Internationalisation outlook

The program of Master's degree in Data Science (statistical orientation) being new, no program of systematic exchange with foreign universities is set up.

The students who wish to gain an experience abroad within a company or an outside body during their program can:

- Do an internship in a private company (in Belgium or abroad).

Certificates

The LSBA also proposes diverse programs of continuous training (certified or not), as the university certificate in statistics and data

