UCLouvain

DATS2M

2024 - 2025

Master [120] in Data Science : Statistic

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In French
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **YES** - Activities in other languages : **NO**
Activities on other sites : **optional**
Main study domain : **Sciences**
Organized by: **Faculty of Science (SC)**
Programme acronym: **DATS2M** - Francophone Certification Framework: 7

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DATS2M - Introduction

Introduction

Introduction

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

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

Year

PROFESSIONAL FOCUS [30.0]

- Mandatory
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- Activity with requisites
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- 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...)

Content:

				Year 1	Year 2
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	

Optionnal course

Choose 1 course among the 2 following.

LDATA2010	Information visualisation	John Lee	[EN] [q1] [30h+30h] [5 Credits] *> French-friendly*		x
LINFO2364	Mining Patterns in Data	Siegfried Nijssen	[EN] [q2] [30h+15h] [5 Credits] *> French-friendly*		x

OPTIONS

The student completes his program with elective courses reported in the list below. With the agreement of the restricted jury, the student can also complete his program by other courses that he would consider relevant and taught at the UCLouvain. The student may include a maximum of 5 language course credits in his or her program, provided that the level is appropriate and consistent with the student's and the program's profile.

> Data in action *[en-prog-2024-dats2m-ldats210o]*
> Data sciences en linguistique et Text Mining *[en-prog-2024-dats2m-ldats211o]*
> Algorithme, informatique, optimisation, recherche opérationnelle *[en-prog-2024-dats2m-ldats220o]*
> Stage *[en-prog-2024-dats2m-ldats240o]*
> Data Sciences appliquées à la gestion *[en-prog-2024-dats2m-ldats250o]*
> Optional courses *[en-prog-2024-dats2m-lsc100o]*

DATA IN ACTION

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Year
1 2

Content:

LDATS2310	Deep learning for Insurance and Finance	Donatien Hainaut	FR [q2] [15h] [3 Credits] *> English-friendly*		x
LSTAT2200	Survey and Sampling	Séverine Guisset Christian Ritter	FR [q2] [15h+5h] [4 Credits]	x	x
LSTAT2320	Design of experiment.	Patrick Bogaert	FR [q2] [22.5h+7.5h] [5 Credits] *> English-friendly*	x	x
LSTAT2340	Statistical Analyses of ¿omics Data				

Year
1 2

Year
1 2

⊠ MLSMM2153	Web Mining	François Fouss Corentin Vande Kerckhove

The student is invited to meet the program advisor to decide which courses should be followed. The restricted jury must next approve his program.

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Mathématique - Analyse et algèbre linéaire

Each of the following three modules allows acquiring similar skills:

Module 1

LINFO1111	Analysis	Pierre-Antoine Absil François Glineur	FR [q1] [45h+37.5h] [7 Credits]
LINFO1112	Algebra	Christophe Craeye Enrico Vitale	FR [q2] [30h+30h] [5 Credits]

Module 2

LINGE1114	Mathematics I: analysis	Heiner Olbermann	FR [q1] [30h+30h] [5 Credits]
LINGE1121	Mathematics II: algebra and matrix calculus	Cécile Coyette (compensates Tom Claeys)	FR [q2] [30h+30h] [5 Credits]

Module 3

LMAT1101	Mathematics 1	Pedro Dos Santos Santana Forte Vaz	FR [q1] [30h+20h] [4 Credits]
LMAT1102	Mathematics 2	Augusto Ponce	FR [q2] [30h+30h] [4 Credits]

Probabilités et Statistique

Each of the following four modules allows acquiring similar skills:

Module 1

LSTAT2014	Elements of probability and mathematical statistics	Eugen Pircalabelu	FR [q1] [22.5h+22.5h] [5 Credits]

Module 2

LBIR1212	Probabilities and statistics (I)	Patrick Bogaert	FR [q1] [30h+15h] [4 Credits]
LBIR1315	Probability and statistics II	Patrick Bogaert	FR [q1] [22.5h+22.5h] [3 Credits]

Module 3

LINGE1113	Probability	Johan Segers	FR [q2] [30h+15h] [4 Credits]
LINGE1214	Further Statistics	Christian Hafner	FR [q1] [30h+15h] [4 Credits]

Module 4

LMAT1271	Calculation of probability and statistical analysis	Rainer von Sachs	FR [q2] [30h+30h] [6 Credits] *> English-friendly*

Programmation et informatique

The student must acquire the skills related to these three courses:

LINFO1101	Introduction to programming	Kim Mens Siegfried Nijssen Charles Pecheur	FR [q1] [30h+30h] [5 Credits]
LEPL1402	Informatics 2	Sébastien Jodogne Ramin Sadre Pierre Schaus	EN [q1] [30h+30h] [5 Credits]
LINGE1322	Computer science: Analysis and Design of Information Systems	Jean Vanderdonckt	FR [q2] [30h+15h] [5 Credits]

Other pre-requisite activities

The teaching units below may be added to the student's program if they are admitted on a case-by-case basis. The choice of these units will be made in consultation with the study advisor.

⊠ LSTAT2011	Éléments de mathématiques pour la statistique	Nathan Uyttendaele (compensates Catherine Legrand)	FR [q1] [15h+15h] [3 Credits]
⊠ LMAFY1101	Data exploration and introduction to statiscal inference	Anouar El Ghouch	FR [q2] [30h+30h] [5 Credits]
⊠ LPSP1209	Statistics, inference on one or two variables	Eugen Pircalabelu	FR [q1] [22.5h+15h] [4 Credits]
⊠ LPSP1306	Statistics: descriptive analysis and GLM multivariate data modeling	Aurélie Bertrand Céline Bugli Nathalie Lefèvre	FR [q2] [30h+15h] [4 Credits]
⊠ LINGE1222	Multivariate Statistical Analysis	Antoine Soetewey	FR [q2] [30h+15h] [4 Credits]
⊠ LANGL1330	English intermediate level - 1st part	Stéphanie Brabant Charline Coduti (compensates Anne-Julie Toubeau) Estelle Dagneaux Jean-Luc Delghust Aurélie Deneumoustier Fanny Desterbecq Marie Duelz Claudine Grommersch Sandrine Mulkers (coord.) Yannick Paquin (compensates Anne-Julie Toubeau) Marc Piwnik (coord.) Françoise Stas	EN [q1 or q2] [20h] [3 Credits]

⊠ Other EU to be determined with the Study Advisor

Depending on his / her previous academic background, the student (in consultation with the study advisor) can add other UEs in order to acquire the necessary prerequisites for the program.

Course prerequisites

The **table** below lists the activities (course units, or CUs) for which there are one or more prerequisites within the programme, i.e. the programme CU for which the learning outcomes must be certified and the corresponding credits awarded by the jury before registering for that CU.

These activities are also identified

			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		

Masters		
Other master degrees	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		

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).