DATE2M

2023 - 2024

Master [120] in Data Science Engineering

At Louvain-la-Neuve - 120 credits - 2 years - Day schedule - In English
Dissertation/Graduation Project : **YES** - Internship : **optional**
Activities in English: **YES** - Activities in other languages : **optional**
Activities on other sites : **NO**
Main study domain : **Sciences de l'ingénieur et technologie**
Organized by: **Louvain School of Engineering (EPL)**
Programme acronym: **DATE2M** - Francophone Certification Framework: 7

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DATE2M - Introduction

Introduction

Introduction

The digital transformation of society has led to explosive growth in the volume of data available. Most of the players in society now place great importance on using this data to help make objective decisions and develop their disciplinary focus. These specific needs have resulted in the emergence of **new data-oriented careers.**

The engineering master's in data science offers a course in **scientific methods and technology tools** for answering social or scientific questions based on **the processing of frequently massive data sets** ("big data"). This discipline usually requires a structured model of the problem in question to be combined with statistics and mathematics to deliver a rigorous, quantitative, operational solution to the question posed. Computer infrastructure and complex calculation algorithms thus complement scientific methods in structuring and processing the data.

A computer infrastructure and complex calculation algorithms also complement these scientific methods to enable the structuring and processing of data.

Finally, cybersecurity has become an essential element in a data-centric world: it will be a question of understanding and being able to manage the risks associated with the data itself, but also of being able to protect stored data and circulate it securely.

The **fields of application** of data science are extremely varied: political and security decision-making, e-commerce, processing network data, processing financial and industrial production data, natural langage processing, biomedical research based on microbiological or imaging data.

Your profile

You have completed a bachelor's or master's degree in which you have acquired solid skills and a taste for the three basic building blocks of data science: mathematics, statistics and computer science, as well as a curiosity for the application areas of these disciplines.

You have a good command of technical English and are able to follow lectures, read scientific literature, write reports and express yourself orally in this language. You have the general skills and personal qualities necessary for a scientific master's degree, such as autonomy, critical thinking, rigour, self-learning and the ability to research and process information.

An additional teaching block (of maximum 60 credits) may be offered to students who lack some of these skills.

Your future job

Your degree in data science prepares you for the posts of « data scientist », « data analyst», « security analyst », « data and analytics manager », « data engineer », « security engineer », or « security architect ».

Your programme

The master's programme: Engineering in Data Science at UCLouvain is based on a common core that provides a technical foundation in the fields of learning theory, databases, and linear statistical models.

This common core is completed by the choice of a focus on data analysis or a focus on cybersecurity.

The data analysis focus offers a range of algorithmic and statistical methods for data mining, learning, and visualization of large data sets.

The cybersecurity focus is structured around five pillars: cryptography, privacy, and hardware, software and system security, as well as an introduction to information theory.

These pillars are completed by majors and elective courses that allow students to deepen their knowledge of algorithmic, computer science, statistical, application or entrepreneurial aspects.

Your parcours

You will primarily develop strong, in-depth, cross-disciplinary skills to be able to address a broad spectrum of data science and cybersecurity problems and to carry out projects or develop research in the field.

Your programme will offer you opportunities to explore, through projects, internships or applied courses, the extremely varied fields of application of data science.

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DATE2M - Teaching profile

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Learning outcomes

 Acquérir de solides bases méthodologiques en analyse et traitement de données et les appliquer dans des domaines variés tel que sciences humaines, ingénierie, marketing, finance, assurance ou sciences du vivant...

Au terme de la formation, l'étudiant maîtrisera les concepts fondamentaux en algorithmique, data mining, machine learning, informatique, mathématiques, statistique nécessaires à l'exercice du métier de « data scientist ». Il développera des compétences en communication et sera capable d'analyser un problème complexe, de collaborer à un projet de recherche. Selon les objectifs visés par l'étudiant, deus options non-exclusives sont proposées : systèmes informatiques, et méthodes numériques et optimisation.

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

1. Démontrer la maîtrise d'un solide corpus de connaissances en sciences des données (finalité AD) ou sécurité des données (finalité CS), lui permettant de résoudre les problèmes qui relèvent de sa discipline

1.1. Les structures de données et algorithmes pour l'analyse de données
1.2. Les théories de l'apprentissage, la fouille de données et la visualisation de données de grande dimension
1.3. L'inférence statistique, la modélisation et l'informatique statistique. L'étudiant dans l'orientation technologies de l'information se spécialise via des cours obligatoires ou au choix
1.4. Les aspects industriels et entrepreneuriaux de la science des données. L'étudiant dans l'orientation en technologies de l'information se spécialise via une option
1.5. La sécurité des données dans ses aspects logiciels, matériel ou cryptographiques.
1.6 Les systèmes informatiques, y compris le calcul distribué, le calcul embarqué, les réseaux et la sécurité (cours optionnels).
1.7 Les méthodes numériques et l'optimisation, y compris la programmation par contraintes, la recherche opérationnelle, l'identification et les mathématiques appliquées (cours optionnels)

2. Organiser et de mener à son terme une démarche de développement d'un système d'exploitation et sécurité de données répondant aux besoins généralement complexes d'un client.

2.1. Analyser le problème à résoudre ou les besoins fonctionnels à rencontrer et formuler le cahier des charges correspondant.
2.2. Formaliser et modéliser le problème et concevoir une ou plusieurs solutions techniques originales répondant à ce cahier des charges.
2.3. Evaluer, justifier et classer les solutions au regard de l'ensemble des critères figurant dans le cahier de charges : efficacité, faisabilité, qualité, pertinence et sécurité.
2.4. Implémenter, tester et valider la solution retenue et en interpréter les résultats.
2.5. Formuler des recommandations pour améliorer le caractère opérationnel de la solution.

3. Organiser et de mener à son terme un travail de recherche pour appréhender une problématique inédite liée à l'exploitation et la sécurité des données selon une méthodologie ou dans un environnement nouveau.

3.1. Se documenter et résumer l'état des connaissances actuelles dans le domaine considéré.
3.2. Proposer une modélisation et/ou un dispositif expérimental permettant de simuler et de tester des hypothèses relatives au problème étudié.
3.3. Mettre en forme un rapport de synthèse visant à décrire la méthodologie avec rigueur et expliciter les potentialités d'innovation théoriques et/ou techniques résultant de ce travail de recherche.

4. Contribuer en équipe à la conduite d'un projet d'exploitation et sécurité de données et le mener à son terme en tenant compte des objectifs, des ressources allouées et des contraintes qui le caractérisent.

4.1. Cadrer et expliciter les objectifs d'un projet (en y associant des indicateurs de performance) compte tenu des enjeux et des contraintes qui caractérisent l'environnement du projet.
4.2. S'engager collectivement sur un plan de travail, un échéancier et des rôles à tenir.
4.3. Fonctionner dans un environnement pluridisciplinaire, conjointement avec d'autres acteurs porteurs de différents points de vue : gérer des points de désaccord ou des conflits.
4.4. Prendre des décisions en équipe lorsqu'il y a des choix à faire : que ce soit sur les solutions techniques ou sur l'organisation du travail pour faire aboutir le projet.

5. Communiquer efficacement oralement et par écrit en vue de mener à bien les projets qui lui sont confiés dans son environnement de travail (en particulier en anglais).

5.1. Identifier clairement les besoins du « client » ou de l'usager : questionner, écouter et comprendre toutes les dimensions de sa demande et pas seulement les aspects techniques.
5.2. Argumenter et convaincre en s'adaptant au langage de ses interlocuteurs : techniciens, collègues, clients, supérieurs hiérarchiques.
5.3. Communiquer sous forme graphique et schématique ; interpréter un schéma, présenter les résultats d'un travail, structurer des informations.
5.4. Lire, analyser et exploiter des documents techniques (diagrammes, manuels, cahiers de charge…).
5.5. Rédiger des documents écrits en tenant compte des exigences contextuelles et des conventions sociales en la matière.
5.6. Faire un exposé oral convaincant en utilisant les techniques modernes de communication.

6. Faire preuve à la fois de rigueur, d'ouverture, d'esprit critique et d'éthique dans son travail.

6.1. Appliquer les normes en vigueur dans les disciplines de la science des données (terminologie, mesures de qualité, …).
6.2. Trouver des solutions qui vont au-delà des enjeux strictement techniques, en intégrant les enjeux de dimension éthique d'un projet (y compris la confidentialité des données et la protection de la vie privée) et de développement durable
6.3. Faire preuve d'esprit critique vis-à-vis d'une solution technique pour en vérifier la robustesse et minimiser les risques qu'elle présente au regard du contexte de sa mise en Œuvre.
6.4. S'autoévaluer et développer de manière autonome les connaissances nécessaires pour rester compétent dans son domaine.

Programme structure

The 120-credit Master in Data Science programme consists of the following items.

A common curriculum of 46 credits, including a final thesis and teaching units in:

- Databases

- Machine Learning

- Statistics

- A seminar

- Professional integration work.

One focus of 30 credits will be taken among a choice of two:

- The data analytics focus offers a range of algorithmic and statistical methods for data mining, learning, and visualization of large data sets.

- The cybersecurity focus is structured around 5 pillars: cryptography, hardware, software and system security, and privacy, as well as an introduction to information theory.

Elective courses and/or options are chosen so as to reach at least 120 credits.

To the 120-credit programme may be added an additional preparatory module for students who do not have all the prerequisites for the Master. These teaching units will be selected with the study advisor.

DATE2M Programme

Detailed programme by subject

CORE COURSES [46.0]

○ Mandatory
✣ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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
○ LDATE2990	Master thesis *The graduation project can be written and presented in French or English, in consultation with the supervisor. It may be accessible to exchange students by prior agreement between the supervisors and/or the two universities.*			EN [q1+q2] [] [25 Credits] ⊕ > *French-friendly*	x	x
○ LEPL2020	Professional integration work *Les modules du cours LEPL2020 sont organisés sur les deux blocs annuels du master. Il est fortement recommandé à l'étudiant.e de les suivre dès le bloc annuel 1, mais il.elle ne pourra inscrire le cours qu'au plus tôt l'année où il.elle présente son travail de fin d'études.*	Myriam Banaï Francesco Contino (coord.) Delphine Ducarme Jean-Pierre Raskin		EN [q1+q2] [30h+15h] [2 Credits] ⊕ > *French-friendly*	x	x
○ LINFO2172	Databases	Siegfried Nijssen		EN [q2] [30h+30h] [6 Credits] ⊕ > *French-friendly*	x	x
○ LSTAT2120	Linear models	Christian Hafner		EN [q1] [30h+7.5h] [5 Credits] ⊕ > *French-friendly*	x	x

				Year
				1 2
O LINFO2262	Machine Learning :classification and evaluation	Pierre Dupont	[q2] [30h+30h] [5 Credits] ⊕ > *French-friendly*	x x

⌧ One course to choose from

				1 2
⌧ LINFO2399	Industrial seminar in computer science	Yves Deville Bernard Geubelle	[q2] [30h] [3 Credits] ⊕ > *French-friendly*	x x
⌧ LINFO2369	Artificial intelligence and machine learning seminar	Sébastien Jodogne Siegfried Nijssen	[q1] [30h] [3 Credits] ⊕ > *French-friendly*	x x
⌧ LINMA2120	Applied mathematics seminar	Pierre-Antoine Absil Gianluca Bianchin Frédéric Crevecoeur Jean-Charles Delvenne François Glineur Julien Hendrickx Laurent Jacques Raphaël Jungers Estelle Massart (coord.) Geovani Nunes Grapiglia	[q1+q2] [30h] [3 Credits] ⊕ > *French-friendly*	x x
⌧ LSTAT2390	Applied statistics workshops	Christian Ritter Laura Symul	[q1+q2] [15h] [3 Credits] ⊕ > *French-friendly*	x x

LIST OF FOCUSES

> Professional Focus : Data Analytics   *[en-prog-2023-date2m-ldate210s]*
> Professional Focus : Cybersecurity   *[en-prog-2023-date2m-ldate230s]*

PROFESSIONAL FOCUS : DATA ANALYTICS [30.0]

O Mandatory
⊗ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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...)

o **Content:**

				Year 1	Year 2
O LDATA2010	Information visualisation	John Lee	EN [q1] [30h+30h] [5 Credits] 🌐 *> French-friendly*	x	x
O LINMA2472	Algorithms in data science	Jean-Charles Delvenne (coord.) Gautier Krings (compensates Vincent Blondel)	EN [q1] [30h+22.5h] [5 Credits] 🌐 *> French-friendly*	x	x
O LINFO2364	Mining Patterns in Data	Siegfried Nijssen	EN [q2] [30h+15h] [5 Credits] 🌐 *> French-friendly*	x	x
O LSTAT2130	Introduction to Bayesian statistics	Philippe Lambert	EN [q2] [22.5h+7.5h] [5 Credits] 🌐	x	x
O LINFO2275	Data mining & decision making	Marco Saerens	EN [q2] [30h+15h] [5 Credits] 🌐 *> French-friendly*	x	x
O LELEC2870	Machine learning : regression, deep networks and dimensionality reduction	John Lee John Lee (compensates Michel Verleysen) Michel Verleysen	EN [q1] [30h+30h] [5 Credits] 🌐 *> French-friendly*	x	x

PROFESSIONAL FOCUS : CYBERSECURITY [30.0]

O Mandatory
⊗ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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...)

o **Content:**

				Year 1	Year 2
O LELEC2760	Secure electronic circuits and systems	François-Xavier Standaert	EN [q2] [30h+30h] [5 Credits] 🌐 *> French-friendly*	x	x

					Year	
					1	2
O LELEC2770	Privacy Enhancing technology	Thomas Peters (compensates Olivier Pereira) François-Xavier Standaert	EN	[q1] [30h+30h] [5 Credits] ⊕ > *French-friendly*	x	x
O LINFO2347	Computer system security	Ramin Sadre	EN	[q2] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x
O LINFO2144	Secured systems engineering	Axel Legay	EN	[q2] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x
O LMAT2450	Cryptography	Thomas Peters (compensates Olivier Pereira)	EN	[q1] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x
O LINGI2348	Information theory and coding	Jérôme Louveaux Jérôme Louveaux (compensates Olivier Pereira) Benoît Macq	EN	[q2] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x

OPTIONS

L'étudiant·e complète son programme pour arriver à min. 90 crédits disciplinaires (dispensés dans les Masters EPL ou sigle STAT, y compris le TFE) en ce non compris les éventuels compléments pris par certains étudiants qui manqueraient de base. Il n'est pas obligatoire de valider une option.

Dans la rubrique "Options et cours au choix en connaissances socioéconomiques", l'étudiant·e valide une des deux options ou choisit obligatoirement au minimum 3 crédits parmi les cours au choix ou les cours de l'option en enjeux de l'entreprise.

Majors in data science

> Major in computer systems   *[en-prog-2023-date2m-ldati220o]*
> Major in numerical methods and optimisation   *[en-prog-2023-date2m-ldati221o]*
> Elective technical courses   *[en-prog-2023-date2m-ldati237o]*

Options et cours au choix en connaissances socio-économiques

> Business risks and opportunities   *[en-prog-2023-date2m-ldati231o]*
> Major in Interdisciplinary Program in Entrepreneurship - INEO   *[en-prog-2023-date2m-ldati232o]*
> Cours au choix en connaissances socio-économiques   *[en-prog-2023-date2m-ldati200o]*

Others elective courses

> Others elective courses   *[en-prog-2023-date2m-ldati223o]*

MAJORS IN DATA SCIENCE

MAJOR IN COMPUTER SYSTEMS

O Mandatory
❁ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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

○ *Content:*

○ **Compulsory courses :**

O LINFO2145	Cloud Computing	Etienne Riviere	EN [q1] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x
O LINFO2241	Architecture and performance of computer systems	Tom Barbette	EN [q1] [30h+30h] [6 Credits] ⊕ > *French-friendly*	x	x

○ **Elective courses**

⌗ LINFO2347	Computer system security	Ramin Sadre	EN [q2] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x
⌗ LINFO2143	Concurrent systems : models and analysis	Charles Pecheur	EN [q1] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x
⌗ LINFO2349	Networking and security seminar	Etienne Riviere Ramin Sadre	EN [q1] [30h] [3 Credits] ⊕ > *French-friendly*	x	x
⌗ LINFO2146	Mobile and Embedded Computing	Ramin Sadre	EN [q2] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x
⌗ LINFO2355	Multicore programming	Etienne Riviere	EN [q2] [30h+15h] [5 Credits] ⊕ > *French-friendly*	x	x

MAJOR IN NUMERICAL METHODS AND OPTIMISATION

O Mandatory
⊗ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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...)

The student who wishes to validate this option chooses 15 credits among:

| | | | | Year |
| | | | | 1 | 2 |

o Content:

o Compulsory courses

					Year 1	Year 2
O LINMA2471	Optimization models and methods II	François Glineur Geovani Nunes Grapiglia	EN [q1] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*		x	x
O LINMA2380	Matrix computations	Raphaël Jungers	EN [q1] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*		x	x

O One course between

				Year 1	Year 2
⊗ LINFO2266	Advanced Algorithms for Optimization	Pierre Schaus	EN [q1] [30h+15h] [5 Credits] 🌐 > *French-friendly*	x	x
⊗ LINMA2450	Combinatorial optimization	Julien Hendrickx Geovani Nunes Grapiglia	EN [q1] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*	x	x

⊗ Elective courses

				Year 1	Year 2
⊗ LINMA2470	Stochastic modelling	Philippe Chevalier Mehdi Madani (compensates Philippe Chevalier)	EN [q2] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*	x	x
⊗ LINMA2491	Operational Research	Mehdi Madani	EN [q2] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*	x	x
⊗ LINMA2171	Numerical Analysis : Approximation, Interpolation, Integration	Pierre-Antoine Absil Simon Vary (compensates Pierre-Antoine Absil)	EN [q1] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*	x	x
⊗ LINMA2875	System Identification	Gianluca Bianchin	EN [q2] [30h+30h] [5 Credits] 🌐 > *French-friendly*	x	x
⊗ LINFO2365	Constraint programming	Pierre Schaus	EN [q2] [30h+15h] [5 Credits] 🌐 > *French-friendly*	x	x
⊗ LINMA2460	Optimization : Nonlinear programming	Geovani Nunes Grapiglia	EN [q2] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*	x	x
⊗ LINMA2120	Applied mathematics seminar	Pierre-Antoine Absil Gianluca Bianchin Frédéric Crevecoeur Jean-Charles Delvenne François Glineur Julien Hendrickx Laurent Jacques Raphaël Jungers Estelle Massart (coord.) Geovani Nunes Grapiglia	EN [q1+q2] [30h] [3 Credits] 🌐 > *French-friendly*	x	x
⊗ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil Laurent Jacques	EN [q1+q2] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*	x	x

ELECTIVE TECHNICAL COURSES

○ Mandatory
⊗ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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

○ *Content:*

⊗ Statistics

					Year 1	2
⊗ LSTAT2200	Survey and Sampling	Séverine Guisset Christian Ritter	FR [q2] [15h+5h] [4 Credits] 🌐		x	x
⊗ LSTAT2380	Statistical consulting	Christian Ritter	EN [q1+q2] [30h] [5 Credits] 🌐 > *French-friendly*		x	x
⊗ LSTAT2390	Applied statistics workshops	Christian Ritter Laura Symul	EN [q1+q2] [15h] [3 Credits] 🌐 > *French-friendly*		x	x
⊗ LSTAT2150	Nonparametric statistics: smoothings methods	Rainer von Sachs	EN [q1] [15h+5h] [4 Credits] 🌐		x	x
⊗ LSTAT2450	Statistical learning. Estimation, selection and inference	Eugen Pircalabelu	EN [q1] [30h+7.5h] [5 Credits] 🌐		x	x

⊗ Machine learning, vision and artificial intelligence

					Year 1	2
⊗ LELEC2885	Image processing and computer vision	Christophe De Vleeschouwer (coord.) Laurent Jacques	EN [q1] [30h+30h] [5 Credits] 🌐 > *French-friendly*		x	x
⊗ LGBIO2010	Bioinformatics	Vincent Branders (compensates Pierre Dupont)	EN [q1] [30h+30h] [5 Credits] 🌐 > *French-friendly*		x	x
⊗ LINFO2263	Computational Linguistics	Pierre Dupont	EN [q1] [30h+15h] [5 Credits] 🌐 > *French-friendly*		x	x
⊗ LINGI2348	Information theory and coding	Jérôme Louveaux Jérôme Louveaux (compensates Olivier Pereira) Benoît Macq	EN [q2] [30h+15h] [5 Credits] 🌐 > *French-friendly*		x	x
⊗ LINFO2369	Artificial intelligence and machine learning seminar	Sébastien Jodogne Siegfried Nijssen	EN [q1] [30h] [3 Credits] 🌐 > *French-friendly*		x	x
⊗ LINFO2381	Health Informatics	Sébastien Jodogne	EN [q2] [30h+30h] [5 Credits] 🌐 > *French-friendly*		x	x

⊗ Data structures and algorithms for data analysis

					Year 1	2
⊗ LINFO2345	Languages and algorithms for distributed Applications	Peter Van Roy	EN [q1] [30h+15h] [5 Credits] 🌐 > *French-friendly*		x	x
⊗ LELEC2770	Privacy Enhancing technology	Thomas Peters (compensates Olivier Pereira) François-Xavier Standaert	EN [q1] [30h+30h] [5 Credits] 🌐 > *French-friendly*		x	x
⊗ LINFO1361	Artificial intelligence	Eric Piette (compensates Yves Deville)	EN [q2] [30h+30h] [5 Credits] 🌐		x	x

OPTIONS ET COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES [3.0]

BUSINESS RISKS AND OPPORTUNITIES

O Mandatory
⌘ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 or the following year
🟨 Activity with requisites
🌐 Open to incoming exchange students
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[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:*

O LEPL2211	Business issues introduction	Benoît Gailly	EN [q2] [30h] [3 Credits] 🌐 > *French-friendly*	x	x
O LEPL2212	Financial performance indicators	Anne-Catherine Provost	EN [q2] [30h+5h] [4 Credits] 🌐 > *French-friendly*	x	x
O LEPL2214	Law, Regulation and Legal Context	Vincent Cassiers Werner Derycke	FR [q1] [30h+5h] [4 Credits] 🌐	x	x

O One course between
From 3 to 5credit(s)

⌘ LEPL2210	Ethics and ICT	Maxime Lambrecht (compensates Axel Gosseries) Maxime Lambrecht (compensates Olivier Pereira)	EN [q2] [30h] [3 Credits] 🌐 > *French-friendly*	x	x
⌘ LLSMS2280	Business Ethics and Compliance Management	Carlos Desmet	EN [q1] [30h] [5 Credits] 🌐	x	x

⌘ Cours en marketing

⌘ MGEST1108	Marketing	Nadia Sinigaglia	FR [q2] [45h+20h] [6 Credits] 🌐	x	x
⌘ MLSMM2136	Trends in Digital Marketing 🟨	Ingrid Poncin	FR [q2] [30h] [5 Credits] 🌐		x
⌘ MLSMM2134	e-Consumer Behavior 🟨	Nicolas Kervyn de Meerendré (compensates Karine Charry)	FR [q2] [30h] [5 Credits] 🌐		x

⌘ Cours en Sourcing and Procurement

⌘ LLSMS2036	Supply Chain Procurement	Per Joakim Agrell Antony Paulraj	EN [q1] [30h] [5 Credits] 🌐	x	x
⌘ LLSMS2038	Procurement Organisation and Scope	Constantin Blome Canan Kocabasoglu Hillmer	EN [q1] [30h] [5 Credits] 🌐	x	x
⌘ LLSMS2037	Sourcing Strategy	Constantin Blome Michael Henke	EN [q1] [30h] [5 Credits] 🌐	x	x

⌘ Alternative to the major in business risks and opportunities for computer science students
Computer science students who have already taken courses in this field while pursuing their Bachelor's degree may choose between 16-20 credits from the courses offered in the management minor for computer sciences.

MAJOR IN INTERDISCIPLINARY PROGRAM IN ENTREPRENEURSHIP - INEO

Commune à la plupart des masters de l'EPL, cette option a pour objectif de familiariser l'étudiant·e avec les spécificités de l'entreprenariat et de la création d'entreprise afin de développer chez lui les aptitudes, connaissances et outils nécessaires à la création d'entreprise.

Cette option rassemble des étudiants de différentes facultés en équipes interdisciplinaires afin de créer un projet entrepreneurial. La formation interdisciplinaire en entrepeneuriat (INEO) est une option qui s'étend sur 2 ans et s'intègre dans plus de 30 Masters de 9 facultés/écoles de l'UCLouvain. Le choix de l'option INEO implique la réalisation d'un mémoire interfacultaire (en équipe) portant sur un projet de création d'entreprise. L'accès à cette option, ainsi qu'à chacun des cours, est limité aux étudiant·es sélectionnés sur dossier. Toutes les informations sur https://uclouvain.be/fr/etudier/ineo.

L'étudiant.e qui choisit de valider cette option doit sélectionner au minimum 20 crédits et au maximum 25 crédits. Cette option n'est pas accessible en anglais et ne peut être prise simultanément avec l'option « Enjeux de l'entreprise ».

○ Mandatory
✴ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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**

○ *Content:*

○ **Required courses**

					1	2
○ LINEO2001	Théorie de l'entrepreneuriat	Frank Janssen	FR [q1] [30h+20h] [5 Credits] 🌐		x	
○ LINEO2002	Aspects juridiques, économiques et managériaux de la création d'entreprise	Yves De Cordt Marine Falize	FR [q1] [30h+15h] [5 Credits] 🌐		x	
○ LINEO2003	Plan d'affaires et étapes-clefs de la création d'entreprise *Les séances du cours LINEO2003 sont réparties sur les deux blocs annuels du master. L'étudiant doit les suivre dès le bloc annuel 1, mais ne pourra inscrire le cours que dans son programme de bloc annuel 2.*	Frank Janssen	FR [q2] [30h+15h] [5 Credits] 🌐			x
○ LINEO2004	Séminaire d'approfondissement en entrepreneuriat	Frank Janssen	FR [q2] [30h+15h] [5 Credits] 🌐		x	

✴ **Prerequisite courses**
Student who have not taken management courses during their previous studies must enroll in LINEO2021.

					1	2
○ LINEO2021	Financer son projet	Yves De Rongé Philippe Grégoire (compensates Yves De Rongé)	FR [q2] [30h+15h] [5 Credits] 🌐		x	

COURS AU CHOIX EN CONNAISSANCES SOCIO-ÉCONOMIQUES

⊙ Mandatory
⌗ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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

⊙ *Content:*

					1	2
⌗ LFSA2995	Company Internship	Dimitri Lederer Jean-Pierre Raskin	FR [q1+q2] [30h] [10 Credits] 🌐		x	x
⌗ LFSA2212	Innovation classes	Benoît Macq Jean-Pierre Raskin Benoît Raucent	EN [q1] [30h+15h] [5 Credits] 🌐 > *French-friendly*		x	x
⌗ LSTAT2380	Statistical consulting	Christian Ritter	EN [q1+q2] [30h] [5 Credits] 🌐 > *French-friendly*		x	x
⌗ LSTAT2390	Applied statistics workshops	Christian Ritter Laura Symul	EN [q1+q2] [15h] [3 Credits] 🌐 > *French-friendly*		x	x
⌗ LINMA2360	Project in mathematical engineering	Pierre-Antoine Absil Laurent Jacques	EN [q1+q2] [30h+22.5h] [5 Credits] 🌐 > *French-friendly*		x	x
⌗ LINMA2120	Applied mathematics seminar	Pierre-Antoine Absil Gianluca Bianchin Frédéric Crevecoeur Jean-Charles Delvenne François Glineur Julien Hendrickx Laurent Jacques Raphaël Jungers Estelle Massart (coord.) Geovani Nunes Grapiglia	EN [q1+q2] [30h] [3 Credits] 🌐 > *French-friendly*		x	x
⌗ LACTU2170	STOCHASTIC FINANCE	Donatien Hainaut	FR [q2] [30h] [5 Credits] 🌐		x	x
⌗ LACTU2030	LIFE INSURANCE	Donatien Hainaut	FR [q1] [45h] [7 Credits] 🌐		x	x
⌗ LLSMS2034	Supply Chain Planning	Marc Foret Mathieu Van Vyve	EN [q2] [30h] [5 Credits] 🌐		x	x
⌗ LINFO2399	Industrial seminar in computer science	Yves Deville Bernard Geubelle	EN [q2] [30h] [3 Credits] 🌐 > *French-friendly*		x	x
⌗ LINFO2402	Open Source Project		EN [q1+q2] [0h] [5 Credits] 🌐 > *French-friendly*		x	x

OTHERS ELECTIVE COURSES

Les cours au choix recommandés et accessibles aux étudiant·es du master ingénieur en sciences des données ou du master en sciences des données sont listés ci-dessus, dans les options et autres listes de cours au choix. L'étudiant·e est également libre de proposer d'autres cours des programmes de Masters EPL qui seraient pertinentes à son parcours personnel, pour autant que cela respecte les règles de constitution de programme du Master. Ces cours doivent être approuvés par le jury restreint.

OTHERS ELECTIVE COURSES

    O Mandatory
    ⊗ Optional
    △ Not offered in 2023-2024
    ⊘ Not offered in 2023-2024 but offered the following year
    ⊕ Offered in 2023-2024 but not the following year
    △ ⊕ Not offered in 2023-2024 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:

The elective courses recommended and available for Master students in Data Science Engineering are listed here above and in the courses of EPL. However, a student can further suggest other courses that would be relevant for his.her personal curriculum, pending that this is compliant with the rules for setting up a personal Master programme.

⊗ Languages
Students may select from any language course offered at the ILV. Special attention is placed on the following seminars in professional development:

⊗ LALLE2500	Professional development seminar German	Caroline Klein (coord.)	DE [q1+q2] [30h] [3 Credits] ⊕	x	x
⊗ LALLE2501	Professional development seminar-German	Caroline Klein (coord.)	DE [q1+q2] [30h] [5 Credits] ⊕	x	x
⊗ LESPA2600	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	ES [q1] [30h] [3 Credits] ⊕	x	x
⊗ LESPA2601	Vocational Induction Seminar - Spanish (B2.2/C1)	Paula Lorente Fernandez (coord.)	ES [q1] [30h] [5 Credits] ⊕	x	x
⊗ LNEER2500	Seminar of Entry to professional life in Dutch - Intermediate level	Isabelle Demeulenaere (coord.)	NL [q1 or q2] [30h] [3 Credits] ⊕	x	x
⊗ LNEER2600	Seminar of entry to professional life in Dutch - Upper-Intermediate level	Isabelle Demeulenaere (coord.) Dag Houdmont	NL [q1 or q2] [30h] [3 Credits] ⊕	x	x

⊗ Group dynamics

⊗ LEPL2351	Become a tutor	Jean-Charles Delvenne (coord.) Delphine Ducarme Thomas Pardoen Benoît Raucent	FR [q1] [15h+30h] [3 Credits] ⊕	x	x
⊗ LEPL2352	Become a tutor	Jean-Charles Delvenne (coord.) Delphine Ducarme Thomas Pardoen Benoît Raucent	FR [q2] [15h+30h] [3 Credits] ⊕	x	x

⊗ Autres UEs hors-EPL
L'étudiant·e peut choisir maximum 8 ects de cours hors EPL considérées comme non-disciplinaires par la commission de diplôme

Supplementary classes

To access this Master, students must have a good command of certain subjects. If this is not the case, students must take supplementary classes chosen by the faculty to satisfy course prerequisites.

O Mandatory
⌧ Optional
△ Not offered in 2023-2024
⊘ Not offered in 2023-2024 but offered the following year
⊕ Offered in 2023-2024 but not the following year
△ ⊕ Not offered in 2023-2024 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...)

⌧ Mathematics - Calculus and linear algebra
The student follows one of the following blocks:

⌧ Module 1

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

⌧ Module 2

O LINGE1114	Mathematics I: analysis	Heiner Olbermann	[FR] [q1] [30h+30h] [5 Credits] ⊕
O LINGE1121	Mathematics II: algebra and matrix calculus	Tom Claeys	[FR] [q2] [30h+30h] [5 Credits] ⊕

O Probability and statistics
The student follows one of the following blocks:

⌧ Module 1

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

⌧ Module 2

O LEPL1108	Discrete mathematics and probability	Jean-Charles Delvenne Jean-Charles Delvenne (compensates Olivier Pereira)	[FR] [q1] [30h+30h] [5 Credits] ⊕
O LEPL1109	Statistics and data sciences	Donatien Hainaut Laurent Jacques	[FR] [q1] [30h+30h] [5 Credits] ⊕

O Programming and computer science
The student follows one of the following blocks:

O LINFO1101	Introduction to programming	Kim Mens Siegfried Nijssen Charles Pecheur	[FR] [q1] [30h+30h] [5 Credits] ⊕
O LINFO1104	Programming language concepts	Peter Van Roy	[FR] [q2] [30h+30h] [5 Credits] ⊕
O LEPL1402	Informatics 2	Sébastien Jodogne Ramin Sadre Pierre Schaus	[FR] [q1] [30h+30h] [5 Credits] ⊕

O Un cours parmi :

⚸ LINMA2111	Discrete mathematics II : Algorithms and complexity	Jean-Charles Delvenne Jean-Charles Delvenne (compensates Vincent Blondel)	[q1] [30h+22.5h] [5 Credits] ⊕ > *French-friendly*
⚸ LINFO1121	Algorithms and data structures	Pierre Schaus	[q1] [30h+30h] [5 Credits] ⊕

⚸ Computer systems:
The student follows one of the following blocks:

⚪ LINFO1341	Computer networks	Olivier Bonaventure	[q2] [30h+30h] [5 Credits] ⊕
⚪ LINFO1252	Informatic Systems	Etienne Riviere	[q1] [30h+30h] [5 Credits] ⊕

⚸ Numerical methods and optimisation:
The student follows one of the following blocks:

⚪ LINMA1702	Optimization models and methods I	François Glineur	[q2] [30h+22.5h] [5 Credits] ⊕

⚪ Un cours parmi :

⚸ LEPL1104	Numerical methods	Vincent Legat	[q2] [30h+30h] [5 Credits] ⊕
⚸ LINFO1113	Numerical algorithmic	Estelle Massart Loïc Quertenmont	[q2] [30h+30h] [6 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 **in the detailed programme**: their title is followed by a yellow square.

Prerequisites and student's annual programme

As the prerequisite is for CU registration pupuses only, there are no prerequisites within a programme year. Prerequisites are defined between CUs of different years and therefore influence the order in which the student will be able to register for the programme's CUs.

In addition, when the jury validates a student's individual programme at the beginning of the year, it ensures its coherence, meaning that it may:

- require the student to combine registration in two separate CUs which it considers necessary from a pedagogical point of view.
- transform a prerequisite into a corequisite if the student is in the final year of a degree course.

For more information, please consult the Academic Regulations and Procedures.

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Prerequisities list
MLSMM2134   "E-comportement du consommateur" has prerequisite(s) MGEST1108

- MGEST1108 - Marketing

MLSMM2136   "Tendances en Digital Marketing" has prerequisite(s) MGEST1108

- MGEST1108 - Marketing

The programme's courses and learning outcomes

For each UCLouvain training programme, a reference framework of learning outcomes specifies the the skills expected of every graduate on completion of the programme. Course unit descriptions specify targeted learning outcomes, as well as the unit's contribution to reference framework of learning outcomes.

DATE2M - **Information**

Access Requirements

Master course admission requirements are defined by the French Community of Belgium Decree of 7 November 2013 defining the hiher 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.

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SUMMARY

Specific access requirements

This programme is taught in English with no prerequisite in French. A certificate is required for the holders of a non-Belgian degree, see selection criteria of the personalized access.

University Bachelors

Diploma	Special Requirements	Access	Remarks
UCLouvain Bachelors			
Bachelor in Engineering		Direct access	Students who have neither major nor minor in the field of their civil engineering Master's degree may have an adapted programme.
Others Bachelors of the French speaking Community of Belgium			
Bachelor in Engineering		Direct access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a Minor in the field of their civil engineering master degree may have an adapted master programme.
Bachelors of the Dutch speaking Community of Belgium			
Bachelor in Engineering		Access with additional training	Students who have no specialisation in the field of their civil engineering master degree may have an adapted master programme with up to 60 additional credits.
Foreign Bachelors			
Bachelor in Engineering	Bachelor degree of Cluster Institution	Direct access	Students with a Bachelor's degree in engineering sciences who have not taken the equivalent of a minor in the field of their civil engineering master

			degree may have an adapted master programme.
Bachelor in Engineering	For others institutions	Access based on application	See "Personalized access"

Non university Bachelors

> Find out more about links to the university

Holders of a 2nd cycle University degree

Diploma	Special Requirements	Access	Remarks
"Licenciés"			
Masters			
Master ingénieur civil		Direct access	
Master [120] ingénieur civil en science des données, deuxième finalité		Direct access	Au terme du master 120, chaque finalité du Master [120] ingénieur civil en science des données peut être obtenue dans un nouveau programme de 30 crédits seulement.

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.

Access based on application

Access based on application : access may be granted either directly or on the condition of completing additional courses of a maximum of 60 ECTS credits, or refused.

The first step of the admission procedure requires to submit an application online : https://uclouvain.be/en/study/inscriptions/futurs-etudiants.html.

Selection criteria are summarized here (contact : epl-admission@uclouvain.be).

Admission and Enrolment Procedures for general registration

Teaching method

Active learning and soft skills

You will play an active role in your training. The teaching approach is a balanced mix of lectures, exercises, projects to be carried out alone or in groups. The teaching methods are varied. At certain times, you will be led to discover concepts or techniques independently, and the teaching staff is then seen as a resource made available to you to support your learning.

At other times, the pedagogy is more transmissive and provides you with the necessary keys to carry out subsequent tasks. An important place is reserved for non-technical skills (autonomy, organisational skills, time management, communication in different modes, etc.). In particular, through a pedagogy that emphasises project activities (including a large-scale project that puts groups of students in a semi-professional situation), the course develops a critical mind capable of designing, modelling, implementing and validating complex computer systems.

Languages

The lingua franca of data science is mainly English. The use of English throughout the programme allows you to develop your command of this language, which will facilitate your professional integration. Course materials and supervision are in English. However, you can always ask questions or take the exam in French if you wish. In addition, the programme offers the possibility of attending extra language courses and participating in exchange programmes abroad.

Interdisciplinarity

Like many academics, the data scientist will be required to manage projects and a team in the course of his or her career, and will have to take an interest in the complex socio-economic context in which data science is embedded. You will therefore be invited to open up your training to other disciplines via elective courses or certain options such as the option "interdisciplinary program in entrepreneurship".

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".

Each unit of the programme includes an oral or written examination, often supplemented by a project leading to a report which is part of the assessment. The optional internship and the master thesis each involve the writing of a document which is defended orally before a jury.

To compute the final grade, the marks obtained for the teaching units are weighted by their respective credits.

Mobility and/or Internationalisation outlook

Since their creation, the Ecole Polytechnique de Louvain (EPL) has participated in the various mobility programmes that have been set up both at the European level and at the global level.

Possible trainings at the end of the programme

The Master of Engineering in Data Science can be followed, under certain conditions, by a PhD thesis.

Contacts

Curriculum Management

Entity

Structure entity	SST/EPL/DACS
Denomination	(DACS)
Faculty	Louvain School of Engineering (EPL)
Sector	Sciences and Technology (SST)
Acronym	DACS
Postal address	Avenue Georges Lemaître 4-6 - bte L4.05.01
	1348 Louvain-la-Neuve
Website	www.uclouvain.be/epl

Academic supervisor: Laurent Jacques

Jury

- Président: Claude Oestges
- Secrétaire du Jury: Sébastien Jodogne

Useful Contact(s)

- Secrétariat: Pascale Premereur