



5.00 credits	30.0 h	Q2
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Teacher(s)	Saerens Marco ;
Language :	English
Place of the course	Mons
Prerequisites	<ul style="list-style-type: none"> <li>• MQANT1227 Mathématiques de gestion 2</li> <li>• MQANT1221 Inférence statistique</li> <li>• MINFO1201 Informatique et algorithmique</li> </ul> <p>(or equivalent)</p>
Main themes	<p>The main themes for this course are the following:</p> <ul style="list-style-type: none"> <li>• Dimensionality reduction methods: Principal Component Analysis, Singular Value Decomposition and Multidimensional Scaling</li> <li>• Kernel methods for classification and regression</li> <li>• Bayesian networks and graphical models</li> <li>• Markov models and hidden Markov model</li> <li>• Reinforcement Learning</li> </ul> <p>Those themes are complementary to those presented in MLSMM2151 'Data Mining'.</p>
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p>With respect to the LSM competency framework. This course contribute to acquiring the following competencies:</p> <p><u>Knowledge and reasoning</u></p> <ul style="list-style-type: none"> <li>• Mastery of the core knowledge for each area of management.</li> <li>• Ability to communicate one's acquired knowledge from the various areas of management.</li> <li>• Ability to properly apply one's acquired knowledge in order to solve problems.</li> </ul> <p><u>A scientific and systematic approach</u></p> <p>1</p> <ul style="list-style-type: none"> <li>• Clear, structured, analytical reasoning based on applying, and if needed adapting, scientifically-based conceptual frameworks and models to define and analyse a problem.</li> <li>• Collecting, selecting and analysing relevant information using rigorous, advanced and appropriate methods.</li> </ul> <p>At the end of this course, the student will be able to:</p> <ul style="list-style-type: none"> <li>• Understand and describe the main methods used in Machine Learning.</li> <li>• Apply dimensionality reduction techniques, when required.</li> <li>• Determine the most relevant methods to use for a given learning problem.</li> <li>• Apply those methods on real-life learning problems.</li> </ul>
Evaluation methods	<p>The final mark takes two results into account:</p> <ul style="list-style-type: none"> <li>• The project evaluation</li> <li>• During the exam session, a written or oral examination (to be defined during the first course)</li> </ul> <p>Concernant le projet/cas d'étude obligatoire et l'utilisation d'IA de type Chat GPT, assurez-vous que :</p> <p>"En soumettant un travail pour évaluation, vous affirmez : (i) qu'il reflète fidèlement le phénomène étudié, et pour cela vous devez avoir vérifié les faits, surtout s'ils sont prétendus par une IA générative (dont vous devez mentionner explicitement l'utilisation en tant qu'outil de soutien à la réalisation de votre travail) ; (ii) avoir respecté toutes les exigences spécifiques du travail qui vous est confié, notamment les exigences pour la transparence et la documentation de la démarche scientifique mise en œuvre. Si l'une de ces affirmations n'est pas vraie, que ce soit intentionnellement ou par négligence, vous êtes en défaut de votre engagement déontologique vis-à-vis de la connaissance produite dans le cadre de votre travail, et éventuellement d'autres aspects de l'intégrité académique, ce qui constitue une faute académique et sera considéré comme tel".</p>

Teaching methods	<ul style="list-style-type: none"> <li>• Lectures, on-site or on-line depending on the situation</li> <li>• Practical sessions integrated to those lectures</li> <li>• A project based on lectures and practical sessions</li> </ul>
Content	<p>Nowadays, the volume of data generated, for instance by internet and social networks, is constantly increasing. On the other hand, there is a great need for efficient ways to infer useful information from those data, which can take different forms. Numerous data mining, machine learning and pattern recognition algorithms were developed in order to predict information for different applications. This course is devoted to some of those techniques, emphasizing on reinforcement learning, dimensionality reduction, Kernel and Bayesian models or some graph related methods. The precise content of the course will change from year to year and will be described/defined during the first course.</p>
Inline resources	<p>Course notes are available on <a href="https://moodleucl.uclouvain.be/">https://moodleucl.uclouvain.be/</a></p>
Bibliography	<p>Recommended books :</p> <p>BISHOP C., Pattern Recognition and Machine Learning, Springer, 2006.</p> <p>DUDA R., Patter Classification (second edition), Wiley, 2001.</p> <p>ALPAYDIN E., Introduction to Machine Learning, 2nd Ed., The MIT Press, 2009.</p> <p>THEODORIDIS S., Machine Learning : A Bayesian and Optimization Perspective, Academic Press, 2015.</p> <p>SUTTON R., Reinforcement Learning : An introduction, The MIT Press, 1998.</p>
Other infos	<p>This course has strong technical requirements :</p> <ul style="list-style-type: none"> <li>- In mathematics : matrix computation, linear algebra, optimization</li> <li>- In statistics : multivariate statistics and statistical inference</li> <li>- In computer science : programmation (like R, Python, and Matlab), algorithmic</li> </ul>
Faculty or entity in charge	<p>CLSM</p>

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] : Business Engineering	INGE2M	5		
Master [120] : Business Engineering	INGM2M	5		
Master [120] in Management (with work-linked-training)	GESA2M	5		