

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

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|-----------|-----------------|----|
| 5 credits | 30.0 h + 30.0 h | Q1 |
|-----------|-----------------|----|

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| Teacher(s)                  | Lee John (compensates Verleysen Michel) ;Verleysen Michel ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Language :                  | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Place of the course         | Louvain-la-Neuve                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Main themes                 | Linear and nonlinear data analysis methods, in particular for regression and dimensionality reduction, including visualization.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Aims                        | <p>With respect to the AA referring system defined for the Master in Electrical Engineering, the course contributes to the development, mastery and assessment of the following skills :</p> <ul style="list-style-type: none"> <li>• AA1.1, AA1.2, AA1.3</li> <li>• AA3.1, AA3.2, AA3.3</li> <li>• AA4.1, AA4.2, AA4.4</li> <li>• AA5.1, AA5.2, AA5.3, AA5.5</li> <li>• AA6.3</li> </ul> <p>1</p> <p>At the end of the course, students will be able to :</p> <ul style="list-style-type: none"> <li>- Understand and apply machine learning techniques for data and signal analysis, in particular for regression and prediction tasks.</li> <li>- Understand and apply linear and nonlinear data visualization techniques.</li> <li>- Evaluate the performances of these methods with appropriate techniques.</li> <li>- Choose between existing methods on the basis of the nature of data and signals to be analyzed.</li> </ul> <p>-----</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p> |
| Evaluation methods          | Closed book oral examination, or written examination (depending on the number of students). The project is part of the evaluation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Teaching methods            | Lectures, exercises, practical sessions on computers, project to be carried out individually or by groups of 2 students                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Content                     | <ul style="list-style-type: none"> <li>• Linear regression</li> <li>• Nonlinear regression with multi-layer perceptrons (MLP)</li> <li>• Deep learning (convolutional CNN and adversarial GAN)</li> <li>• Clustering and vector quantization</li> <li>• Nonlinear regression with radial-basis function networks (RBFN)</li> <li>• Model selection</li> <li>• Feature selection</li> <li>• Principal Component Analysis (PCA)</li> <li>• Nonlinear dimensionality reduction and data visualization</li> <li>• Independent Component Analysis (ICA)</li> <li>• Kernel methods (SVM)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Inline resources            | <a href="http://moodleucl.uclouvain.be/course/view.php?id=84">http://moodleucl.uclouvain.be/course/view.php?id=84</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Bibliography                | Divers livres de références (mais non obligatoires) mentionnés sur le site du cours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Faculty or entity in charge | ELEC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Programmes containing this learning unit (UE)                                 |         |         |              |                                                                                       |
|-------------------------------------------------------------------------------|---------|---------|--------------|---------------------------------------------------------------------------------------|
| Program title                                                                 | Acronym | Credits | Prerequisite | Aims                                                                                  |
| Master [120] in Data Science Engineering                                      | DATE2M  | 5       |              |    |
| Master [120] in Biomedical Engineering                                        | GBIO2M  | 5       |              |    |
| Master [120] in Computer Science and Engineering                              | INFO2M  | 5       |              |    |
| Master [120] in Chemistry and Bioindustries                                   | BIRC2M  | 5       |              |    |
| Master [120] in Mathematical Engineering                                      | MAP2M   | 5       |              |    |
| Certificat d'université : Statistique et sciences des données (15/30 crédits) | STAT2FC | 5       |              |    |
| Master [120] in Statistic: General                                            | STAT2M  | 5       |              |    |
| Master [120] in Agricultural Bioengineering                                   | BIRA2M  | 5       |              |  |
| Master [120] in Environmental Bioengineering                                  | BIRE2M  | 5       |              |  |
| Master [120] in Computer Science                                              | SINF2M  | 5       |              |  |
| Master [120] in Electrical Engineering                                        | ELEC2M  | 5       |              |  |
| Master [120] in Forests and Natural Areas Engineering                         | BIRF2M  | 5       |              |  |
| Master [120] in Data Science : Statistic                                      | DATS2M  | 5       |              |  |
| Master [120] in Data Science: Information Technology                          | DATI2M  | 5       |              |  |