



## Cancer, Ageing and Rejuvenation Graduate School - CARE

### Master's Programme

2022 - 2023

| Title of the Teaching Unit (UE): Computer Science : <b>Analysis and learning in massive data: from basic data to a readable and useful</b> |  |                          |
|--|--|--------------------------|
| <b>Semester: 8</b>   | <b>Number of ECTS: 6</b>   | <b>Hourly volume: 54</b> |
| <b>Teaching Team</b>   | Coordinators : <b>Emmanuelle Claeys, Tom Rohmer</b><br><br>Teaching team : Bertrand Servin   |                          |
| <b>Objective</b>   | <ul style="list-style-type: none"> <li>- Characterizing the techniques to handle randomness (probability &amp; statistics) and their role in the processing of some types of data.</li> <li>- Choosing based on objective criteria data structures, and designing the best algorithms to address a given problem.</li> <li>- Identifying the fundamental concepts of complexity, calculability, decidability, and verification: assessing the complexity and the domain of validity of a solution.</li> <li>- Adopting rational approaches to solve complex problems by decomposing them and/or by making successive approximations, and applying relevant analysis methods to design some apps and algorithms given an incomplete set of specifications.</li> <li>- Mastering several algorithmic paradigmas and programming styles as well as several programming languages.</li> <li>- Using formal computation or scientific computation softwares</li> <li>- Analyzing and synthesizing data for exploitation.</li> </ul> |                          |
| <b>Content</b>   | Introduction to modeling, Model development, Linear model (practical work in R), Data visualization, Introduction to Python, Dynamical systems & differential equations (practical work in Python), Monte Carlo methods (practical work in Python)   |                          |
| <b>Pre-requisites</b>  | Basics in statistics and dynamical system modeling   |                          |
| <b>Keywords</b>  | Modeling, Model development, Programming in R, Data visualization, Python, Dynamical systems, Monte Carlo  |                          |
| <b>Skills</b>  | Identifying and applying data acquisition tools (satellite image processing, geomatics), and mathematic/informatic tools to ecological objects (stats, writing and studying mathematical models) (A)// Resorting to basic programming skills for task automation in data analysis (A)// Using, conceiving and developing visualization and representation tools for biological data, knowledge, and results of analyses, in order to allow synthetic reading, information sharing and interpretation of bio-information data (M)// Integrating several data sources and various results from simulations, bioinformatics, mathematics, and statistics in order to create links between several data types.   |                          |



|                        |  |
|------------------------|--|
|                        | <p>Biologically interpreting biological processes and systems in the framework of applied, translational or fundamental research. (A)</p> <p>3.1 Identifying, selecting and analyzing with a critical mind numerous specialized references works in order to argue and sum up this data for exploitation</p> <p>1.2 Knowing by yourself how to use advanced digital tools for related jobs or research sectors in the field (A)</p> <p>Conducting an experimental approach (methodological rigor, data collection and analysis, use and design of interpretable models)</p> <p>4.6 Conceiving and conducting an experimental strategy in order to address a research question or to test a scientific hypothesis by leading the project by yourself or among a team : from the data collection to the presentation of the results. (M)</p> |
| <b>Block of Skills</b> | 1 3 4  |