

Mathematical and Statistical Techniques

Master in Astrophysics, Particle Physics and Cosmology

Barcelona, autumn 2022



X. Luri, L. Garrido



UNIVERSITAT DE
BARCELONA



Institut de Ciències del Cosmos

Part one: fundamentals of probability theory and statistics

- General review of probability theory
- Monte-Carlo
- Statistical Inference and significance test

Assignments: 1 set of problems + 2 exercises to be simulated in a computer (you can use your preferred language, only a random number generator is needed)

Part two: Multivariate Analysis and statistical treatment techniques

Introduction to multivariate analysis, statistical treatment techniques: concepts and main techniques, hands-on work using specialized software. Data Mining concepts.

- o Data analysis and representation
- o PCA
- o Clustering
- o Discriminant analysis
- o Neural Networks
- o Estimation of the PDF
- o Overview of Data Mining

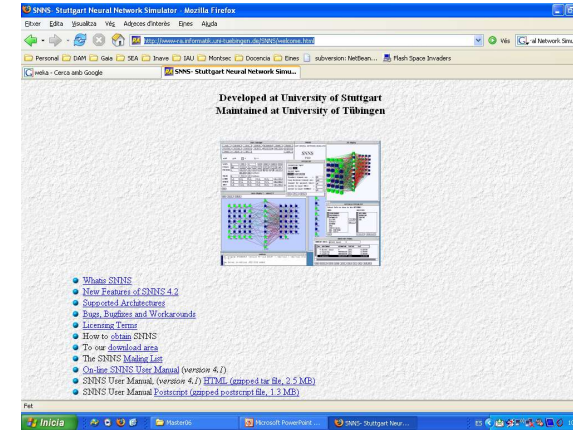
3 data análisis assignments

Part two: tools

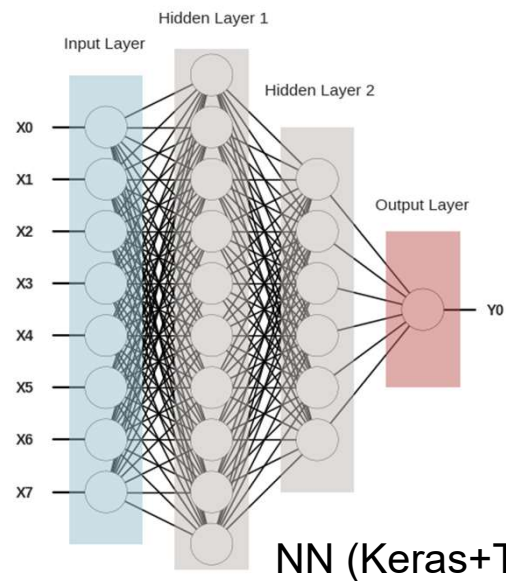
Weka



JNNS



Python



NN (Keras+Tensorflow)

Course Material: Campus virtual

<http://campusvirtual.ub.edu>

The screenshot shows a web browser window displaying the virtual campus interface. The browser's address bar shows the URL <https://campusvirtual.ub.edu/course/view.php?id=31769#section-0>. The page header includes the Universitat de Barcelona logo and the text 'Els meus cursos' with a user profile picture and a settings icon. The main content area features a banner for the course 'Tècniques Matemàtiques i Estadístiques (2020-2021)' with a background image of statistical terms. Below the banner, there is a search bar and a list of course contents on the left, including 'Introduction', 'Assignments', 'Slides', 'Course tools', 'Sample R files', 'Sample Weka files', 'Sample JNNS files', and 'First part (Proba, Stats, Monte-Carlo)'. The main content area displays the 'Introduction' section, which includes a welcome message from Luri Carrascoso Francesc Xavier and a link to 'Edita la secció'. A forum section is also visible, containing a link to 'Avisos i notícies'. The Windows taskbar is visible at the bottom of the screen.

Curs: Tècniques Matemàtiques

https://campusvirtual.ub.edu/course/view.php?id=31769#section-0

UNIVERSITAT DE BARCELONA

Els meus cursos

Tauler / Els meus cursos

Tècniques Matemàtiques i Estadístiques (2020-2021)

Canvia la imatge de portada

CONTINGUTS

- Introduction
Progrés: 0 / 2
- Assignments
No publicat per als estudiants
- Slides
- Course tools
Progrés: 0 / 3
- Sample R files
- Sample Weka files
Progrés: 0 / 1
- Sample JNNS files
- First part (Proba, Stats, Monte-Carlo)

Introduction

Benvingut al vostre curs nou Luri Carrascoso Francesc Xavier.
Comenceu per descriure de què tracta el curs amb text, imatges, àudio i vídeo.

Edita la secció

FÒRUM

- Avisos i notícies

Calendar and evaluation

6 credits

Part 1: weeks 1-6

Part 2: weeks 7-12

There will be no final exam for this course.

The average of the 6 problem assignments that will be given during this course, will compose the final global grading.