NEURAL COMPUTING

INF/01 - 6 CFU - 1° semestre

Docente titolare dell’ insegnamento

SEBASTIANO BATTIATO

Email: battiato@dmi.unict.it
Edificio / Indirizzo: Dipartimento di Matematica e Informatica - Viale Andrea Doria 6
Telefono: +390957383206
Orario ricevimento: Consultare il sito web del docente (See personal home page)

OBIETTIVI FORMATIVI

The course covers the theory and practice of artificial neural networks, highlighting their relevance both for artificial intelligence applications and for modeling human cognition and brain function. Theoretical discussion of various types of neural networks and learning algorithms is complemented by hands-on practices in the computer lab. Models for classification and regression, as well as neural network architectures (e.g., Deep Learning) will be discussed. The course will present the techniques to design and optimize learning algorithms, and those useful to assess the performance of Machine Learning systems.

MODALITÀ DI SVOLGIMENTO DELL’ INSEGNAMENTO

The main teaching methods are as follows:

- Lectures, to provide theoretical and methodological knowledge of the subject;
- Hands-on exercises, to provide “problem solving” skills and to apply design methodology;
- Laboratories, to learn and test the usage of related tools.

Should teaching be carried out in mixed mode or remotely, it may be necessary to introduce changes with respect to previous statements, in line with the programme planned and outlined in the syllabus.

PREREQUISITI RICHIESTI

Basic Calculus and Math

Algebra and Matrix Notation
Machine learning basic principle
Python programming language

---

**FREQUENZA LEZIONI**

Strongly recommended

---

**CONTENUTI DEL CORSO**

Linear Models for Regression: Linear Models for Classification: Gradient Descent, Multi-Class Classification, Classifiers Evaluation

Neural models and Network Architectures

Basic neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function based multilayer perceptron, neural network decision trees, etc.

Basic learning algorithms: the delta learning rule, the back propagation algorithm, self-organization learning, etc.

Supervised Learning with Neural Networks

Deep Learning: Convolutional Neural Network

Python programming and Python Libraries for Machine Learning

---

**TESTI DI RIFERIMENTO**

DEEP LEARNING FROM BASICS TO PRACTICE (2020)
https://www.glassner.com/portfolio/deep-learning-from-basics-to-practice/

Dive into Deep Learning (2020)

**OTHER**


ALTRO MATERIALE DIDATTICO
Course notes
Script and code provided by the teacher
Video Material (on line courses)

PROGRAMMAZIONE DEL CORSO

<table>
<thead>
<tr>
<th>Argomenti</th>
<th>Riferimenti testi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Logistic Regression</td>
<td>Glassner (vol .1, vol 2)</td>
</tr>
<tr>
<td>2 BacKpropagation</td>
<td>Glassner (vol .1, vol 2)</td>
</tr>
<tr>
<td>3 Supervised vs Unsupervised Learning</td>
<td>Glassner (vol .1, vol 2)</td>
</tr>
<tr>
<td>4 Neural Network principles</td>
<td>Bishop</td>
</tr>
<tr>
<td>5 Convolutional Neural Networks</td>
<td>Dive into Deep Learning</td>
</tr>
</tbody>
</table>

VERIFICA DELL'APPRENDIMENTO

MODALITÀ DI VERIFICA DELL'APPRENDIMENTO
Writtten and Oral Examination

*Learning assessment may also be carried out on line, should the conditions require it.*

ESEMPI DI DOMANDE E/O ESERCIZI FREQUENTI
Example of Algorithms based on training data

Cross Validation

NN Architecture