

Module Title: Machine Learning

Lecturers: Marco Aiello , Anna Corazza* , Diego Gragnaniello* , Francesco Isgrò* , Roberto Prevete* , Francesco Raimondi*** , Carlo Sansone***

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Dates and Locations

Date	Hours	Room
6 luglio 2020	11-13	Microsoft Teams
7 luglio 2020	11-13	Microsoft Teams
8 luglio 2020	11-13	Microsoft Teams
9 luglio 2020	11-13	Microsoft Teams
10 luglio 2020	11-13	Microsoft Teams
13 luglio 2020	11-13	Microsoft Teams
14 luglio 2020	11-13	Microsoft Teams
15 luglio 2020	11-13	Microsoft Teams
16 luglio 2020	11-13	Microsoft Teams
17 luglio 2020	11-13	Microsoft Teams

Content

Lecture I - Supervised machine learning: introduction to the course, definition of supervised machine learning with particular emphasis on classification, decision trees, representation of the input, similarity, example of classification approaches in the vector space model (Rocchio, kNN), statistical methods, Bayes classification rule and MLE, Naive Bayes classifier. (Anna Corazza).

Lecture II - Support Vector Machines: performance assessment, overfitting and generalization, linear versus non linear classifiers, hard margin support vector machines (SVM), soft margin support vector machines, kernels. (Anna Corazza)

Lecture III - Unsupervised machine learning: Introduction to clustering, flat clustering, K-means, clustering assessment, choice of the number of clusters. Hierarchical clustering: introduction, dendrograms, single-link, complete link, centroid based, GAAC. (Anna Corazza)

Module Announcement

Lecture IV - Feature design: Introduction to the problem of dimensionality reduction; definition of the projection error; geometrical introduction to Principal Component Analysis and its statistical interpretation; introduction to the feature selection problem; the ada-boost algorithm; application to face detection. (Francesco Isgrò)

Lecture V - Challenges and opportunity of medical imaging in the era of big data. The diagnostic imaging field has undergone considerable growth both in terms of technological development and market expansion; with the following increasing production of a considerable amount of data that potentially fully poses diagnostic imaging in the context of big data in healthcare. Nevertheless, the mere production of a large amount of data does not automatically permit the real exploitation of their intrinsic value. Therefore, it is necessary to develop digital platforms and applications that foster the management and analysis of diagnostic images such as Big data. This talk aims to frame the role of diagnostic imaging in this new scenario, emphasizing the opportunities and open challenges in exploiting such intense data generation for decision making with Big data analytics. (Marco Aiello, SDN)

Lecture VI - Ensemble methods: Combining Multiple Models. Bagging. Randomization: Random Subspace Ensemble, Random Forest, Rotation Forest. Boosting, Additive Regression. Stacking. Error Correcting Output Codes. (Carlo Sansone).

Lecture VII - Neural Networks: Structure and behavior of Multi-layer Feed-Forward Neural Networks. Shallow networks as universal approximators. Error Functions and Optimization methods based on gradient descent. Back-propagation algorithm to compute error gradient. The impact of choosing a "good" activation functions: Trainable activation functions. (Roberto Prevete)

Lecture VIII - From shallow networks to deep networks: basic principles. Unsupervised learning algorithms to pretrain multi-layered neural networks: Noised Stacked Auto-Encoders. Deep Network without pretraining: Rectified Linear Units (ReLU) and its variants. Convolutional Neural Networks. Network in Network (NIN) (Roberto Prevete)

Lecture IX - Recurrent networks: Neural networks for sequences: Recurrent Neural Networks. Simple Recurrent Neural Networks (S-RNN). Problems with this simple models. Long Short Term Memory (LSTM) neural networks. (Anna Corazza)

Lecture X - Machine Learning for the Ultrasound Evaluation of Neonatal Respiratory Status (Francesco Raimondi, Diego Gagnaniello)

ECTS Credits: 4.0

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Gli studenti interessati sono invitati a iscriversi al Gruppo Teams

<https://teams.microsoft.com/l/team/19%3aced18ba8d334d23a70e664112ceef14%40thread.tacv2/conversations?groupId=06d63fa4-3fe3-47a7-889d-679995c1393f&tenantId=2fcfe26a-bb62-46b0-b1e3-28f9da0c45fd>

