AD HOC TEACHING MODULE Announcement

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

PHD IN INFORMATION AND COMMUNICATION TECHNOLOGY FOR HEALTH

PHD IN INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Module Title: Machine Learning

Lecturers:

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

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**** Istituto di Ricerca IRCCS SDN, Napoli**
***** Dipartimento di Scienze mediche traslazionali, Università di Napoli Federico II**

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Dates and Locations

Date	Hours	Room
July 6 2020	11.00-13.00	Microsoft Teams
July 7 2020	11.00-13.00	Microsoft Teams
July 8 2020	11.00-13.00	Microsoft Teams
July 9 2020	11.00-13.00	Microsoft Teams
July 10 2020	11.00-13.00	Microsoft Teams
July 13 2020	11.00-13.00	Microsoft Teams
July 14 2020	11.00-13.00	Microsoft Teams
July 15 2020	11.00-13.00	Microsoft Teams
July 16 2020	11.00-13.00	Microsoft Teams
July 17 2020	11.00-13.00	Microsoft Teams

Content

Lesson 1- 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).

Lesson 2 - 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)

Lesson 3 - 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)

Lesson 4 - 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)

Lesson 5 - 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)

Lesson 6 - Ensemble methods: Combining Multiple Models. Bagging. Randomization: Random Subspace Ensemble, Random Forest, Rotation Forest. Boosting, Additive Regression. Stacking. Error Correcting Output Codes. (Carlo Sansone).

Lesson 7 – 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)

Lesson 8 - 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)

Lesson 9 - 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)

Lesson 10 – Machine Learning for the Ultrasound Evaluation of Neonatal Respiratory Status (Francesco Raimondi, Diego Gragnaniello)

ECTS Credits: 4 (20 hours)

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Gli studenti interessati sono invitati a iscriversi al Gruppo Teams https://teams.microsoft.com/l/team/19%3acbed18ba8d334d23a70e664112ceef14%40thread.tacv2/conversations?groupId=06d63fa4-3fe3-47a7-889d-679995c1393f&tenantId=2fcfe26a-bb62-46b0-b1e3-28f9da0c45fd