Francesco Di Luzio

ISTRUZIONE E FORMAZIONE

[01/05/2022 – 30/09/2022]

PhD Visiting Period

Fundaciò TecnoCampus Matarò-Maresme

Città: Barcellona
Paese: Spagna

[01/11/2020 – Attuale]

PhD student

Sapienza, Università di Roma

Città: Roma
Paese: Italia
Campi di studio: Deep Learning Models for Emotion Recognition and Behavioral Analysis

Vincitore bando di selezione BS-J 09/2020 per l'assegnazione di una borsa di studio avente come oggetto attività di ricerca nell'ambito del setto concorsuale/scientifico disciplinare ING/IND-31

Sapienza, Università di Roma

Città: Roma
Paese: Italia

[01/09/2018 – 27/10/2020]

Laurea Magistrale in Ingegneria Gestionale

Sapienza, Università di Roma

Città: Roma
Paese: Italia
Campi di studio: Business Intelligence and Analytics
Voto finale: 110/110 con Lode

[01/09/2015 – 18/07/2018]

Laurea Triennale in Ingegneria Gestionale

Sapienza, Università di Roma

Città: Roma
Paese: Italia
Voto finale: 110/110

[09/2010 – 07/2015]

Diploma di Liceo Scientifico

Liceo Scientifico Guglielmo Marconi

Città: Colleferro
Paese: Italia
Voto finale: 100/100

COMPETENZE LINGUISTICHE

Lingua madre: Italiano

Altre lingue:

Inglese

ASCOLTO C2 **LETTURA** C2 **SCRITTURA** C2

PRODUZIONE ORALE C2 **INTERAZIONE ORALE** C2

spagnolo

ASCOLTO B1 **LETTURA** B2 **SCRITTURA** B1

PRODUZIONE ORALE B1 **INTERAZIONE ORALE** B1

francese

ASCOLTO A2 **LETTURA** A2 **SCRITTURA** A2

PRODUZIONE ORALE A2 **INTERAZIONE ORALE** A2

Livelli: A1 e A2: Livello elementare B1 e B2: Livello intermedio C1 e C2: Livello avanzato

COMPETENZE DIGITALI

Pacchetto office | Programmazione in python | Programmazione in matlab | Gestione di basi di dati | Pytorch | Keras | MySql | Linux | Windows | git | github | programmazione in java | programmazione in R e Rstudio

PUBBLICAZIONI

[2023]

A Randomized Deep Neural Network for Emotion Recognition with Landmarks Detection

In this paper, we present an innovative deep neural architecture employing parameter randomization in a complex classification model for emotion recognition. Actually, randomized deep neural networks represent an interesting alternative to exploring the efficiency-to-accuracy balance in real-life applications. Moreover, we also introduce the use of input frames composed of 468 facial landmarks coordinates and an innovative sampling procedure avoiding padding. The proposed randomized classifier is trained for emotion recognition on video sequences and the related accuracy is compared with a non-randomized version of the same model and with well-known benchmark architectures, demonstrating the robustness of the proposed approach in terms of classification accuracy and training time.

[2022]

A Fast Deep Learning Technique for Wi-Fi Based Human Activity Recognition

Despite recent advances, fast and reliable Human Activity Recognition in confined space is still an open problem related to many real-world applications, especially in health and biomedical monitoring. With the ubiquitous presence of Wi-Fi networks, the activity recognition and classification problems can be solved by leveraging some characteristics of the Channel State Information of the 802.11 standard. Given the well-documented advantages of Deep Learning algorithms in solving complex pattern recognition problems, many solutions in Human Activity Recognition domain are taking advantage of those models. To improve the time and precision of activity classification of time-series data stemming from Channel State Information, we propose herein a fast deep neural model encompassing concepts not only from state-of-the-art recurrent neural networks, but also using convolutional operators with added randomization. Results from real data in an experimental environment show promising results.

[2021]

Deep Neural Networks for Electric Energy Theft and Anomaly Detection in the Distribution Grid

Time series classification is a fundamental problem when applied to energy distribution issues. In this paper, the authors propose a solution for the detection of electric energy theft (as well as of electric energy anomalies) by introducing a novel time series classification. Data obtained via actual measurements in industrial sites were employed.

Our approach was based on the training of a DNN to recognize whether a measurement of a single-day energy profile were subject to any anomaly. Our proposed method was tested and experimentally validated against the results of accepted benchmarks. The outcomes clearly indicate that the performance of our methodology does outperform the other architectures employed as a benchmark, considering the accuracy and its standard deviation.

[2021]

Multivariate Prediction of Energy Time Series by Autoencoded LSTM Networks

In this paper, a novel approach for the multivariate prediction of energy time series is presented. It is based on the Long Short-Term Memory deep neural network. The latter is made up of two stacked recurrent layers and it is used in two different training configurations. First, an encoder-decoder structure is implemented in order to extract meaningful representative features from the time series. Then, this embedded data are used to improve the actual prediction. To prove the goodness of our approach, its performance is compared with two different benchmarks. The numerical results show that the proposed model outperforms the aforementioned benchmarks.

[2021]

A Blockwise Embedding for Multi-Day-Ahead Prediction of Energy Time Series by Randomized Deep Neural Networks

Nowadays, deep learning is gaining attraction as one of the most successful paradigm for a plethora of machine learning applications. While its benefits are undoubted, the high computational burden associated with its training algorithms and cross-validation procedures is stimulating new lines of research. To this end, randomized deep neural networks are one of the best alternatives in terms of efficiency-to-accuracy balance. In this paper, we present a deep neural architecture that uses randomization of some parameters in a complex structure whose novelty is twofold: it embeds past samples of the time series by using daily blocks in the input frame of a convolutional layer; it predicts a day on the whole by solving a suitable regression problem. The proposed randomized approach is compared with state-of-the-art prediction algorithms on the challenging context related to energy time series, where the day-ahead prediction is usual, obtaining comparable or even better results in terms of forecasting accuracy and training time.

[2022] **Detection of Autism Spectrum Disorder by a Fast Deep Neural Network**

Autism spectrum disorder is a psychiatric illness that refers to a wide range of conditions caused by a biologically determined developmental disorder with onset of symptoms within the first three years of life. Autism can be diagnosed at any stage of life with problems beginning in childhood and continuing into adolescence and adulthood. Given the immense attraction gained by deep learning as one of the most successful paradigms for a plethora of real-world medical applications, in this paper we explore the possibility of using fast deep learning models for the detection of autism in children. To this end, random deep neural networks are one of the most important alternatives, in particular because they strike a good balance in the trade-off between accuracy and efficiency. We propose a deep neural architecture that employs the randomization of some parameters in a complex structure for the detection of autism spectrum disorder. The proposed approach is validated by using a three-dimensional dataset consisting of body joint positions taken from videos of both suffering and sane children. To evaluate the classification performance of the proposed network, the latter is compared with a fully trainable, non-randomized version of the same model and with state-of-the-art binary classifiers applied to the same data. Numerical results show that the proposed method outperforms reference benchmarks in terms of accuracy and speed, demonstrating the inherent capabilities of the implemented system that makes use of such specific features.

[2022] **A Price-aware Dynamic Decision System in Energy Communities**

The optimization of energy demand and response is crucial for several energy distribution applications, especially in autonomous contexts, such as energy communities, employing renewable energy sources. In these frameworks, the overall

balance between the produced and consumed energy is important to efficiently regulate generation and loads. For this reason, in this paper, we propose a decision system based on the elastic net regularization, which is able to incorporate the prediction of energy prices in order to optimize the energy unbalance and the cost. We tested this novel method on real-world data, obtaining promising performance.

[2021] **Time Series Prediction with Autoencoding LSTM Networks**

Nowadays, solving prediction problems in green computing is an open and challenging task, for which solutions based on deep learning are studied. In this work, we present a forecasting algorithm based on Long Short-Term Memory networks applied to renewable energy sources time series prediction. We make use of an encoder-decoder structure to extract useful representative sequence data, employing a stacked LSTM architecture for data embedding and successive prediction. By comparing the performance of the proposed forecasting scheme with a classical two-layer LSTM structure, we are able to asses the performance of the former as a robust tool for solving prediction problems in the green computing framework.

[2023]

F. Di Luzio, A. Paiardini, F. Colonnese, A. Rosato e M. Panella "A Deep Neural Network for G-Quadruplexes Binding Proteins Classification", in Advances in Computational Intelligence (IWANN 2023, I. Rojas, G. Joya e A. Catala, Eds.), Lecture Notes in Computer Science, Vol. 14134, pp. 1-12, ISBN: 978-3-031-43084-8, ISSN: 0302-9743, DOI: 10.1007/978-3-031-43085-5_41, Springer Nature, Svizzera, 2023 (in stampa).

[2023]

F. Colonnese, F. Di Luzio, A. Rosato e M. Panella, "Fast Convolutional Analysis of Task-based fMRI Data for ADHD Detection", in Advances in Computational Intelligence (IWANN 2023, I. Rojas, G. Joya e A. Catala, Eds.), Lecture Notes in Computer Science, Vol. 14135, pp. 1-12, ISBN: 978-3-031-43077-0, ISSN: 0302-9743, DOI: 10.1007/ 978-3-031-43078-7_30, Springer Nature, Svizzera, 2023 (in stampa).