Gabriele Accarino

Nationality: Italian | https://www.linkedin.com/in/gabrieleaccarino/

WORK EXPERIENCE

28/02/2022 – 09/06/2022 – Lecce, Italy
CONTRACT PROFESSOR – UNIVERSITY OF SALENTO, DEPT. OF ENGINEERING FOR INNOVATION

- Role: **Contract Professor of High Performance Computing**
- Academic Discipline: **09/H1 - INFORMATION PROCESSING SYSTEMS (SSD: ING-INF/05)**
- Course: **Master's Degree in Computer Engineering**
- Topics: **High Performance Computing and Machine Learning**

31/01/2022 – 31/01/2023 – Lecce, Italy
RESEARCH FELLOW – UNIVERSITY OF SALENTO, DEPT. OF ENGINEERING FOR INNOVATION

Research Fellowship topic: **Machine Learning for Climate Science research**
SSD: **09/H1 - INFORMATION PROCESSING SYSTEMS (SSD: ING-INF/05)**
Scientific Advisors: **Prof. Italo Epicoco (University of Salento & CMCC Foundation), Prof. Giovanni Aloisio (University of Salento & CMCC Foundation)**

12/2021 – 02/2022 – Lecce, Italy
FIXED-TERM APPOINTMENT – UNIVERSITY OF SALENTO, DEPT. OF HUMANITIES

Project: **Development of an automatic speech recognition system for investigative and forensic applications**
Client: **Italian Government Presidency of the Council of Ministers**
Deliverable: **Organisation and development of a speech database suitable for use in automated voice comparison and speech identification systems**
Scientific Advisor: **Prof. Milko A. Grimaldi**

02/2019 – 06/2021 – Lecce, Italy
ASSISTANT LECTURER – UNIVERSITY OF SALENTO, DEPT. OF ENGINEERING FOR INNOVATION

As a Ph.D. Fellow, I carried out programming exercise activities as part of the **High-Performance Computing Master's course**, held by Prof. Giovanni Aloisio.

The activities involved the use of the **Python** language and the **Jupyter Notebook** environment for implementing some **Machine Learning** algorithms from scratch, avoiding the use of existing libraries and frameworks. The **vectorized** implementation of the considered algorithms has been also proposed in the place of the loop-based one, in order to make the execution much faster.

Main topics:
- Linear Regression (Univariate/Multivariate)
- Logistic Regression (Univariate/Multivariate)
- Polynomial Regression
- Bias and Variance trade-off, learning curves
- Regularization
- Artificial Neural Networks

- The Keras Machine Learning framework

04/2018 – 10/2018 – Lecce, Italy
POST DEGREE RESEARCH ASSISTANT

Data Science and Learning Research Unit, Advanced Scientific Computing Division (ASC), Euro-Mediterranean Center on Climate Change (CMCC Foundation)

As a Post-Degree Research Assistant at the CMCC Foundation, I contributed to the research activities of the Data Analysis and Learning Research Unit within the Advanced Scientific Computing Division. In particular, I contributed to:

- Design of **Long-Short Term Memory Neural Networks** for the task of **sea level forecasting** in different coastal locations belonging to the Southern Adriatic Northern Ionian (SANI) domain
- Investigation of **Hybrid Modelling** approaches aimed at replacing computationally expensive software components (kernels) of climate models with Artificial Neural Networks predictions. Experiments focused on the MUSCL advection kernel of the **Nucleus for European Modeling of the Ocean** (NEMO) code, the state of the art of oceanic frameworks for oceanographic research

11/2017 – 03/2018
INTERNSHIP AT THE CMCC FOUNDATION

Advanced Scientific Computing Division (ASC), **Euro-Mediterranean Center on Climate Change (CMCC Foundation)**

I have carried out an in-depth study of the state of the art of "data movement" tools in the scientific field. The study focused on **Big Data** techniques and movement tools with the aim of testing their costs and benefits on real high-performance computing facilities. I contributed to:

- Create an exhaustive documentation about the most important tools and commands, including examples of their usage
- Move data from the **Earth System Grid Federation (ESGF)** repositories, a Peer-to-Peer (P2P) infrastructure that maintains a global system of federated data centers, providing access to the largest **climate data** archive in the world

EDUCATION AND TRAINING

11/11/2018 – 27/05/2022 – Lecce, Italy
PH.D. IN BIOLOGICAL AND ENVIRONMENTAL SCIENCES AND TECHNOLOGIES – University of Salento, Dept. of Biological and Environmental Sciences and Technologies

Department of Biological and Environmental Sciences and Technologies (DiSTeBA)

Ph.D. Thesis Title: **Exploring Machine Learning for Applications to the Climate Science Domain**
Scientific Supervisors: **Prof. Giovanni Aloisio (Full Professor), Prof. Luigi De Bellis (Full Professor)**
Academic Discipline: **09/H1 - INFORMATION PROCESSING SYSTEMS (SSD: ING-INF/05)**

ABSTRACT. According to the Intergovernmental Panel on Climate Change, anthropogenic activities are among the main causes of the substantial change that the Earth's climate has been experiencing since the industrial revolution. So far, the study of climate change has been focused on using complex mathematical frameworks that model different physical processes of the Earth system and the interaction among them, allowing the simulation of the long-term trend of several climatic variables as a response to different forcing. Despite
their wide adoption, mathematical frameworks present some limitations too: (i) such processes are difficult to be translated into computer programs since they are complex, highly non-linear, and often not fully known, and (ii) they require massive supercomputing resources to run and produce results. Going beyond traditional physics-based approaches, the dissertation explores the application of Machine Learning techniques to several climate-science related case studies with the aim of addressing the
current limitations of state-of-the-art climate models, improving them from a computational standpoint or providing cutting-edge data-driven solutions instead of physics-based ones. The outcomes of this

dissertation showed that Machine Learning is a valuable and effective tool for climate science-related applications, and it can provide cost-effective solutions.

The following case studies have been investigated, though the use of Machine Learning, during the Ph.D. project:

- Sea level forecasting
- Machine Learning for Downscaling climate fields
- Hybrid modeling
- Extreme Weather Events (Tropical Cyclones, wildfires, etc.)
- Assessing the relationship between climate change and intra-state conflicts
- Assessing the relationship between atmospheric pollution and COVID-19 mortality in Italy

Co-supervision activities:

- 5 Master's and Bachelor's degree students supervised from 2018 to 2019.
- 2 Master's degree students supervised within 2020
- 7 Master's degree students supervised within 2021
- 13 Master's degree students supervised within 2022

Address Lecce, Italy

07/2020 – Lecce, Italy
PROFESSIONAL QUALIFICATION AS LICENSED ENGINEER (ICT AREA) – University of Salento, Dept. of Engineering for Innovation

Public examination for the qualification to practice the profession of Information Engineer (Section A). 1st session of 2020

Address Lecce, Italy | **Final grade** Qualified

2014 – 2017 – Lecce, Italy
MASTER'S DEGREE IN COMPUTER ENGINEERING – University of Salento

Final Mark: **110/110 cum laude (with honors)**
GPA: **29.00 / 30**

Thesis title: **On the use of Deep Learning in the Climate Change domain**
Master Thesis in **High Performance Computing**

Supervisor: **Prof. Giovanni Aloisio (Full Professor)**
Co-Supervisor: **Sandro Luigi Fiore, Ph.D. (Assistant Professor)**

Address Lecce, Italy

2010 – 2015 – Lecce, Italy
BACHELOR'S DEGREE IN INFORMATION ENGINEERING – University of Salento

Final Mark: **105/110**

Thesis title: **Control systems with Smith's Predictor, analysis and fundamental properties**
Supervisor: **Prof. Giovanni Indiveri (Assistant Professor)**

Related subject: Foundations of Automatic Controls

Address Lecce, Italy

2005 – 2011 – Lecce, Italy
HIGH SCHOOL DIPLOMA – Istituto Tecnico Economico Galilei - Costa

Final Mark: 100/100

◦ Winner of several money awards for merit.

Address Lecce, Italy

LANGUAGE SKILLS

Mother tongue(s): **ITALIANO**

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
INGLESE C1	C1	C1	C1	C1
SPAGNOLO A1	A1	A1	A1	A1
FRANCESE A1	A1	A1	A1	A1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

DIGITAL SKILLS

My Digital Skills

Google Drive │ Google Docs │ Microsoft Office │ Zoom │ Instagram │ LinkedIn │ Skype │ Facebook

PROJECTS

31/12/2020 – CURRENT
eFlows4HPC

https://eflows4hpc.eu/
The eFlows4HPC project, funded by the European High-Performance Computing Joint Undertaking (EuroHPC JU) and participating states, will create a European workflow platform for the design of complex applications that integrate HPC processes, data analytics, and artificial intelligence.

This project has received funding from the European High-Performance Computing Joint Undertaking (JU) under grant agreement No 955558. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Spain, Germany, France, Italy, Poland, Switzerland, Norway. All rights reserved.

2019 – CURRENT
IS-ENES3

IS-ENES3, an Horizon 2020 project, is the third phase of the distributed e-infrastructure of the European Network for Earth System Modelling (ENES).

The project fosters collaboration between twenty-two European climate research institutions.

The community aims to develop a better understanding of past and present-day climate and to project future variability and changes through the development and sharing of model components, modelling tools and data infrastructure.

The IS-ENES3 three main objectives are to:

Foster collaboration among the modelling groups to speed-up the development and use of models of the complex Earth's climate system, namely "Earth System models" (ESMs)
Deliver common strategies for the research infrastructure
Disseminate model data

2018
ANIMA: An artificial intelligence tool for migration analysis and projections

Project topic: Cognitive Systems

The project explores the predictive potential offered by the application of Deep Learning algorithms to the challenge of forecasting in the social sciences, and, in particular, to the prediction of international migration flows. An Artificial Neural Network model is adopted to design the likely direction and timing of migration models and identify the most likely countries of origin and arrival in the medium to long term.

Winner of the Leonardo Innovation Award 2018, Ph.D. category

Paola Vesco, University Cà Foscari & CMCC Foundation, Venice, Italy
Gabriele Accarino, University of Salento & CMCC Foundation, Lecce, Italy

07/2017 – 09/2017
The Stanford Arm: development of a simulator and a Kinematic Control Law

The Stanford Arm is a robot arm designed in 1969 by Victor Scheinman, a Mechanical Engineering student working in the Stanford Artificial Intelligence Lab (SAIL). This 6 degree of freedom (6-dof) all-electric mechanical manipulator was one of the first 'robots' designed exclusively for computer control.

The work is inspired to the Stanford Arm. The main aim the project was:

• Producing a suitable design of the Stanford Arm in the Robot Operating System (ROS) environment
• Design and implementation of modules and messages exchanged between ROS modules
• Definition of a Control Law in order to solve the Inverse Kinematic problem
• Design and implementation of a graphic simulator to visualise and test the motion of the end-effector's manipulator in the operative environment

03/2016 – 06/2016
Rigidity based formation control of nano-quadcopters

Design and implementation of a semi-distributed algorithm for the maintenance of the rigidity property of a framework composed by a fleet of nano-quadcopters (drones). The Robot Operating System (ROS) framework was used to define the distributed architecture and the distributed control law.

● HONOURS AND AWARDS

2018
Leonardo Innovation Award 2018

ANIMA: An artificial intelligence tool for the migration analysis and projections

● CONFERENCES AND SEMINARS

07/06/2022 – 08/06/2022 – Marina di Ugento, Lecce, Italy
CMCC Annual Meeting 2022

I contributed as **rapporteur** to the CMCC Annual Meeting 2022 within **The Digital Twin Breakout Group 1.3** for the question: **Why and how AI is key in data driven methods? And how to integrate AI with more classical approaches such as modelling?**

02/11/2021 – 03/11/2021 – Castello Carlo V, Lecce, Italy
CMCC Annual Meeting 2021

13/12/2020 – Virtual
CMCC Annual Meeting 2020

06/2019 – Marina di Ugento, Lecce, Italy
CMCC Annual Meeting 2019

06/2018 – Marina di Ugento, Lecce, Italy
CMCC Annual Meeting 2018

10/2019 – Trento, Italy
Projecting Conflict under a Changing Climate: An Artificial Intelligence application

Vesco P., **Accarino G.**, Gabrielli M. L., Essenfelder A., Mistry M. N., Aloisio G., Flash Talk and Poster, *SISC 7th Annual Conference (ClimRisk2019)*

10/2019 – Paris, France
The 9th Climate Informatics Workshop

Ecole Normale Supérieure

09/2019 – Oxford, UK
Early Experiences on Machine Learning for Climate Change Applications at CMCC

Accarino G., Elia D., *Machine Learning for weather and climate modelling*, Corpus Christi College

28/08/2019 – 31/08/2019 – Washington DC, USA
Projecting Conflict Under Climate Change: An Artificial Intelligence Application

Vesco P., **Accarino G.**, Gabrielli M. L., Essenfelder A., Mistry M. N., Aloisio G., *APSA Annual Conference*

16/05/2018 – 17/05/2018 – Lecce, Italy
5th ENES HPC Workshop on HPC for High-Resolution Climate and Weather Modelling

- **ORGANISATIONAL SKILLS**

Organisational skills

- Advanced organizational and managerial skills, mainly acquired in research and academic environments
- Within the Advanced Scientific Computing Division of the CMCC Foundation, I'm supervising the research activities of a team composed by 4 people working on Machine Learning topics in the context of Climate Science
- Strong ability to work and lead groups of small to moderate size composed by people with different academic and scientific backgrounds and to contribute in co-designing the overall research activities
- Strong capabilities in supervising different research projects, mainly related to Machine Learning and Climate Science, acquired during the supervision of more than 25 Bachelor's and Master's degree students within 2018 and 2022
- Excellent ability to work and cooperate physically or remotely with other people through the use of video calling (Skype, Zoom, Google Meet) and text (Slack, Telegram) tools, as well as sharing codes and other resources (Google Drive, GitHub, BitBucket)

- Excellent ability to adapt to new contexts and environments, meet new people, and make synergic links and collaboration with other researches and institutions, as well as in partecipating as speaker to conferences and to travel abroad
- Strong ability to share the outcomes of the research by writing and submitting scientific papers to peer-reviewed international journals
- Strong ability to find, read and contribute to European Research projects and initiatives. Indeed, I contributed to the writing of several European proposals such as eFlows4HPC, InterTwin and ACCURATE-AI, by defining of the overall structure of WPs and Tasks as well as to the scheduling and planning of the research activities

COMMUNICATION AND INTERPERSONAL SKILLS

Communication and interpersonal skills

Excellent communication skills and natural aptitude to work in teams with heterogeneous people. Strong ability to forge new alliances and collaborations, as well as reinforcing existing sponsorships. Dynamism, optimism and spirit of initiative guide my work.

JOB-RELATED SKILLS

Job-related skills

- Advanced knowledge of tools and techniques of Information and Communication Technology for design and management of information systems, computers, computer networks, databases and automatic control systems
- 7+ years experience in Python coding (clean, modular and efficient) and strong knowledge of scientific libraries (Numpy, Pandas, Scipy, Scikit-learn, Statsmodel, Matplotlib etc.)
- Strong use of Jupyter Notebooks for research and educational purposes
- Strong ability to process data in different formats (e.g., text, csv, npy, hdf5, NetCDF etc.)
- Strong ability in analyzing data by using statistical tools and methods
- Strong knowledge of state-of-the-art Machine Learning and Deep Learning frameworks (TensorFlow and Keras)
- Strong ability to design and implement Machine Learning models for distributed training (single node or multi-node)
- Strong theoretical and practical (coding) background on Machine Learning algorithms. During the exercises of the Machine Learning module of the HPC course, I coded several algorithms from scratch by means of loop-based and vectorised implementations
- Strong capabilities to design, implement, train and test ad-hoc Machine Learning algorithms for specific scientific problems
- Strong ability in retrieving climate datasets from the Copernicus Service

COURSES

Possibility and uncertainty: the tools of stochastic processes

Prof. Angelo Coluccia, 30 hours, University of Salento, Lecce, Italy

Machine Learning Stanford (Prof. Andrew Ng)

Certification obtained through the Coursera platform, 11 weeks, grade 96.9 (https://www.*coursera.org/account/accomplishments/certificate/P8M5EJNZ9ZP5)*.

Data Analysis techniques with deep learning and examples

Dr. Julian Rautenberg, 10 hours, University of Wuppertal, Wuppertal, Germany

Intensive Course on Neural Networks and Deep Learning

Prof. Giorgio Buttazzo, 18 hours, Scuola Superiore Sant'Anna, Pisa, Italy

PUBLICATIONS

Assessing correlations between short-term exposure to atmospheric pollutants and COVID-19 spread in all Italian territorial areas

10.1016/j.envpol.2020.115714
2021
Accarino G., Lorenzetti S., Aloisio G., *Environmental Pollution*, Volume 268, Part A, 2021, 115714, ISSN 0269-7491

MSG-GAN-SD: A Multi-Scale Gradients GAN for statistical downscaling of 2-meter temperature over the EURO-CORDEX domain

10.3390/ai2040036
2021
Accarino G., Chiarelli M., Immorlano F., Aloisi V., Gatto A. and Aloisio G., *AI* 2021, *2*(4), 600-620

A multi-model architecture based on Long Short-Term Memory neural networks for multi-step sea level forecasting

10.1016/j.future.2021.05.008
2021
Accarino G., Chiarelli M., Fiore S., Federico I., Causio S., Coppini G., Aloisio G., *Future Generation Computer Systems*, Volume 124, 2021, Pages 1-9, ISSN 0167-739X

The effect of known and unknown confounders on the relationship between air pollution and Covid-19 mortality in Italy: A sensitivity analysis of an ecological study based on the E-value

10.1016/j.envres.2021.112131
2021
Aloisi V., Gatto A., **Accarino G.**, Donato F., Aloisio G., Environmental Research, vol. 207, p. 112131, 2022

Limits of Compartmental Models and New Opportunities for Machine Learning: A Case Study to Forecast the Second Wave of COVID-19 Hospitalizations in Lombardy, Italy

10.3390/informatics8030057
2021
Gatto A., **Accarino G.**, Aloisi V., Immorlano F., Donato F. and Aloisio G., *MDPI Informatics*, vol. 8, no. 3, p. 57

An Artificial Neural Network-based approach for predicting the COVID-19 daily effective reproduction number Rt in Italy

https://doi.org/10.3390/ai3010009
2022
Gatto A., Aloisi V., **Accarino G.**, Immorlano F., Aloisio G., *AI* 2022, *(3)*1, 146-163

DRIVING LICENCE

Driving Licence:B