



Gabriele Accarino

Nationality: Italian | **Gender:** Male |

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WORK EXPERIENCE

03/2019 – CURRENT

ASSISTANT LECTURER – HIGH PERFORMANCE COMPUTING MASTER'S COURSE

University of Salento, Lecce (Italy)

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

05/2018 – 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

12/2017 – 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

11/2018 – CURRENT – Lecce, Italy

PH.D. IN BIOLOGICAL AND ENVIRONMENTAL SCIENCES AND TECHNOLOGIES – University of Salento

Department of Biological and Environmental Sciences and Technologies (DiSTeBA)

The Ph.D. project aims at researching at the intersection of Machine Learning and Climate Science to leverage Machine Learning opportunities for tackling different case studies in the climate science context, also in connection with climate change. Indeed, the use of Machine Learning is increasingly becoming attractive and popular in the climate science domain as opposite to traditional physics-based approaches that require a higher number of computational resources on modern High Performance Computing facilities. The availability of huge amount of data, coming from observations and climate models simulations, makes Machine Learning approaches to work properly and particularly suited for addressing climate-related tasks, leading to unprecedented performances in terms of accuracy and time-to-solution.

Within the Ph.D. project, the following case studies will be investigated by means of Machine Learning:

- 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

07/2020

QUALIFIED TO PRACTICE AS INFORMATION ENGINEER

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

Qualified

2015 – 2017 – Lecce, Italy

MASTER'S DEGREE IN COMPUTER ENGINEERING – University of Salento

Average Mark: 29.00 / 30

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

Master Thesis in High Performance Computing

Thesis title: On the use of Deep Learning in the Climate Change domain

Supervisor: Prof. Giovanni Aloisio

Co-Supervisor: Sandro Fiore, Ph.D.

The thesis was elected to constitute a scientific document that I am currently working

- Course held entirely in **English**;
- Studied fields: Data Science, Robotics and Controls, Network Technologies, Software Engineering, Parallel and High-Performance Computing;
- I ranked at the **top** of my course.

Final Mark: 105/110

Thesis title: Control systems with Smith's Predictor, analysis and fundamental properties.

Related subject: Foundations of Automatic Controls

Supervisor: Prof. Giovanni Indiveri

● **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**

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

● **CONFERENCES AND SEMINARS**

14/12/2020 – Virtual

CMCC Annual Meeting 2020

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

29/08/2019 – 01/09/2019 – 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*

06/2019 – Marina di Ugento, Lecce, Italy

CMCC Annual Meeting 2019

06/2018 – Marina di Ugento, Lecce, Italy

CMCC Annual Meeting 2018

17/05/2018 – 18/05/2018 – Lecce, Italy

5th ENES HPC Workshop on HPC for High-Resolution Climate and Weather Modelling

● **PROJECTS**

01/01/2021 – 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.

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

08/2017 – 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

04/2016 – 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

● **ORGANISATIONAL SKILLS**

Organisational skills

Advanced organizational and managerial skills, thanks to my experience as a Team Leader in the management of a research group of 4 people. Excellent ability to coordinate work groups even if physically distant through messaging tools, video calling (Skype) and Cloud (Drive, GitHub, BitBucket). Great ability to adapt to new contexts.

● **COMMUNICATION AND INTERPERSONAL SKILLS**

Communication and interpersonal skills

Advanced communication skills developed through the continuous presentation of my projects and work in research environments. As a researcher, I have made new alliances and collaborations, reinforcing existing sponsorships. Dynamism, optimism and spirit of initiative guide my work.

● **JOB-RELATED SKILLS**

Job-related skills

Skill acquired:

- Coding (Python, C, Bash, Java, MATLAB, SQL, UML, HTML);
- Professional Python programming (over 6 years) and use of scientific libraries like Pandas, Numpy, Scikit-learn, Matplotlib;
- Data Science;
- Professional use of state-of-the-art Machine Learning frameworks like TensorFlow and Keras to prototype and develop learning algorithms;
- Strong theoretical background on Machine Learning. I implemented several learning algorithms from scratch, such as Linear and Logistic Regression, Neural Networks, SVM, K-Means, PCA, Recommender Systems and Anomaly Detection Systems;
- Strong capabilities to design and implement ad-hoc Machine Learning algorithms for the problem;
- Ability to start and supervise new software projects that involve Machine Learning issues in a multidisciplinary environment;
- Strong coding capabilities: clean, modular and efficient;
- Design of databases and related management.

● **PRESENTATIONS**

Presentations

- CMCC Foundation 2019 Annual Meeting. Marina di Ugento, Lecce, Italy. June 04-05, 2019. I gave a talk entitled: *Machine Learning for Climate Change applications and open issues*.

● **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*, In Press

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 R_t in Italy

2021

Gatto A., Aloisi V., **Accarino G.**, Immorlano F., Aloisio G., Submitted to *IEEE Transactions on Neural Networks and Learning Systems*. Under Review

● DRIVING LICENCE

Driving Licence: B