Simone Azeglio

Personal Information

Email simone.azeglio@gmail.com
Mobile Phone +39 335 736 9931
LinkedIn simoneazeglio
Github sazio

Education

Oct 2018 – Apr 2021 **M.Sc. in Physics of Complex Systems**, – *University of Turin, Turin, Italy.*

- **Grade**: *110/110 cum laude and honourable mention.*

Oct 2014 – Apr 2018 **B.Sc. in Physics** – *University of Turin, Turin, Italy.*

Publications

Oct 2021 *Azeglio S, Di Bernardo A, Penna G, Pittatore F, Poetto S, Gruenwald J, Kapeller C, Kamada K, Guger C*, **Topological Data Analysis (TDA) Techniques Enhance Hand Pose Classification from ECoG Neural Recordings**, arXiv

Mar 2021 *Bottero L, Calisto F, Graziano G, Pagliarino V, Scauda M, Tiengo S, Azeglio S*, **Physics-Informed Machine Learning Simulator for Wildfire Propagation**, AAAI-MLPS 2021.

Jul 2021 *Zubov K, McCarthy Z, Ma Y, Calisto F, Pagliarino V, Azeglio S, Bottero L, Luján E, Sulzer V, Bharambe A, Vinchhi N, Balakrishnan K, Upadhyay D, Rackauckas C*, **NeuralPDE: Automating Physics-Informed Neural Networks (PINNs) with Error Approximations**, arXiv

Aug 2021 *Azeglio S*, **Modernization of the TMVA GUI. RVariablePlotter: modular plotting for TMVA**, CERN Document Server

Oct 2021 *Azeglio S, Fordiani M*, **Optimizing Urban Mobility Restrictions: a Multi-Agent System (MAS) for SARS-CoV-2**, arXiv

In Preparation *Azeglio S, Bottero L, Di Bernardo A, Villata B, Fina P. R,* **Random Convolutional Kernels for Near Real-Time SSVEP Feature Extraction**.

Experience

Research

Nov 2021 – Present **Research Engineer** – Institut Pasteur, *Paris, France*

- I work on nonlinear models of auditory perception in *Brice Bathellier's* Lab, at the Hearing Institute, part of Institut Pasteur. The objective is to employ linear-non-linear modules with basic 1-D Convolutional Neural Network layers in order to construct a goal-driven architecture which is able to reproduce biological signals, similar to a recent line from James DiCarlo's lab.

Apr 2019 – Present **R&D Lead** – Machine Learning Journal Club, *Turin, Italy*

- I collaborate with **Julia Computing** and *Christopher Rackauckas* (**MIT**) on Scientific Machine Learning. Currently working on *NeuralPDE* and its foundational paper.
- I designed and supervised several Machine Learning projects involving: real time high performance Machine Learning on Xilinx FPGAs and NVIDIA Jetson Xavier for data-driven dynamical systems identification and control through **Koopman operator** theory and **reinforcement learning** (with **NPO Torino S.r.l**); Brain Computer Interfaces experiment design with EEG caps and data analysis, e.g. applications of **Topological Data Analysis** and **Random Convolutional Kernels** for feature extraction, (in collaboration with **g.tec**); Natural Language Processing projects on SOTA architectures, e.g. **Sentence Transformers** for assessing the readability of a text and HuggingFace x JAX Community Week project on the largest ever (1B parameters) sentence transformer.

Jun 2021 – Aug 2021 **Research Intern** – CERN, *Geneva, Switzerland*

- Contributed to *ROOT*, one of the largest scientific data analysis and Machine Learning **C++** packages (**1.6k+ stars**) by implementing low-level ROOT data structures conversion and designing methods for plotting several metrics, e.g. ROC Curve. I was a member of the TMVA team, part of the ROOT group supervised by *Lorenzo Moneta*

Aug 2020 – Jun 2021 **Visiting Student Researcher** – University of Ottawa, *Centre for Neural Dynamics, Ottawa, Canada* (Longtin's & Maler's Labs)

- Devised a recurrent neuronal network architecture (**Julia/Python/C++**) for sequential memory retrieval as part of my master thesis project: **Transients in Hippocampal Attractor Networks**, mainly based on Rabinovich's Winnerless Competition principle. This architecture can be considered as a dynamical alternative of Hopfield Nets, where instead of having stable fixed points for memories, we have saddle-points which are connected by a heteroclinic stable 1-D orbit. In this way, it is possible to memorize and retrieve sequences of events. U. of Turin's supervisor: Professor *Lamberto Rondoni*.

May 2020 – Dec 2020 **Lead Mentor** – University of Toronto, *ProjectX2020 Competition*

- Worked on **Physics Informed Neural Networks** (PINNs) techniques (in **Julia**) for wildfire propagation models. Achieved the first real-world scenario application of PINNs: paper accepted in AAAI-MLPS 2021
- Represented the *University of Turin*, as the **only Italian University**. Recruited and **supervised** *University of Turin's* team.

Jul 2019 – Sep 2019
Jul 2018 – Sep 2018 **Visiting Student Researcher** – University of Ottawa, *Centre for Neural Dynamics, Ottawa, Canada* , (Maler's Lab - In collaboration with André Longtin)

- Increased animal tracking accuracy by **33%** and reduced manual labelling time by **90%** by introducing **DeepLabCut** (based on CNNs) instead of non-Deep-Learning based softwares.
- Debugged previous animal tracking software (**MATLAB**-based) and coded several scripts in **Python** to extract relevant statistics for quantifying spatial learning in weakly electric fish and mice.

Feb 2017 – Apr 2018 **Research Assistant (Undergraduate)** – I.N.Ri.M, *Turin, Italy*, (Quantum Information, Genovese's Lab)

- Designed, ran and analyzed data for an experiment on the **violation of a Leggett-Garg inequality** (foundations of Quantum Mechanics).
- Mastered usage of several **nonlinear optics prototypes**: Single-Photon Avalanche Diode (SPAD) arrays, BBO4 crystals for Spontaneous Parametric Down Conversion, which helped me to develop a deeper understanding of imaging techniques relevant to neuroscience.

Consulting

Apr 2021 – Present **Machine Learning Consultant** – Freelance

- I work on several projects ranging from: designing Machine Learning pipelines for **biometric data** (e.g. WESAD Dataset), federated Machine Learning approaches for privacy preserving, natural language processing pipelines by designing custom architectures and preparing the national **industrial AI strategy** for *NPO Torino S.r.l* with **TIM Group**.

Presentations

Posters

Jan 2021 **Physics-Informed Machine Learning Simulator for Wildfire Propagation** – Mediterranean Machine Learning Summer School (www.m2lschool.org)

Sep 2018 **Active Electrosensing for Spatial Map Encoding in a Fish** – Neural Coding 2018, International Workshop on Theoretical and Computational Neuroscience (www.neuralcoding2018.unito.it)

May 2017 **Leggett-Garg Inequality Violation Exploiting Weak Measurements** – Quantum 2017, International Workshop on Quantum Optics and Quantum Information (www.quantum2017.unito.it)

Public Outreach

Feb 2021 **National TV News Program, TG1** – RAI, Radiotelevisione italiana (video excerpt)

- Presented Machine Learning Journal Club's work on Physics Informed Neural Network for wildfire spread prediction as a contribute in applications of Machine Learning to Climate Change.

Talks

Feb 2020 **Machine Learning Journal Club: Open Learning for Open Science** – Machine Learning Meets Chemistry, Department of Chemistry, University of Turin (Programme)

- Presented Machine Learning Journal Club as a contribution to Open Science.
- Discussed Graph Neural Networks applications in Fake News detection and Chemistry.

Leadership and Awards

Sep 2021 – Present **Mentee** – *LeadTheFuture*

- LeadTheFuture empowers top-performing students (acceptance rate $< 20\%$) to achieve their goals and contribute to their communities by giving them one-on-one (or two-on-one in my case) guidance from high-impact mentors coming from the world's leading STEM innovation hubs such as Silicon Valley and CERN.

Jun 2021 – Aug 2021 **Summer Student Scholarship** – *CERN, Geneva, Switzerland*

- Awarded a 10-weeks scholarship, selected **among +7k candidates**.

Jan 2021 **Outstanding Poster** – *Mediterranean Machine Learning School*

- Awarded a 700 EUR prize in Google Cloud resources. Poster presentation

Dec 2020 – Mar 2021 **Overseas Mobility Scholarship** – *University of Turin, Turin, Italy*

- Awarded a 4-months scholarship (**maximum allowed**) for my Master Thesis project

Aug 2020 - Jun 2021 **Visiting Student Researcher Scholarship** – *University of Ottawa, Ottawa, Canada*

- Selected as a recipient of this scholarship (**+20k CAD**) for my master thesis project.

Mar 2020 **International Admission Scholarship** – *University of Ottawa, Ottawa, Canada*

- Selected as the **only winner** of this international scholarship for research purposes (approx 132k CAD) in the March 2020 session to investigate the physical bases of path representation in neural networks that support memory formation and search strategies (conditional to PhD admission at U. of Ottawa)

Apr 2019 – Present **Founder & President** – *Machine Learning Journal Club, Turin, Italy*

- Created the **1st Italian** collaborative research project (*non-profit organization*) managed by students, in cooperation with the University of Turin.
- Obtained **+20k Euros** from both U. of Turin and several companies for research purposes
- I teach **Python** for Scientific Computing and practical Machine (and Deep) Learning to undergraduate and graduate students.

Apr 2019 – Apr 2021 **Co-opted Students Representative** – *Dept. of Physics, University of Turin*

- Designated as Students Representative by the Head of Physics of Complex Systems after the creation of the Machine Learning Journal Club.

Jul 2014 – Sep 2014 **Master Talenti Neodiplomati Scholarship** – *Fondazione CRT, Turin, Italy*

- Selected as **1 out of 103** eligible students (in my high school) for a *studying-working* 3-months experience as in Malta.

Jul 2013 – Sep 2013 **Banca Sella Scholarship** – *Banca Sella Group, Biella, Italy*

- Selected among the most promising students in the Province of Biella for a 10-weeks *studying-working* experience in the E-Commerce section.

Background Knowledge & Skills

Workshops

Aug 2021 **Neuromatch Academy: Deep Learning**

- 3 weeks intensive program on *Deep Learning Theory* and hands-on *Pytorch* implementations.

Jul 2021 **Eastern European Machine Learning Summer School**,*Deepmind (web-based due to Covid19)*

Jun 2021 **Regularization Methods for Machine Learning**,*University of Genoa (web-based due to Covid19)*

Apr 2021 **g.tec BCI & Neurotechnology Spring School**,*g.tec., (web-based due to Covid19)*

Jan 2021 **Mediterranean Machine Learning Summer School**, *Deepmind, (web-based due to Covid19)*

Dec 2020 – Feb 2021 **Personalized Multi-Scale Brain Simulation** *Bernstein Center for Computational Neuroscience, Berlin & Charité Doctorate Program* (web-based due to Covid19)

- Theoretical background of large-scale brain network modeling and practical session for individualization of brain network modeling, processing of brain images (MRI, fMRI, DTI, PET) and electrophysiological data (EEG, MEG)

Oct 2020 – Feb 2021 **InnoVentureLab Pre-accelerator Program** *Polytechnic University of Milan & Polytechnic University of Turin*

Oct 2020 – Dec 2020 **HelloAI RIS** *EITHealth*

- Training program designed to introduce participants to the field of AI in Healthcare. Mentored by experts from **GE**, **KTH** and **LEITAT**.

Jul 2020 **Lviv Data Science Summer School**, *Ukrainian Catholic University (web-based due to Covid19)*

May 2018 – Jun 2018 **Eight Summer School of the Centre for Neural Dynamics** *University of Ottawa, Ottawa, Canada*

- Simulated a "strokes toy model" by using **AllenSDK** for data retrieval.

Languages

Italian, *Native.* **English**, *Advanced.* **French**, *Elementary.*

Coursera's Specialization Programs

Dec 2020 - May 2021 **Natural Language Processing Specialization** – Deeplearning.ai (4/4 courses)

Apr 2020 - Present **Advanced Machine Learning Specialization** – HSE, Moscow (3/7 courses)

Apr 2020 - Present **AI for Medicine Specialization** – Deeplearning.ai (2/3 courses)

Apr 2020 - May 2020 **Information Visualization Specialization** – NYU, New York City (4/4 courses)

Apr 2020 - May 2020 **Tensorflow in Practice Specialization** – Deeplearning.ai (4/4 courses)

Mar 2020 - Apr 2020 **IBM AI Engineering Professional Certificate** – IBM (6/6 courses)

Julia Academy

Oct 2020 **Introduction to Julia (for Programmers)**

Oct 2020 **Julia for Data Science**

Interests & Side Projects

Hackathons

Oct 2021 **IEEE SMC 2021**, Virtual Br41n.io Hackathon.

- Achieved state-of-the-art classification error scores in sub-second settings on SSVEP data analysis by employing **Random Convolutional Kernels** for **feature extraction**.

Apr 2021 **Virtual BR41N.IO**, International Brain Computer Interface Hackathon.

- Won the competition by employing **Topological Data Analysis** techniques and **data augmentation** on ECoG time series.

Oct 2020 **BR41N.IO (Toronto)**, International Brain Computer Interface Hackathon.

- Worked on EEG data, introducing **Manifold Learning** techniques for a classification problem.

Nov 2019 **B-Pioneers** – organized by **Biogen** and **Wired**)

- Selected among 200+ candidates in order to create highly innovative solutions for people affected by **SMA** (**S**pinal **M**uscular **A**trophy). Devised a Machine Learning approach for predicting respiratory distress from biometric data.

Personal Projects

Feb 2021 – Present **LearningNLP**: A tutorial series on Natural Language Processing, mainly applied on Social Science problems.

- Designed, wrote and coded several tutorials with the aim of paving the way for NLP competitions, such as the CommonLit Readability Challenge. Source code at https://github.com/MachineLearningJournalClub/LearningNLP

Jun 2020 – Mar 2021 **GAMELEON**: A multi-agent simulation of Covid-19 epidemics in the city of Toronto.

- Processed **GIS** data and employed multiplex networks with Python (*multinetx*), multi-agent-systems with **GAMA** and gathered data through APIs (e.g. TomTom API for traffic data). Source code at https://github.com/MachineLearningJournalClub/GAMELEON/

May 2020 – Present **How to Tackle a Machine Learning Competition**: A tutorial series on practical Machine Learning and useful Data Science for competitions.

- I designed the entire series, wrote and coded a few lectures, as a propaedeutic material for the students I mentored for **ProjectX2020**. Source at https://github.com/MachineLearningJournalClub/HowToTackleAMLCompetition

May 2018 – Jun 2018 **MineNavigation**: Navigation Tasks in a Reinforcement Learning Framework

- Developed a Reinforcement Learning exploration strategy for my Minecraft Agent (Microsoft's **Project Malmo**). Source at terna.to.it/tesineEconofisica/navigation.htm

Volunteering

Mar 2020 – Jun 2020 **Covid-19 Forecasting** – Future of Humanity Institute, University of Oxford

- Built parts of database by annotating useful news. Project available at epidemicforecasting.org

Mar 2020 **Covid-19 News Tracker**, – University of Greenwich, ISI Foundation & Quick Algorithm

- Annotated news for sentiment analysis purposes. Project available at covid19.scops.ai

Sep 2017 – Mar 2018 **TEDxTorino**

- Collaborated as a translator (Italian to English) and as a member of Curators Team, responsible of guiding and supervising TEDx speakers.