



Giulia Raffaella De Luca

BIOMEDICAL ENGINEER

PROFILE

Born in Napoli (NA) il 20/02/1998

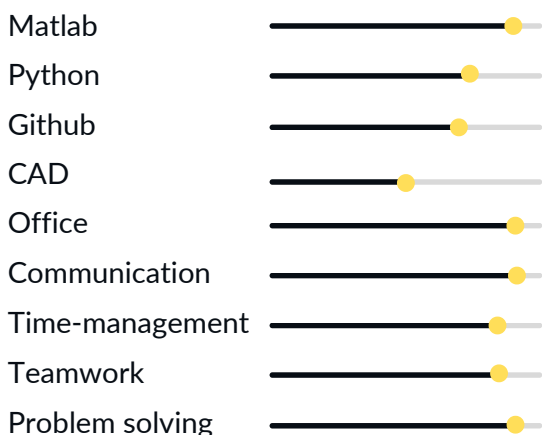
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SKILLS



SUMMARY

I graduated with a master's degree in Biomedical Engineering, specialized in 'Innovative Technologies in Diagnostics and Therapy' from Alma Mater Studiorum - University of Bologna in March 2023. I am currently a PhD student in the Health and Technology programme at the Department of Electronic and Information Engineering at the same university, and my research project focuses on the integration of artificial intelligence in lung cancer screening. In my free time, I enjoy playing basketball and embroidery, as well as exploring the sea and the mountains.

EDUCATION

Second Cycle Degree in Biomedical Engineering - Innovative Technologies in Diagnostics and Therapy

Alma Mater Studiorum - University of Bologna

September 2020 - March 2023

Final grade: 110/110 cum Laude

Type of credits: CFU (University Credits)

Number of credits: 120

Thesis: Patient Stratification in Lung Cancer Screening using SmileGAN

Supervisor: Prof. Stefano Diciotti

Co-supervisor: Dr. Matteo Lai

Abstract: While lung cancer remains the deadliest cancer worldwide, completed lung cancer screening trials have shown a significant decrease in lung cancer mortality, but at the price of a high overdiagnosis rate. This work aimed to assess the potential of SmileGAN, a generative adversarial network for semi-supervised clustering, in patient stratification for lung cancer screening. Since the completed lung cancer screening trials showed that the major causes of death in the screening cohort were cardiovascular disease, lung cancer, and respiratory illnesses, we wanted to ascertain whether SmileGAN was able to cluster these three cohorts of patients. In each of the three test scenarios, namely synthetic, semi-synthetic, and 'real-world', SmileGAN clustering performance surpassed the K-means one, reaching an accuracy of 0.58 and 0.97, respectively, in the cases where 3 or 2 clusters were considered.

During the thesis work carried out at the Department of Electrical, Electronic, and Information Engineering "Guglielmo Marconi," I extensively used Python, particularly the Pandas, NumPy, and Sci-kit libraries, as well as GitHub for publishing the developed scripts and version control. I also gained familiarity with Bash and Linux for executing scripts from the command window and with 3DSlicer, an open-source tool for pre-processing and processing biomedical images, for extracting emphysema data from Computed Tomography images. During the research, I used and evaluated the use of two Deep Learning algorithms, SmileGAN and K-Means, on data from two screening programs, ITALUNG and NLST. I also collaborated with Prof. Mario Mascacchi from the Department of Biomedical, Experimental, and Clinical Sciences "Mario Serio" at the University of Florence, consulting with him periodically throughout the work.

Courses:

- Applied Biochemistry
- Artificial Organs
- Bioelectromagnetism
- Laboratory of Wearable Sensors and Mobile Health
- Numerical Analysis and Linear Algebra
- Biological System Modeling
- Biomedical Instrumentation
- Biomedical Signal Processing and Machine Learning
- Biological Engineering
- Computational Cardiology
- Context Sensitive Design of Medical Devices
- Smart Medical Imaging
- Sensors and Nanotechnology

Advanced Training School "The Bioengineer and New Technologies in the Electrophysiology Room"

Alma Mater Studiorum - University of Bologna, Cesena Campus

01/06/2022 - 20/07/2022

Bachelor's Degree in Biomedical Engineering

Alma Mater Studiorum - University of Bologna, Cesena Campus

September 2016 - July 2020

Final grade: 95/110

Type of credits: CFU (University Credits)

Number of credits: 180

Thesis: Dosimetry and Radioprotection: Innovations introduced by Directive 2013/59/EURATOM and its implementation in Italy

Supervisor: Prof. Cristiana Corsi

Abstract: The objective of this work is to delve into the subjects concerning radioprotection in the medical domain and explore its intricacies. The first chapter elucidates the operational mechanisms of radiological equipment and the fundamental principles of physics underlying them. Subsequently, the second chapter presents the pivotal aspects of the aforementioned European directive, accentuating both its challenges and potential advantages upon its forthcoming implementation. The final section encompasses two studies that analyze the radiation exposure arising from medical procedures in Emilia-Romagna, thereby furnishing a tangible illustration and reinforcing the significance of directive compliance.

Characterizing courses:

- Signal Processing
- Electrotechnics
- Physiology
- Bioengineering
- Automatic Controls
- Electronics
- Mechanics of Solids for Biomedical Engineering
- Properties of Biomaterials
- Fundamentals of Biomechanics
- Fundamentals of Biomedical Instrumentation
- Clinical Engineering

PROJECTS

LetsMED: A decision support software for medical staff in adverse condition

Course: Context-sensitive design of medical devices

Prof. Stefano Severi, Prof. Johannes De Bie

Academic Year: 2021-2022

Contents: Standard ISO, EU Medical Device Regulation, Risk Analysis, Software Prototyping, mobileHealth

S.A.M. Project: Study of Alzheimer's disease under Microgravity condition

Course: Biological Engineering

Prof. Emanuele Domenico Giordano, Prof. Joseph Lovecchio

Academic Year: 2021-2022

Contents: Alzheimer Disease, Microgravity, Bioreactor, Lateral Flow Assay, CAD, Arduino

PARTICIPATION IN RESEARCH PROJECTS

“Progetto Pilota per un programma di screening per il tumore polmonare integrato con la cessazione del fumo: percorsi, selezione dei soggetti e protocolli diagnostici, in vista di una valutazione HTA”

01/04/2023 - Current

Funded by Ministero della Salute under CCM programme 2019 (Centro Nazionale per la Prevenzione ed il Controllo delle Malattie).

National coordinator: Dr. Marco Zappa, Istituto per lo Studio, la prevenzione e la rete oncologica - ISPRO, Firenze.

Research unit coordinator: Prof. Stefano Diciotti, DEI Department, University of Bologna

WORK EXPERIENCE

Postgraduate Researcher

01/04/2023 - 31/10/2023

Alma Mater Studiorum - University of Bologna

City: Cesena (FC), Italy

Title: Archive of CT Images and Evaluation of Diagnostic Support Systems for Lung Cancer Screening

Research Objectives: The activity focused on completing the development of a set of tools, partly already in place, capable of archiving Digital Imaging and Communications in Medicine (DICOM) images of chest Computed Tomography (CT) for lung cancer screening. The research was integrated into the "Pilot Project of a Lung Cancer Screening Program integrated with smoking cessation: pathways, subject selection, and diagnostic protocols, for HTA evaluation" funded by the National Center for Disease Prevention and Control (CCM) in 2019, under the Ministry of Health. The system was designed to be flexible and reconfigurable to adapt to the research needs in lung cancer screening programs, including the integration of Picture Archiving and Communication Systems (PACS) and diagnostic support systems. Additionally, the activity involved the evaluation of available diagnostic support systems for lung cancer within the project.

Tools:

- Python (main libraries: Pandas, Numpy, Matplotlib, Seaborn, TensorFlow, Keras, PyTorch)
- Linux
- GitHub
- 3D Slicer
- ImageJ
- MicroDicom

Academic Tutor

01/12/2021 - 31/10/2022

Alma Mater Studiorum - University of Bologna

City: Cesena (FC), Italy

Support activities for Biomedical Engineering study programs, including:

1. Participating in orientation initiatives
2. Monitoring student careers

Ice Cream Vendor

14/06/2021 - 30/09/2021

Gelateria Borgomarina - Magni Aurelia Fausta

City: Cervia (RA), Italy

Bartender

01/06/2017 - 30/09/2020

Open Space Lounge Bar

City: Cervia (RA), Italy

Accountant's Office Intern (seasonal)

01/06/2014 - 20/08/2016

Studio Commerciale Benini

City: Cervia (RA), Italy

POST - GRADUATE EDUCATION

MACHINE LEARNING course, Prof. Davide Maltoni

18/09/2023 - 18/12/2023

Course details: Master's Degree in Computer Engineering and Science (code: 8614)

Alma Mater Studiorum - University of Bologna, Cesena Campus

Course contents:

- Artificial Intelligence and Machine Learning
- Supervised and Unsupervised Learning
- Classification and Regression
- Classifiers: Bayes, k-Nearest Neighbor, Support Vector Machines, Multiclassifiers
- Clustering (K-means, EM) and Dimensionality Reduction (PCA, DA)
- Neural Networks (NN)
- Introduction to Deep Learning
- Convolutional Neural Networks (CNN)
- Recurrent Neural Networks (RNN)
- Reinforcement Learning (RL)

AI and Machine Learning for Healthcare Summer School

11/09/2023 - 15/12/2023

Cambridge Centre for AI in Medicine - University of Cambridge

Course contents:

- Data-centric AI
- Causal deep learning
- Uncertainty quantification
- Treatment effect estimation
- Self-supervised learning
- Automated machine learning (AutoML), with hands-on session
- Time-series modelling
- Regulatory/privacy issues
- Informatics infrastructure in healthcare
- Data management
- Real-world ML applications in cancer and cystic fibrosis

POST - GRADUATE EDUCATION

ASAI-ER: Advanced School in Artificial Intelligence in Emilia Romagna

Alma Mater Studiorum - University of Bologna, University Residential Centre at Bertinoro (Ce.U.B.)

17/07/2023 - 28/07/2023

Course contents:

- *Mathematics for artificial intelligence*
- *Introduction to Python programming*
- *Introduction to Machine Learning*
- *Python programming - hands on session*
- *Deep Learning*
- *Data Mining*
- *Data Analytics*
- *Natural Language Processing*
- *Computer Vision*
- *Logic programming with Prolog*
- *Knowledge engineering*
- *Intelligent agents*
- *Decision support systems*
- *Robotics*
- *Reinforcement Learning*

DEEP LEARNING course, Prof. Matteo Ferrara

24/03/2023 - 26/05/2023

Course details: Master's Degree in Computer Engineering and Science (code: 8614)

Alma Mater Studiorum - University of Bologna, Cesena Campus

Course contents:

- *Introduction to deep learning*
- *Linear algebra, calculus, and automatic differentiation*
- *Neural networks*
- *Backpropagation*
- *Optimization algorithms*
- *Convolutional Neural Networks (CNN)*
- *Recurrent Neural Networks (RNN)*
- *Transformers*
- *Autoencoders (AE)*
- *Generative models*
- *Reinforcement Learning (RL)*
- *Natural Language Processing (NLP) (practical example)*

POST - GRADUATE EDUCATION

Artificial Intelligence and Deep Learning with examples and applications in Medical Physics

Università degli Studi di Roma "Tor Vergata"

PhD Matteo Ferrante, PhD Tommaso Boccato

9/03/2023 - 24/03/2023

Course contents:

- *Types of learning, data visualization, and analysis.*
- *Data preparation and linear machine learning models (linear regression, logistic regression, SVM).*
- *Non-linear models, decision trees, evaluation metrics, XGBoost, ensemble learning, random forest.*
- *Unsupervised learning, clustering.*
- *Model selection, cross-validation, and hyperparameter tuning.*
- *Neural networks: mathematical and theoretical principles.*
- *Gradient descent.*
- *Convolutional, recurrent, and transformer neural networks.*
- *Types of tasks: classification, regression, segmentation, generation, stratification.*
- *Learning with few data: data augmentation, transfer learning, knowledge distillation.*
- *Explainability.*
- *Generative models, large-scale generative models: DALL-E, ChatGPT, and similar.*
- *Reinforcement learning.*
- *Graph learning, unsupervised learning, contrastive learning, multiple-instance learning.*
- *Physically constrained neural networks, GAN, diffusion models, spiking neural networks.*
- *Hands-on: Examples and code discussion in Python using libraries such as scikit-learn, PyTorch Lightning, weights and biases, and Captum, with examples of image classification and segmentation on biomedical data*

CONFERENCES AND SEMINARS

Screening Tumore Polmonare: Update e Problemi Aperti

15/12/2023, Pisa

Scientific Director: Prof. Laura Carrozzi

Duration: 8 hours

BrainGain: Revitalizing Talent for Local Impact

01/12/2023 - 02/12/2023, MUG - Bologna

Offered by: ART-ER Attrattività Ricerca Territorio, ADI Bologna

Scienza aperta e valutazione della ricerca

25/10/2023, Alma Mater Studiorum - University of Bologna

Open Science Week 2023

44th International Conference on Screening for Lung Cancer & 12th Conference on Research for Early Lung Cancer Treatment New Challenges and Solutions

29-30/06/2023, University of Verona, Ospedale Borgo Roma, Verona, Italy

Directors: Claudia Henschke, David Yankelevitz, Maurizio Valentino Infante

VIBRE: Lessons learned

11/07/2023, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Luca Talevi

Offered by: IEEE Student Branch - Bologna

Duration: 2 hours

CONFERENCES AND SEMINARS

Introduction to AI Ethics Alma Mater Studiorum - University of Bologna, Cesena Campus

12/05/2023, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Gabriele Graffieti

Offered by: Ambarella, AI for People

Duration: 3 hours

Counterfactual Explanations of (some) Machine Learning Models

27/03/2023, Online

Speaker: Prof. Fabrizio Silvestri

Offered by: DiSIA - University of Florence, ARTES 4.0

Duration: 1.5 hours

"Is attention all we need?" - The Transformer Architecture and Practical Examples

24/03/2023, Online

Speaker: Tommaso Boccato, PhD

Offered by: School of Specialization in Medical Physics - University of Rome "Tor Vergata"

Duration: 2 hours

Medical Device Development Process: From Idea to Marketing - Study Case: CHIARA Device

27/05/2022, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: PhD Alessandra Ventresca

Offered by: MediCon Ingegneria, Alma Mater Studiorum - University of Bologna

Duration: 3 hours

Development and Cooperation

25/05/2022, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: M.D. Angelo Stefanini

Offered by: Alma Mater Studiorum - University of Bologna

Duration: 3 hours

Open Source Medical Devices and the UBORA Platform

16/05/2022, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Prof. Carmelo De Maria

Offered by: University of Pisa, Alma Mater Studiorum - University of Bologna

Duration: 3 hours

Functional Safety in Biomedical Devices

07/04/2022, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speakers: Claudia Perazzini, Andrea Visotti

Offered by: ibd biomed, Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Introduction to Global Health

23/02/2022, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: M.D. Angelo Stefanini

Offered by: Alma Mater Studiorum - University of Bologna

Duration: 3 hours

The Semiconductor Crisis: A Wide but Personal Perspective

21/12/2021, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Prof. Alessandro Piovaccari

Offered by: Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Host-aware Construct Design for Cell Engineering

16/12/2021, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Dr. Francesca Ceroni

Offered by: Imperial College of London, Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Biological Control: From Synthetic Circuits to Living Dynamical Systems

15/12/2021, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Dr. Lucia Bandiera

Offered by: University of Edinburgh, Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Numerical and Experimental Techniques for Single Cell Analyses

14/12/2021, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Prof. Simone Furini

Offered by: University of Siena, Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Using a Microscope to Quantify Single Cell Level Fluorescence: From Edge Detection to Deep Learning

02/12/2021, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: PhD Marilisa Cortesi

Offered by: University of New South Wales (Sydney), Alma Mater Studiorum - University of Bologna

Duration: 2 hours

In vivo Electronic Sensors and Communication

01/12/2021, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Prof. Marco Tartagni

Offered by: Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Wearable Sleep Technology

26/03/2021, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speakers: Dr. Massimiliano de Zambotti, PhD Luca Menghini

Offered by: Translational Sleep Technology Unit, Human Sleep Research Program, SRI International, and Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Acute Care Therapies

26/11/2020, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Arianna Ferrari

Offered by: Medtronic, Alma Mater Studiorum - University of Bologna

Duration: 2 hours

Mechanical Circulatory Support: Limits of Applicability and New Concepts

19/11/2020, Alma Mater Studiorum - University of Bologna, Cesena Campus

Speaker: Giuseppe Ciccarello

Offered by: Abbott, Alma Mater Studiorum - University of Bologna

Duration: 2 hours