

Senigallia, AN

Carlo Mengucci

Scopus
GitHub:
CarloMengucci
OrcID:
0000-0003-0602-3003
ResearchGate:
Carlo-Mengucci
WOS:
GZG-7907-2022

EDUCATION

Ph.D. **2018 - 2022**

Alma Mater Studiorum - Università di Bologna

Dottorato di Ricerca in Nanoscienze per la Medicina e per l'Ambiente

Specific field of the degree course: General Chemistry-Applied Physics

Dissertation/thesis title: A Take on Complexity: Bio-Molecules and Human Metabolism Interaction

Modelling for Health and Nutrition with Machine Learning

Dissertation/thesis subject: General and Inorganic Chemistry-CHIM/03

Thesis supervisor: Francesco Capozzi

Master of Physics **2015-2018**

Alma Mater Studiorum - Università di Bologna

Specific field of the degree course: Applied Physics LM-17 - 2nd level degree in Physics

Dissertation/thesis title: WISDoM: Wishart Distributed Matrices Multiple Order Classification. Definition and Application to fMRI Resting State Data.

Final degree mark: 110/110 cum laude

Thesis supervisor: Enrico Giampieri

Bachelor of Physics **2011-2015**

Alma Mater Studiorum - Università di Bologna

L-30 - 1st level degree in Physics

Dissertation/thesis title: Modello Bayesiano per la regressione di dati troncati con applicazione a dati biologici

Thesis supervisor: Daniel Remondini

RESEARCH ACTIVITY & EXPERTISE

- Extensive Background in statistical and mathematical physics applied to omic sciences
- ¹H NMR Spectroscopy metabolomics
- Machine learning and advanced data analysis with Python
- Database creation and maintenance
- Complex network modelling
- Numerical methods for 2D NMR spectroscopy
- Imaging, TD-NMR and data integration for food structure characterization

RESEARCH EXPERIENCE

Researcher (Junior) **03/2023 - Ongoing**
DISTAL, UniBo *Cesena, FC*

Main activities and responsibilities:

Machine and Deep learning applied to NMR spectrometry and relaxometry for food structure characterization and biomarkers of intake detection. Omic sciences data integration for free living populations phenotyping (PE-10 ONFOOD).

Post Doctoral Fellow
CERM-CIRMMP, UniFi

03/2022 - 03/2023
Sesto Fiorentino, FI

Main activities and responsibilities:

In-vivo cell NMR kinetic studies. Digital biopsy modelling in the latent space, clustering and machine learning for in-vivo cells spectral data. Numerical methods for spectral data processing and MCR algorithms.

Research Grant, Collaborazione Coordinata e Continuativa
Università di Bologna-DISTAL, Bio-NMR Group

04/2018 - 07/2018
Cesena, FC

Main activities and responsibilities:

Development of multivariate models and learning algorithms for 1H NMR spectroscopy and MultiOmics data analysis in FOODBALL (The Food Biomarkers Alliance, Funding action: JPI HDHL JFA “Biomarkers for Nutrition and Health”, BioNH 2014), Contract: Prot.n.1149, 12/03/2018.

Internship, Tirocinio Curricolare
Università di Bologna-DIFA, Biophysics Group

08/2017 - 03/2018
Bologna, BO

Main activities and responsibilities:

Pipeline implementation and advanced server set-up for highly automated fMRI data analysis and machine-learning.

Internship, Collaborazione a Titolo Gratuito
Università Politecnica delle Marche-SIMAU

04/2017 - 06/2017
Ancona, AN

Main activities and responsibilities:

Dimensional analyses of metallic powders for additive manufacturing technology by machine-learning image-driven techniques.

Internship, Collaborazione a Titolo Gratuito
Università Politecnica delle Marche-Dipartimento di Medicina

10/2016 - 12/2016
Ancona, AN

Main activities and responsibilities:

Bayesian Modeling of First Aid intervention data and statistical characterization for logistic planning and resource optimization.

INTERNATIONAL COLLABORATION

INFOGEST Network

2019-Ongoing

Work Group 6 membership, in-silico simulation and advanced modelling of gastric digestion.

Research Internship
Technion, Israel Institute of Technology

09/2021-12/2021
Haifa, Israel

Project: Characterization of bioaccessibility and bioavailability of food grade carrageenans in meat based products and their implications on health.

Supervisor: prof. Uri Lesmes

PARTICIPATION IN PROJECTS

- **PATHWAY-27**, Pivotal assessment of the effects of bioactives on health and wellbeing. From human genoma to food industry. *Grant agreement No: 311876*
- **AIM**, Artificial Intelligence in Medicine. *Funding by INFN-CSN5*
- **FOODBALL**, The Food Biomarker Alliance. *Joint Funding Action, JPI HDHL JFA “Biomarkers for Nutrition and Health” (BioNH 2014)*

- **FUTUREEUAQUA**, Future growth in sustainable, resilient and climate friendly organic and conventional European aquaculture. *Funding by European Union's Horizon 2020 research and innovation program under Grant Agreement No: 817737*
 - **MARKAGE**, European Study to Establish Biomarkers of Human Ageing. *Grant agreement No: 200880, Funded under FP7-HEALTH*
 - **NUAGE**, New dietary strategies addressing the specific needs of elderly population for an healthy ageing in Europe. *Grant agreement No: 266486, FP7-KBBE*
 - **COST ACTION IG15209**, Nuclear Magnetic Resonance Relaxometry for Dairy Products. *Funded under E-COST, European Cooperation in Science and Technology*
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CONFERENCES AND SEMINARS

As Invited Speaker/Trainer:

- COST Action IG15209 - Nuclear Magnetic Resonance Relaxometry for Dairy Products, International Training School, *Practicing protocols of dairy product analysis from "A to Z" for industry members*, Cesena, Italy, 24-27/10/2022.

As Contributed/Selected Speaker:

- *Multi-scale Bone Remodeling Prediction in Patients Undergoing Total Hip Arthroplasty*, Padua Days on Muscle & Mobility Medicine (PDM3), Padova, 2022
- *Modelling Nutrients Kinetics and Bioaccessibility: the FOODBALL Study*, International Conference on Foodomics, Cesena, 2020, **Award Winning Oral Presentation**
- *Classification of Prostate Tumors from NMR Images Texture Analysis: a Machine Learning Approach*, INFN-Artificial Intelligence in Medicine, Pisa, 2020
- *WISDoM: Toward Correlation-Based Modeling of Neurological Data*, INFN-Biophys and Plexnet, Napoli, 2019
- *CHIMeRA - Complex Human Interactions in Medical Records and Atlases*, International Conference on Complex Systems, Trento, 2019
- *WISDoM: Wishart Distributed Matrices Multiple Order Classification. Database and Results*, INFN-Biophys and Plexnet, Arcidosso, 2018

Posters:

- MRFOOD, Aarhus, Denmark, 2022
 - ECMP-European Congress of Medical Physics, Torino, 2021
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AWARDS

Foodomics International Conference Award 2020

Nutrients Award for Best Oral Presentation, *Modelling Nutrients Kinetics and Bioaccessibility: the FOODBALL Study*.

TEACHING ACTIVITIES & THESIS SUPERVISION

Excercises in General Chemistry, CHIM/03, Scienze e Culture della Gastronomia **2022-2023**
Università di Bologna-DISTAL *Cesena, FC*

Role: Teaching Tutor, contr. 188027 (20 hrs)

Main Professor: Francesco Capozzi

Excercises in General Chemistry, CHIM/03, Tecnologie Alimentari **2022-2023**
Università di Bologna-DISTAL *Cesena, FC*

Role: Teaching Tutor, contr. 176473 (40 hrs)

Main Professor: Luca Laghi

Excercises in General Chemistry, CHIM/03, Tecnologie Alimentari
Università di Bologna-DISTAL

2021-2022
Cesena, FC

Role: Teaching Tutor, contr. 157324 (40 hrs)

Main Professor: Luca Laghi

OFA Suppletive Course, Physics and Chemistry, Tecnologie Agrarie
Università di Bologna-DISTAL

2020-2021
Bologna, BO

Role: Teaching Tutor, contr. 145061 (20 hrs)

Excercises in General Chemistry, CHIM/03, Tecnologie Alimentari
Università di Bologna-DISTAL

2020-2021
Cesena, FC

Role: Teaching Tutor, contr. 124181 (40 hrs)

Main Professor: Francesco Capozzi

Course in Pattern Recognition, FIS/07, Laurea Magistrale in Fisica Applicata
Università di Bologna-DIFA

2019-2020
Bologna, BO

Role: Guest Lecturer (8 hrs)

Main Professors: Gastone Castellani, Daniel Remondini

Thesis Supervision:

- Co-supervisor, Corso di Studio in Scienze e tecnologie alimentari [LM-DM270], Cesena, University of Bologna. Master Thesis : *Struttura sovra molecolare e autenticità degli alimenti: Applicazione delle curve di rilassamento nucleare 1H al caso delle mozzarelle di bufala campana D.O.P.*, Davide Rabiti, 2020
- Co-supervisor, Corso di Studio in Scienze e tecnologie alimentari [LM-DM270], Cesena, University of Bologna. Master Thesis : *Utilizzo di biomarcatori molecolari di consumo alimentare per la validazione dei risultati di strumenti nutrizionali convenzionali.*, Carlotta Bernabini, 2020

REFeree EXPERIENCE

Referee for MDPI Journals and Frontiers Journals. Check:

- [Loop](#)
- [OrcID](#)

SKILLS

Programming Python, C++, Git, R, L^AT_EX, Matlab, Markdown

Communication Italian (native), English (Europass level C1)

Other Unix Based OS, Microsoft Office, ChemoMx, TopSpin

PUBLISHED WORK

Metrics

- **Citations (all):** 27 (Scopus), 41 (Scholar)
- **H-Index:** ResearchGate, Scholar: 4; Scopus, Web of Science: 3
- **On Peer Reviewed International Journals:** 10
- **As First Author:** 9

On Peer Reviewed International Journals

*: Authors contributed equally

1. **Mengucci, C.*; Nissen, L.*;** Picone, G.; Malpuech Brugère, C.; Orfila, C.; Ricciardiello, L.; Bordoni, A.; Capozzi, F.; Gianotti, A. *K-Clique Multiomics Framework: A Novel Protocol to Decipher the Role of Gut Microbiota Communities in Nutritional Intervention Trials*. *Metabolites*, 2022, 12
2. **Mengucci, C.;** Ferranti, P.; Romano A.; Masi, P.; Picone, G.; Capozzi, F. *Food structure, function and artificial intelligence*. *Trends in Food Science & Technology*, 2022, 123
3. Picone, G.; **Mengucci, C.;** Capozzi, F. *The NMR added value to the Green Foodomics perspective: advances by machine learning to the holistic view on food and nutrition*. *Magnetic Resonance in Chemistry*, 2022, 60
4. **Simonetti, G.*; Mengucci, C.*;** Padella, A. et al. *Integrated genomic-metabolic classification of acute myeloid leukemia defines a subgroup with NPM1 and cohesin/DNA damage mutations*. *Nature Leukemia*, 2021, 35
5. **Mengucci C.;** Remondini D.; Castellani G.; Marrale M., Giampieri E. *WISDoM: a framework for the analysis of wishart-distributed matrices for neuroinformatics*. *Physica Medica*, 2021, 92
6. **Mengucci, C.;** Rabiti, D.; Urbinati, E.; Picone, G.; Romano, R.; Aiello, A.; Ferranti, P.; Capozzi, F. *Spotting Frozen Curd in PDO Buffalo Mozzarella Cheese Through Insights on Its Supramolecular Structure Acquired by 1H TD-NMR Relaxation Experiments*. *Applied Sciences* 2021, 11
7. **Danesi, F.*; Mengucci, C.*;** Vita, S.; Bub, A.; Seifert, S.; Malpuech-Brugère, C.; Richard, R.; Orfila, C.; Sutulic, S.; Ricciardiello, L.; Marcato, E.; Capozzi, F.; Bordoni, A. *Unveiling the Correlation between Inadequate Energy/Macronutrient Intake and Clinical Alterations in Volunteers at Risk of Metabolic Syndrome by a Predictive Model*. *Nutrients* 2021, 13
8. **Mengucci C.;** Remondini D.; Castellani G.; Giampieri E. *WISDoM: Characterizing Neurological Time Series With the Wishart Distribution*. *Frontiers in Neuroinformatics*, 2021, 14
9. **Biagi, E.*; Mengucci, C.*;** Barone, M.; Picone, G.; Lucchi, A.; Celi, P.; Litta, G.; Candela, M.; Manfreda, G.; Brigidi, P.; Capozzi, F.; De Cesare, A. *Effects of Vitamin B2 Supplementation in Broilers Microbiota and Metabolome*. *Microorganisms* 2020, 8
10. **Mengucci, C.;** Bordoni, A.; Capozzi, F. *Understanding the kinetics of nutrients bioaccessibility by modelling foodomics data*. *Current Opinion in Food Science* 2020, 31

Proceedings

1. Simonetti, G; Padella, A; **Mengucci, C;** Fonzi, E; Picone, G; Pazzaglia, M; Perricone, M; Fontana, M; Bruno, S; Bochicchio, MT. *PF197 A NEW CLASSIFICATION OF ACUTE MYELOID LEUKEMIA BASED ON INTEGRATED GENOMICS AND METABOLOMICS*. *HemaSphere*, 3, S1, 51, 2019
2. Simonetti, G; Padella, A; **Mengucci, C;** Fonzi, E; Picone, G; Pazzaglia, M; Perricone, M; Fontana, MC; Bruno, S; Bochic-Chio, MT. *INTRACELLULAR AND SYSTEMIC METABOLIC PROFILING OF ACUTE MYELOID LEUKEMIA IMPROVES GENOMIC CLASSIFICATION AND SUGGESTS NOVEL THERAPEUTIC TARGETS*. *Haematologica*, 104, 51-51, 2019
3. Simonetti, G; **Mengucci, C;** Padella, A; Fonzi, E; Picone, G; Delpino, C; Nanni, J; De Tommaso, R; Franchini, E; Papayannidis, C. *THE METABOLOMIC PROFILE DISTINGUISHES TWO SUBGROUPS OF NPM1-MUTATED ACUTE MYELOID LEUKEMIA WITH DIVERSE GENOMIC, TRANSCRIPTOMIC SIGNATURES AND TARGETED DRUG RESPONSE*. *Haematologica*, 105, S23-S23, 2020
4. Simonetti, G; **Mengucci, C;** Padella, A; Fonzi, E; Picone, G; Delpino, C; Nanni, J; De Tommaso, R; Franchini, E; Papayannidis, C. *METABOLIC STRATEGIES OF MYELOID BLAST SURVIVAL*. *Haematologica*, 107, 6-6, 2022

PhD. Dissertation Thesis:

A take on complexity: bio-molecules and human metabolism interaction modelling for health and nutrition with machine learning.

- **Supervisor:** Francesco Capozzi
 - **Co-Supervisor:** Daniel Remondini
 - **PhD Course:** Nanoscienze per la medicina e per l'ambiente, Ciclo 34
 - **SSD:** CHIM/03
 - **Keywords:** ¹H NMR, Machine Learning, Metabolomics, Health, Nutrition, Omic Sciences
 - **DOI:** 10.48676/unibo/amsdottorato/10198
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