

PROF. PIERANTONIO FACCO, PHD



PERSONAL DATA

Birth date and place: XXXXXXXXXXXXXXXX
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Citizenship: Italian

Permanent address: XXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXX

Fiscal code: XXXXXXXXXXXXXXXX

Mobile: XXXXXXXXXXXXXXXX

RESEARCH PROFILE

Pierantonio Facco is **Associate Professor** at the Department of Industrial Engineering of the University of Padova, where he earned a **M.S. in Chemical Engineer** and a **Ph.D. in Industrial Engineering**.

His **research interests** deal with the development of digital models to support chemical and process engineering activities, such as: product formulation and process development; process understanding and troubleshooting; process and product quality monitoring; digital twinning; process continuous improvement; process, product and technology scale-up/down and transfer; data fusion. His main activities are concerned with machine learning, deep learning, hybrid modelling, multivariate statistical process and quality monitoring and control, Quality-by-Design, adaptive and recursive systems, soft-sensing, process analytical technologies, development of artificial vision systems, treatment of -omics data, statistical and model-based design of experiments.

He is author of **>130 publications**, among which 2 book chapters, >70 conference proceedings and 62 papers in peer reviewed journals, also as corresponding author. His bibliometric indices are: H-index = 21 on Scopus with 1161 citations in 916 documents; 23 on Google Scholar with 1524 citations; 20 on Web of Science with 998 citations in 767 documents [data assessed on October 23rd, 2024]. He attended several international congresses, presenting different works, also as an invited speaker. He is referee of several prestigious scientific journals.

Prof. Facco acquired more than 1.5 M€ of research and commercial funding. He is involved in national and international academic collaborations (Imperial College London, University College London, Louisiana State University, Polytechnic University of Valencia, Pukyong National University, Rutgers University) and industrial partnerships (GlaxoSmithKline, Buhler, BASF, Casale, Versalis-Eni, Eli Lilly, Pfizer, Newchem, Fresenius Kabi, Merial/Sanofi, Novamont, Safilo, Unox, Sirca), also as a Principal Investigator.

Dr. Facco currently teaches *Machine learning for process industry* for the curriculum of Chemical and Process Engineering, *Quality control and data analytics in food production* for the curriculum of Food and Health, and *Transport phenomena* for the curriculum in Environmental Engineering at the University of Padova. He contributed to the organization and the realization of different courses and PhD schools, among which a MOOC (Massive Open Online Course) on *4.0 Shades of digitalization for the Chemical and Process industries* and a course of *Industrial Engineering Statistics* for the International Educational Hub between the University of Padova and Texas State.

The main skills of Dr. Facco's are: the ability to transfer research innovations to the industrial world, good communication ability, great attitude to teamwork and to conceive innovative solutions and to develop new research ideas.

CURRENT POSITION

Associate Professor, Department of Industrial Engineering, University of Padova (G.S.D. 09/ICHI-01, S.S.D. ICHI-01/C - Teoria dello sviluppo dei processi chimici)

- From February 12, 2021

Address: via Marzolo, 9
35131 Padova – Italy
Phone: +39.049.827.5470
E-mail: pierantonio.facco@unipd.it

Affiliate, INSTM, Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali, Florence (Italy)

- From 2020

Address: via G. Giusti 9
50121 Firenze – Italy

NATIONAL SCIENTIFIC QUALIFICATION AS FULL PROFESSOR

December 17th 2023 - December 17th 2034: **Italian National Scientific Habilitation as a Full Professor**

(Abilitazione Scientifica Nazionale a Professore di Prima Fascia)

Gruppo Scientifico Disciplinare: 09/ICHI-01 – Sistemi, metodi e tecnologie dell'Ingegneria Chimica e di Processo

PREVIOUS POSITIONS & RESEARCH EXPERIENCE

Affiliate, ISPE SIG Biotechnology – Data and process science

- 2021 – 2023

Assistant Professor (Ricercatore a Tempo Determinato di tipo b, s.s.d. ING-IND/26), Department of Industrial Engineering, University of Padova

- February 12, 2018 - February 11, 2021
- Teaching assignments: Data analytics and design of industrial experiments

Address: via Marzolo, 9
35131 Padova – Italy

Associate Researcher, INFN-LNL, Istituto Nazionale di Fisica Nucleare – Laboratori Nazionali di Legnaro

- July, 2018 – December 2022

Address: viale dell'Università, 2
35020 Legnaro (PD) – Italy

Post-Doc Researcher: Department of Industrial Engineering, University of Padova

- Post-Doc - Assegno di ricerca Senior 01/02/2016-31/01/2018
- Post-Doc - Assegno di ricerca Senior 01/02/2014-31/01/2016
- Post-Doc - Assegno di ricerca Senior 01/02/2012-31/01/2014
- Post-Doc - Assegno di ricerca 01/03/2011-31/01/2012
- Post-Doc - Assegno di ricerca 01/02/2009-31/01/2011

EDUCATION

2006-2008 **PhD in Industrial Engineering - Chemical Engineering** (March 6, 2009), Department of Chemical Engineering Principles and Practice, University of Padova

- Dissertation: "Development of multivariate statistical techniques for quality monitoring in the batch manufacturing of high value-added products"
- Supervisor: Prof. M. Barolo
- Co-supervisor: Prof. J. A. Romagnoli

2005: **Master of Science in Chemical Engineering** (October 21, 2005), Department of Chemical Engineering Principles and Practice, University of Padova

- Thesis: "Monitoring of a semi-batch polymerization process through multivariate statistical methods" (in Italian)
- Supervisor: Prof. M. Barolo

ACADEMIC INTERNATIONALIZATION ACTIVITY

2019: **Initiative of academic cooperation** (University of Padova):

- Invitation to Prof. Marianthi Ierapetritou (Rutgers University, USA)
- Subject: A process systems engineering perspective to advanced pharmaceutical manufacturing

March 30 - April 6, 2019: **Mobility for teaching under Program ERASMUS+** (University of Padova):

- Invitation to Dr. Simeone Zomer (GlaxoSmithKline, Ware, UK)
- Subject: Data analytics and modeling to accelerate the development of pharmaceutical products

INTERNATIONAL RESEARCH EXPERIENCE

March 2012: **Visiting researcher** at Intelligent System Laboratory, Department of Chemical Engineering, Pukyong National University, Busan (Korea)

- Project of International Academic Cooperation (granted by the International Research Service, University of Padova)
- Reference: Prof. J. J. Liu

July 2007 – January 2008: **PhD visiting student** at "Gordon A. and Mary Cain" Department of Chemical Engineering, Louisiana State University, 110 South Stadium Road, Baton Rouge, LA 70803 (USA)

- Project #1: development of both a metrology and a monitoring system for semiconductor manufacturing through multivariate and multiresolution techniques
- Project #2: virtual sensor for the online estimation of the top and bottom products in a pace distillation column
- Supervisor: Prof. J. A. Romagnoli

Service and management activity

ACADEMIC SERVICE AND MANAGEMENT

From 2021: **Member of the Statistical Studies Commission of the Engineering School**
(Commissione Statistica della Scuola di Ingegneria) University of Padova

From 2021: **Member of the board of the Master Degree program in Food & Health,**
University of Padova

From 2018: **Member of the board of the PhD program of Industrial Engineering**
(Collegio Docenti della Scuola di Dottorato in Ingegneria Industriale)
Department of Industrial Engineering, University of Padova

From 2018: **Member of the board of the Master Degree program in Chemical and
Process Engineering**
Department of Industrial Engineering, University of Padova

February 2018 – January 2021 and from January to September 2023: **Member of the
Department Board**
(Giunta di Dipartimento)
Department of Industrial Engineering, University of Padova

Scientific activity

SUMMARY OF THE MAIN BIBLIOMETRIC INDICES

| | Scopus | Web of Science | Scholar |
|------------------|--------|----------------|---------|
| H index | 21 | 20 | 23 |
| citations | 1161 | 998 | 1524 |
| documents | 916 | 767 | - |

PRESENT AND FUTURE RESEARCH INTERESTS

Current and future research interests involve:

- development of innovative techniques for the quality monitoring of high value-added products through multivariate and multiresolution methodologies
 - a) artificial vision systems for the characterization of materials, such as, granulated powders, nanostructured materials (semiconductors, nanofiber membranes)
 - b) development and implementation of adaptive systems for the multivariate statistical models updating to new process and plant conditions
 - c) anti-fraud and anti-sophistication technologies for pharmaceutical, manufacturing and food industries from data and sensor fusion
 - d) Quality-by-Design methodologies for the exploration and the characterization of the design space in the pharmaceutical industry through multivariate statistical techniques and Design of Experiments
- development and implementation of methodologies for *Big Data analytics in the Industry 4.0* perspective
 - a) data analytics, machine learning and deep learning for process understanding and data mining, pattern recognition and product/process classification, predictive and prescriptive purposes

- b) application of multivariate methods for Big Data volume compression
- c) application of pattern recognition techniques for the joint analysis and the visualization of wide volumes of Big Data with differentiated varieties
- d) application of methodologies for the real-time updating of models for Big Data velocity treatment
- e) assessing the veracity of Big Data dealing with multivariate statistical model parameter uncertainty
- development of digital twins for *multivariate exploratory analysis and data correlation extraction* in *biochemical processes*
 - a) development and industrial implementation of a framework to aid both the process scale-up and scale-down in biopharmaceutical processes
 - b) digital twins for data augmentation and in-silico experimentation
 - c) development of automatic tools for the real time cell line selection
 - d) stability and productivity cell lines performance mapping and prediction
 - e) process data fusion with –omics data
 - f) definition of optimal experimental protocols from dynamic design of experiments
 - g) definition of a host-specific culture management to condition the cell behavior to the desired performance through specific process settings and feeding strategies;
 - h) development of a methodology to identify targets for host engineering in terms of metabolites and metabolic pathways;
 - i) prediction of process performance in the continuous manufacturing scales from batch data available in the small scales and cell line progression in process transfer.
- development of methodologies to streamline the drug substance and the drug product development in the pharmaceutical industry through system digital twins in such a way as to:
 - a) characterize the parameter estimability with scarce data from the experimental campaigns;
 - b) reduce the cost of the experimental campaigns;
 - c) study the confidence associated to system models and reducing the uncertainty
 - d) enhance parameter estimation through hybrid models.
- novel methodologies for both the *product formulation* and the *process, product and technology transfer* between different production scales or different industrial sites, with particular attention to the application of the *Quality-by-Design* paradigm and the implementation of *Process Analytical Technologies* in the pharmaceutical industry
- development of technologies for the *real time process, product, and quality monitoring* based on *data fusion (adaptive process monitoring, soft sensing, artificial vision systems, hyperspectral data management)*
 - a) development of anti-fraud and anti-sophistication technologies for food characterization, authentication and labelling
 - b) adoption of multivariate Gaussian Mixture models and Hidden Markov models for process monitoring and soft sensing
 - c) exploration of kriging methodologies for soft sensing
 - d) comparison among non-linear multivariate statistical techniques and classical non-linear methodologies, such as neural networks and support vector machines
 - e) development of high-level structures for the performance monitoring of control systems
 - f) development of methodologies for the predictive maintenance in different industrial applications
 - g) development of novel multi-block and multivariate statistical techniques for managing different types of variables such as manipulated variables, measured variables and response variables

- innovative methodologies for the *multivariate Design of Experiments* (DoE) and *Model-based Design of Experiments* (MbDoE)
 - a) study of response hyper-surface methodologies from latent variable modelling
 - b) comparison of classical statistical DoE methodologies with multivariate DoE and latent variable inversion models
 - c) analysis and extension of methodologies for dynamic DoE
 - d) hybrid strategies, based on classical MbDoE and machine learning, for model-based design of experiments
- development of strategies for *multivariate exploratory analysis and data correlation extraction* in *biomedical applications*
 - a) study of the circadian features in RNA/DNA expression and –omics applications
 - b) data based modelling of the role of neuroblastoma-derived exosomes in cancer dissemination.

COORDINATION OF RESEARCH PROJECTS AND RESEARCH GRANTS

March 2024 – March 2025: **GlaxoSmithKline** - Biopharm Process Research, Stevanage (UK)

- Project: "Process trajectory understanding in support of biopharm bioreactor scale-up"
- 2nd amendment of the research agreement: 3000040130
- Grant: 120 000 €
- Referent: Mr. Gary Finka; Mrs. Paloma Diaz-Fernandez

May 2024 – May 2027: **Fondo per la Crescita Sostenibile - Accordi per l'innovazione**

- PI for the research unit of Padova for the project: "Digi-Spray Drying 4.0" Prog. n. F/350073/01-04/X60
- Proponent: NewChem (Verona, Italia)
- Grant: 537 062.5 €
- Referent: Dr. Emanuele Attolino

May 2023 – October 2026: **Casale**, Lugano (Switzerland)

- Project: "Development of artificial intelligence and machine learning methodologies for the optimization of laboratory experimental protocols in nitrogen industry 4.0"
- Grant: 120 000 €
- Referent: Dr. Alberto Biasin

November 2022 – January 2024: **GlaxoSmithKline** - Biopharm Process Research, Ware (UK)

- Project: "Development of multi-omics approaches for optimization in the feeding schedule in biopharmaceutical processes"
- 2nd amendment of the research agreement: 3000037096
- Grant: 110 000 €
- Referent: Mr. Gary Finka

November 2019 – May 2021: **GlaxoSmithKline** - Biopharm Process Research, Ware (UK)

- Project: "Lessons from failure: overcoming the survivorship bias on cell line selection and increasing cell line phenotypes understanding"
- Research agreement: 3000037096
- Grant: 75 000 €
- Referent: Mr. Gary Finka

June 2021 – May 2022: **Eni Versalis**, Mantova (Italia)

- Project: Exploratory analysis, process understanding and data fusion in fine chemical manufacturing
- Research agreement: 2500041990 under Framework Agreement 4400010240 between ENI and University of Padova

- Grant: 90 000 €
- Referent: Mrs. S. Varrasso

January 2021 – July 2021: **GlaxoSmithKline** – Process Engineering and Analytics, Ware (UK)

- Project: Accelerating drug substance development through data-driven reaction modelling
- Research agreement with INSTM
- Grant: 30 000 €
- Referent: Dr. S. Zomer

December 2020 – June 2021: **Safilo Industrial**, Padova (Italy)

- Project: Optimization of nichel-free galvanic processes for eyewear industry through machine learning
- Research agreement under POR FESR Veneto 2014-2020 research grant, ID 10229137
- Grant: 40 000 €
- Referent: Mr. Simone Zambelli Titton

November 2019 – May 2021: **GlaxoSmithKline** - Biopharm Process Research, Ware (UK)

- Project: Data-driven modelling for the characterization and performance prediction of biopharmaceutical cell-line platform data
- Research agreement: COL3000035536
- Grant: 67 000 GBP
- Referent: Dr. S. Zomer, Mr. Gary Finka

November 2018 – April 2021: **SID 2018** – Strategic Investment of the Department of Industrial Engineering for the innovative projects of excellence, University of Padova

- Research project: DATA-BIOscale: Data Analytics Tools to Aid BIOpharmaceutical SCALE-up/down
- Research action: BIRD 2018, University of Padova
- Grant: 34 938 €

August 2018 – April 2019: **GlaxoSmithKline** - Research & Development, Harlow (UK)

- Research project: Automatic maintenance of data-driven models for life-cycle product management in continuous pharmaceutical manufacturing
- Research agreement: BIDS3000033979
- Grant: 42 500 €
- Referent: Dr. S. Zomer

INDUSTRIAL COLLABORATIONS

May 2023 – October 2026: **Casale**, Lugano (Switzerland)

- Project: "Development of artificial intelligence and machine learning methodologies for the optimization of laboratory experimental protocols in nitrogen industry 4.0"
- Referent: Dr. Alberto Biasin

November 2022 – January 2024: **GlaxoSmithKline** - Biopharm Process Research, Ware (UK)

- Project: "Development of multi-omics approaches for optimization in the feeding schedule in biopharmaceutical processes" under the 2nd amendment of the research agreement: 3000037096
- Referent: Mr. Gary Finka

October 2021 – September 2022: **GlaxoSmithKline** - Biopharm Process Research, Ware (UK)

- Project: "Lessons from failure: overcoming the survivorship bias on cell line selection and increasing cell line phenotypes understanding" under research agreement: 3000037096
 - Referent: Mr. Gary Finka
- June 2021 – May 2022: **Versalis**, Mantova (Italy)
- Project: "A.L.I.C.E. - Analysis of Laboratory and Industrial scale in Chemical Environment – A Machine Learning approach to scale processes" under research agreement: Contratto applicativo 2500041990 Accordo Quadro 4400010240 ENI – Università degli Studi di Padova
 - Referent: Mrs. Simona Varrasso
- December 2020 – June 2021: **Safilo**, Longarone (Italy)
- Project: Optimization of nickel-free galvanic processes for eyewear industry through machine learning
 - Referent: Mr. Simone Zambelli Titton
- October 2020 – September 2023: **GlaxoSmithKline** – Process Engineering and Analytics, Ware (UK)
- Project: "Estimability and confidence of system models for pharmaceutical manufacturing"
 - Referent: Dr. Simeone Zomer
- October 2020 – September 2023: **BASF**, Bologna (Italy)
- Project: "Approaching process reliability through the smart use of sensor data in the Industry 4.0 era"
 - Referent: Dr. Matteo Ciccio
- October 2020 – September 2023: **Novamont**, Novara (Italy)
- Project: "An Industry 4.0 approach to the optimization of biopolymer production processes in territory-integrated biorefineries"
 - Referent: Dr. Daniele Turati
- November 2019 – May 2021: **GlaxoSmithKline** - Biopharm Process Research, Ware (UK)
- Project: "Data-driven modelling for the characterization and performance prediction of biopharmaceutical cell-line platform data" under research agreement: COL3000035536
 - Referent: Dr. Simeone Zomer, Mr. Gary Finka
- May 2019 – January 2020: **GlaxoSmithKline** – Consumer Healthcare (UK), Kingston upon Thames (UK)
- Project: "Analysis of process data for quality assessment in healthcare products"
 - Referent: Dr. Bob Sochon
- November 2018 – June 2020: **Eli Lilly**, Indianapolis (USA)
- Project: development of hybrid (multivariate statistics and Kalman filtering) monitoring systems in the pharmaceutical industry
 - Referent: Dr. S. Garcia-Muñoz
- March 2019 - September 2019: **BASF**, Pontecchio Marconi (Italy)
- Project: MVDA - approaching process reliability through sensors-data smart use
 - Referents: Dr. M. Ciccio
- August 2018 – February 2019: **GlaxoSmithKline** - Research & Development, Harlow (UK)
- Project: "Automatic maintenance of data-driven models for life-cycle product management in continuous pharmaceutical manufacturing" under research agreement: BIDS3000033979
 - Referents: Dr. S. Zomer
- March 2017 – May 2018: **GlaxoSmithKline** - Research & Development, Harlow (UK)

- Project: data-based characterization of a biopharmaceutical process and analysis of process scale-up
 - Referents: Dr. S. Zomer, Dr. G. Finka
- September 2017 – June 2018: **Unox**, Cadoneghe (Italy), and **Carel**, Brugine (Italy)
- Project: FSE project – Cloud data exploration and patterns analysis for predictive maintenance in Industry 4.0
 - Referents: Dr. M. Cammarota (Unox), Ing. M. Furlan (Carel)
- January 2016 – December 2016: **Unox**, Cadoneghe (Italy) and DII, Department of Industrial Engineering, University of Padova (Italy)
- Project: optimization of professional cooking ovens - energy efficiency, control systems, and development of hardware and software sensors: exploratory analysis of analytical systems; big data analysis and multivariate monitoring systems.
 - Referent: Dr. M. Cammarota, Prof. F. Dughiero
- January 2014 – December 2016: **Buhler** - Grain Processing Division, Uzwil (Switzerland)
- Project: development of data analysis methodologies to optimize grain continuous manufacturing and processing operations
 - Referent: Dr. E. Zamprogna
- October 2015 – April 2016: **GlaxoSmithKline** - Research & Development, Harlow (UK)
- Project: characterization a granulation product design space throughout different production scales
 - Referent: Dr. S. Zomer
- February 2015 – April 2016: **GlaxoSmithKline** - Research & Development, Harlow (UK)
- Project: operating phase recognition, batch identification and characterization by statistical techniques
 - Referent: Dr. S. Zomer
- January 2015 – December 2015: **Novamont**, Novara (Italy)
- Education and training program on multivariate statistical techniques and statistical process monitoring applied to process industry
 - Project: process understanding and soft-sensor development in an extrusion process for the production of MaterB™.
- February 2014 – January 2015: **Merial – Sanofi**, Noventa Padovana (Italy)
- Project: process understanding and troubleshooting, process and quality monitoring, and quality prediction in an infection process for the manufacturing of poultry vaccines
- June 2013 – November 2014: **GlaxoSmithKline** - Research & Development, Harlow (UK)
- Project: characterization of the continuous wet granulation process through multivariate statistical analysis: data management, process understanding, and process settings fingerprints on the critical quality attributes of the product
 - Referent: Dr. S. Zomer
- November 2012 – April 2013: **GlaxoSmithKline** - Research & Development, Harlow (UK)
- Project #1: development of data analysis methodologies to optimize continuous manufacturing and processing operations
 - Project #2: continuous wet granulation: data management, analysis & process monitoring to support process understanding, and risk management activities
 - Referent: Dr. S. Zomer
- September 2011 – May 2012: **Fresenius Kabi**, Cavezzo (MO, Italy)
- Project: development of a system for the measurement of fiber diameter in nanostructured assemblies; development of a graphic user interface of the measurement system
- October 2011 – May 2012: **GlaxoSmithKline** - Research & Development, Harlow (UK)

- Project: development of techniques for product transfer from batch granulation to continuous granulation and for process understanding and troubleshooting
 - Referents: Dr. S. Zomer, Dr. J. Robertson
- March 2010 – September 2010: **Pfizer Inc.**, Groton, NY (USA)
- Project: development of techniques for the process monitoring transfer in a spray-drying process
 - Referent: Dr. S. Garcia-Muñoz
- January 2006 – December 2008: **SIRCA S.p.A.** – Resins and coatings, via Roma, 85, San Dono di Massanzago (PD, Italy)
- Financial support to the PhD
 - Project: development and implementation of virtual sensors for the online estimation of product quality and for the real-time prediction of batch length

ACADEMIC COLLABORATIONS

From March 2023: **University College London** (U.K.)

- Co-supervision of F. Cenci, visiting PhD student at UCL
- Project: development of innovative explorative model-based DoE methodologies
- Referent: Prof. F. Galvanin

February 2022 – August 2022: **Imperial College**, London (U.K.)

- Co-supervision of Dr. G. Barberi, visiting PhD student at Imperial College
- Project: development of novel machine learning methodologies to support biopharma process development through GMM modelling
- Referent: Prof. C. Kontoravdi

From November 2015: **Universitat Politècnica de Valencia** (Spain)

- Co-supervision of D. Palacì-Lopez, visiting PhD student at the University of Padova
- Project: comparison of classical Design-of-Experiment methodologies based on (multivariate) response surface modelling and latent variable inversion techniques under uncertainty
- Referents: Prof. Barolo, Prof. A. Ferrer (Polytechnic University of Valencia)

November 2016 – August 2022: **BioEra**, University of Padova

- Co-supervision of Dr. Silvia Galvanin on the application of data analytics methodology for biomedical applications
- Co-supervision of Mr. Bicego on the application of data analytics methodology for biomedical applications
- Project: time expression of DNA/RNA sequencing data analysis for circadian rhythms identification
- Referent: Prof. N. Elvassore, University of Padova

2019-2022: collaboration with ERC project **MICRONEX**: Microbioreactor platforms as in vivo-like systems to probe the role of Neuroblastoma-derived Exosomes in cancer dissemination, University of Padova

- Co-supervision of Mr. L. Zanella.
- Data-based modelling the role of neuroblastoma-derived exosomes in cancer dissemination
- Principal investigator: Prof. E. Cimetta, University of Padova

February 2017 – December 2019: **Rutgers University** (USA)

- Co-supervision of Dr. Gabriele Bano
- Project: joint application of multivariate statistical techniques feasibility analysis for design space identification in the pharmaceutical sector

- Referent: Prof. Martianthi Ierapetritou

January 2010 – July 2010: **Department of Animal Science and Public Health**, University of Padova

- Project #1: standardization of portable NIR instrumentation for the analysis of animal foodstuff
- Project #2: development of anti-sophistication technologies in food industry
- Referent: Prof. P. Berzaghi (Department of Animal Medicine, Production and Health)

June 2010 – September 2011: **Department of Automation Engineering**, University of Padova

- Project: development of robust methods for image analysis
- Referent: Prof. P. Beghi (Department of Information Engineering, University of Padova)

CHAIRMAN/REVIEWER ACTIVITY, PARTICIPATION TO EDITORIAL BOARDS

Editorial board for international scientific journals:

- Review Editor for Frontiers in Chemical Engineering
- Guest Editor of special Issue: "Digital Design of Products, Processes and Operations in the (Bio)Pharmaceutical Industry", Processes, MDPI
- Guest Editor of special Issue: Selected Papers from the 11th Colloquium Chemiometricum Mediterraneum", Chemom. Intell. Lab. Sys., Elsevier

Chairman for international congresses:

- IFPAC 2023 - Manufacturing Innovation and the Global Regulatory Harmonization (Cortona, Italy), October 8-11. Active participant, session leader and chairman of a session on "Industry 4.0: machine learning, IT & data information management"
- Bioprocessing Summit Europe 2023 (Barcelona, Spain), Cambridge Healthtech Institute, March 14-16– Cell line development Session on March 16th.
- ENBIS-14 2014 (European Network for Business and Industrial Statistics; Linz, Austria), Session of "Process control & optimization", September 21–25.

Reviewer for international scientific journals:

- Scientific reports, AIChE Journal, Journal of Process Control, Chemical Engineering Science, Computers and Chemical Engineering, Bioengineering, Chemometrics and Intelligent Laboratory System, Industrial Engineering and Chemistry Research, Journal of Chemometrics, Analytica Chimica Acta, Frontiers, PlosOne, Journal of Control Science and Engineering, IEEE Transactions on Control Systems Technology, Sensors, Current Opinions in Chemical Engineering, Applied Sciences, Computers in Industry, Chemical Engineering Communications, Analytical Chemistry, Mathematics, Computers and Electronics in Agriculture, Journal of NIR Spectroscopy, Trends in Food Science & Technology, Journal of Engineered Fiber Fabrics, Quality and Reliability Engineering, Brazilian Journal of Chemical Engineering

Reviewer for international congresses:

- ESCAPE 34/PSE 24, ADCHEM 2021, IFAC 2014 18th IFAC World Conference 2011, ICheaP-10th International Conference on Chemical & Process Engineering 2011, 50th IEEE Conference on Decision and Control and European Control Conference 2011

Patents and technology transfer

PATENT

1. **Patent WO2024105005-A1** (2024): **Method for predicting production stability of clonal cell lines**

Selecting clonal cell line for producing therapeutic protein involves measuring product concentration of each clonal cell line, determining product concentration profile data, inputting product concentration profile data into learning model, and generating output indicating production stability.

Inventors: Benedetti A., **P. Facco**, R. C. Rowland-Jones

Patent Assignee: GlaxoSmithKline Intellectual Property

Derwent Primary Accession Number: 2024-536067; indexed: 2024-06-21.

International Patent Classification: C12M-001/34; C12M-001/36.

Patent detail: patent number: WO2024105005-A1; 23 May 2024.

Application number: US425886P; November 16th, 2022.

Local Filing Number: WOEP081700, 14 Nov 2023.

TECHNOLOGY TRANSFER

1. Software: eFiber (2012).

Subject: artificial vision system for microfiber diameter measurement from SEM images.

Industrial partner: Fresenius Kabi (Cavezzo, MO, Italy).

2. Software: ADAM (2022).

Subject: software for the metabolomics dynamics interpretation.

Industrial partner: GlaxoSmithKline (Ware, U.K.).

3. Software: COSMO (2024).

Subject: software for cell-line selection and process data analysis.

Industrial partner: GlaxoSmithKline (Ware, U.K.).

Publications

BOOK CHAPTERS

1. Palací-López, D., J. Borràs-Ferrís, **P. Facco**, M. Barolo, A. Ferrer (2024). Inverse design via PLS model inversion. In: *The Digital Transformation of Product Formulation - Concepts, challenges, and applications for accelerated innovation* (A. Schmid, K. Wallace), CRC Press – Taylor and Francis, 266-286.
2. **Facco, P.**, N. Meneghetti, F. Bezzo, M. Barolo (2018). Mining information from developmental data: process understanding, design space identification, and product transfer. In: *Multivariate Analysis in the Pharmaceutical Industry* (A. P. Ferreira, J. Cardoso Menezes, M. Tobyn Eds.), Elsevier, 267-292.

PUBLICATIONS ON PEER-REVIEWED JOURNALS

1. Barberi, G., C. Giacomuzzi, P. Facco (2024). Bioprocess feeding optimization through in-silico dynamic experiments and hybrid digital models - A proof of concept. *Front. Chem. Eng.*, 6, 124233 (**corresponding author**).
2. Barberi, G., A. Benedetti, P. Diaz-Fernandez, D. C. Sévin, J. Vappiani, G. Finka, F. Bezzo, **P. Facco** (2024). Productive CHO cell lines selection in biopharm process development through machine learning on metabolomic dynamics. *Accepted by AIChE J.* (**corresponding author**).
3. Zhu, Q, P. Facco, Z. Zhao, M. Barolo (2024). Capturing connectivity information from process flow diagrams by sequential-orthogonalized PLS to improve soft-sensor performance. *Chemom. Intell. Lab. Sys.*, 105192
4. Arnese-Feffin, E., **P. Facco**, F. Bezzo, M. Barolo (2024). Systematizing product design by latent-variable modeling – A unifying framework for the formulation and solution of PLS model inversion problems. *Chem. Eng. Sci.*, 120505.
5. Cenci, F., S. Diab, P. Ferrini, C. Harabajiu, M. Barolo, F. Bezzo, **P. Facco** (2024). Predicting drug solubility in organic solvents mixtures: A machine-learning approach supported by high-throughput experimentation. *Int. J. Pharma.*, 124233 (**corresponding author**).
6. Arnese-Feffin, E., **P. Facco**, D. Turati, F. Bezzo, M. Barolo (2024). Understanding fouling in an industrial biorefinery membrane separation process by feature-oriented data-driven modeling. *Ind. Eng. Chem. Res.*, accepted.
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39. Dal Pastro, F., **P. Facco**, F. Bezzo, H. Thomas, E. Zamprogna, M. Barolo (2015). Data-based multivariate modeling of a grain comminution process. In: *12th International Symposium on Process Systems Engineering and 25th European Symposium on Computer Aided Process Engineering*, K. V. Gernaey, J. K. Huusom and R. Gani Eds., May 31 – June 4, Copenhagen (Denmark), Elsevier B.V.
40. **Facco, P.** (2014). On the Effect of Prediction Uncertainty in the Design of New Pharmaceutical Products. *ENBIS 14*. September 21-25, Linz, Austria (**Invited talk**)
41. Meneghetti, N., **P. Facco**, F. Bezzo, M. Barolo (2014). Diagnosing process/model mismatch in first-principles models by latent variable modeling. In: *Computer-Aided Chemical Engineering 33, 24th European Symposium on Computer Aided Process Engineering*, J.J. Klemeš, P.S. Varbanov, P.Y. Liew Eds., Elsevier, June 15-18, Budapest (Hungary), 1897-1902.
42. **Facco, P.**, M. Ottavian, L. Fasolato, M. Barolo (2013). Toward species-independent foodstuff authentication from spectral data: the case of fresh and frozen-thawed fish. In Proc.: *VIII Colloquium Chemometricum Mediterraneum*. June 30 – July 4, Bevagna (Italy), 197-198. (**corresponding author**)
43. **Facco, P.**, E. Tomba, N. Meneghetti, T. Zelenková, A. A. Barresi, D. L. Marchisio, F. Bezzo, M. Barolo (2013). Transferring the manufacturing of a pharmaceutical nanoparticle product between different plants. In Proc.: *VIII Colloquium Chemometricum Mediterraneum*. June 30 – July 4, Bevagna (Italy), 86-87 (**corresponding author**).
44. **Facco, P.** (2013). Applications of Multivariate Image Analysis to the Quality Monitoring in the Manufacturing of High Value-added Products. In proc.: *II International Workshop on Multivariate Image Analysis*, May 23-24, Valencia (Spain) (**Invited talk**).
45. Meneghetti, N., E. Tomba, **P. Facco**, F. Lince, D.L. Marchisio, A.A. Barresi, F. Bezzo, M. Barolo (2013). Supporting the transfer of products between different equipment through latent variable model inversion. In: *Computer-Aided Chemical Engineering 32, 23rd European Symposium on Computer Aided Process Engineering* (A. Kraslawski and I. Turunen, Eds.), Elsevier, Amsterdam (The Netherlands), 511-516.
46. Ottavian, M., **P. Facco**, L. Fasolato, L. Serva, M. Mirisola, M. Barolo (2012). Authentication of fresh *Pseudopeneus prayensis* fillets using a portable NIR instrument. In: *NIR Italia – 5th Italian symposium of NIR Spectroscopy*, September 26-28, Agripolis - Legnaro PD (Italia).
47. Tomba, E., S. Garcia-Muñoz, **P. Facco**, F. Bezzo, M. Barolo (2012). A general framework for latent variable model inversion to support product and process design. In Proc.: *ESCAPE 22 - 22nd European Symposium on Computer Aided Process Engineering* (I. D. Lockhart Bogle and M. Fairweather, Eds.), June 17 - 20, London.
48. Riovanto, R., L. Serva, M. Mirisola, J. C. Ferlito, F. Benozzo, **P. Facco**, P. Berzaghi (2012). Pork fat composition calibration transfer between twonear infraredspectrometers using different multivariate standardisation approaches. In: *Proceedings of the 15th International Conference on Near Infrared Spectroscopy* (M. Manley, C.M. McGoverin, D.B. Thomas and G. Downey Eds.), Cape Town, South Africa, pp. 114-118.
49. **Facco, P.**, A. Masiero, F. Bezzo, M. Barolo, e A. Beghi (2011). Improved multivariate image analysis for quality control of nanofiber membranes. *IFAC 18th World Congress*, August 28 – September 2, Milan (Italy), 12066-12071 (**corresponding author**).
50. **Facco, P.**, E. Tomba (2010). Soft sensor for the characterization of fibrous materials through multivariate and multiresolution image analysis. In: *IEEE Sensors Conference 2010*, Waikoloa (Hawaii, USA), November 4-8, 1319-1324 (**corresponding author**).
51. **Facco, P.**, F. Benozzo, M. Barolo, P. Berzaghi (2010). Comparison between different standardization methods for the quality estimation of forages in portable NIR spectrometers. In: *Proc. NIR on the go 2010*, Padova (Italy), May 27-28, 23-25 (**corresponding author**).
52. **Facco, P.**, A. Faggian, F. Doplicher, F. Bezzo, M. Barolo (2008). Virtual sensors can reduce lab analysis requirements in the industrial production of specialty chemicals. In: *Proc. EMCC5 – 5th Chemical Engineering Conference for Collaborative Research in Eastern Mediterranean Countries*, Cetraro (Italy), May 24-29, 178-181.

53. **Facco, P.**, M. Olivi, C. Rebuscini, F. Bezzo, M. Barolo (2007). Multivariate statistical estimation of product quality in the industrial batch production of a resin. In: *Proc. DYCOPS 2007 – 8th IFAC Symposium on Dynamics and Control of Process Systems* (B. Foss and J. Alvarez, Eds.), Cancun (Mexico), June, vol. 2, 93-98.

CONFERENCE PROCEEDINGS

1. Barberi, G., J. Morrissey, B. Strain, C. Kontoravdi, **P. Facco** (2022). NEXT-FLUX (Neural-net EXtracellular Trained Flux Constraints) *2022 Virtual AIChE Annual Meeting*.
2. Barberi, G., A. Benedetti, P. Diaz-Fernandez, D. C. Sévin, J. Vappiani, G. Finka, F. Bezzo, **P. Facco** (2022). Accelerating cell lines selection in biopharmaceutical process development through machine learning on process and metabolomic dynamics information. *GRICU 2022*.
3. Castaldello, C., **P. Facco**, F. Bezzo, C. Georgakis, M. Barolo (2022). Data-driven optimization of freeze-drying unit using design of dynamic experiments. *GRICU 2022*.
4. Sartori F., Zuecco F., Facco P., Bezzo F., Barolo M. Coupling machine learning and engineering judgment to reduce the cycle time of an industrial batch process. *GRICU 2022*.
5. Cenci, F., G. Bano, C. Christodoulou, Y. Vueva, S. Zomer, **P. Facco** (2022). Development of model-based strategies to accelerate the experimental campaign for the production of oral solid dosage through direct compression. *GRICU 2022*.
6. Destro, F., S. Garcia-Munoz, **P. Facco**, F. Bezzo, M. Barolo (2020). Monitoring Loss-in-Weight Pharmaceutical Feeders through State Estimation. *2020 Virtual AIChE Annual Meeting*.
7. **Facco, P.**, Andrea C. Santomaso, Massimiliano Barolo (2016). An artificial vision system for the characterization of particle dimensions in granular materials (in Italian). *GRICU 2016*, Anacapri (Italy), September 12-14 (**corresponding author**).
8. Meneghetti, N., **P. Facco**, F. Bezzo, C. Himawan, S. Zomer, M. Barolo (2016). Characterization of particle dimension in granulated materials – An artificial vision system (in Italian). *GRICU 2016*, Anacapri (Italy), September 12-14
9. Bano, G., **P. Facco**, N. Meneghetti, F. Bezzo, M. Barolo (2016). Uncertainty characterization in the design space determination for the development of a new pharmaceutical product (in Italian). *GRICU 2016*, Anacapri (Italy), September 12-14
10. Dal Pasto, F., **P. Facco**, F. Bezzo, E. Zamprogna, M. Barolo (2016). Towards the modellization of grain milling processes (in Italian). *GRICU 2016*, Anacapri (Italy), September 12-14.
11. Meneghetti, N., **P. Facco**, F. Bezzo, M. Barolo (2014). Process/model mismatch diagnosis by latent variable modeling. *Presented at APM – Advanced Process Modelling Forum, London (U.K.)*, April 2-3.
12. **Facco, P.**, S. Bergonzini, M. Barolo (2012). Artificial vision system for the characterization of nanostructured devices for hemodialysis (in Italian). *In: Congresso Gr.I.C.U. 2012*, Montesilvano (Italy), September 16-19. (**corresponding author**).
13. **Facco, P.**, M. Ottavian, L. Fasolato, M. Barolo (2012). Characterization of product quality in food industry through multivariate statistical models (in Italian). *In: Congresso Gr.I.C.U. 2012*, Montesilvano (Italy), September 16-19. (**corresponding author**).
14. Tomba, E., **P. Facco**, F. Bezzo, S. García-Muñoz, M. Barolo (2012). Exploiting historical datasets to develop new products: applications to pharmaceutical industry (in Italian). *In: Congresso Gr.I.C.U. 2012*, Montesilvano (Italy), September 16-19.
15. Tomba, E., **P. Facco**, F. Bezzo, S. García-Muñoz, M. Barolo (2012). Transfer of process monitoring models between different plants (in Italian). *In: Congresso Gr.I.C.U. 2012*, Montesilvano (Italy), September 16-19.

16. Ottavian, M., **P. Facco**, M. Barolo, S. García-Muñoz (2012). Standardization of artificial vision systems for the characterization of pharmaceutical products (in Italian). *In: Congresso Gr.I.C.U. 2012*, Montesilvano (Italy), September 16-19.
17. Tomba, E., M. De Martin, **P. Facco**, F. Bezzo, S. Zomer, J. Robertson, M. Barolo (2012). Multivariate statistic tools to support continuous pharmaceutical process development: an industrial case-study. *In: Congresso Gr.I.C.U. 2012*, Montesilvano (Italy), September 16-19.
18. Tomba, E., **P. Facco**, F. Bezzo, S. García-Muñoz and M. Barolo (2011). Transferring monitoring models between different scales through multivariate statistical techniques. *In: AIChE Annual Meeting 2011*, Minneapolis (MN, USA), October 16-21 (**corresponding author**).
19. **Facco, P.**, F. Bezzo, and M. Barolo (2009). Online maintenance of multivariate statistical soft sensors for quality monitoring in batch processes. *In: AIChE Meeting 2009*, Nashville (TN, USA), November 8-13 (**corresponding author**).
20. **Facco, P.**, E. Tomba, M. Roso, M. Modesti, F. Bezzo, and M. Barolo (2009). Surface characterization and quality monitoring of polymer nanofibre membranes using multivariate image analysis. *In: AIChE Meeting 2009*, Nashville (TN, USA), November 8-13 (**corresponding author**).
21. **Facco, P.**, F. Bezzo, and M. Barolo (2009). Statistical process control: a tool for the implementation of PAT technologies (in Italian). *In Workshop: "Giornata di studio: Soluzioni PAT per il miglioramento dell'Efficienza e della Qualità nell'Industria Chimica e Farmaceutica"*, Milano (Italia), October 6.
22. **Facco, P.**, F. Bezzo, J. A. Romagnoli, M. Barolo (2008). Multiscale and multivariate monitoring of photolithographic processes for the manufacturing of integrated circuits (in Italian). *In: Proc. Congresso Gr.I.C.U 2008: Ingegneria Chimica, le nuove sfide*, Le Castella (Italia), September 14-17, 1383-1388.
23. **Facco, P.**, F. Bezzo, J. A. Romagnoli and M. Barolo (2008). Using digital images for fast, reliable, and automatic characterization of surface quality: a case study on the manufacturing of semiconductors. *In: Workshop on nanomaterials production, characterization and industrial applications*, December 3, Milano (Italy).

PUBLICATIONS ON TECHNICAL JOURNALS

- Barolo, M., F. Bezzo and **P. Facco** (2008). Virtual sensors for quality and process monitoring (in Italian). *ICP*, 36 (4), 82-84.

Presentations

INVITED TALKS

- May 23, 2024: *L'Intelligenza Artificiale come Futura Frontiera per l'Innovazione Chimica e Farmaceutica* (Milano), CPA - Chemical Pharmaceutical Generic Association
Invited talk: Digitalization in the (bio)pharmaceutical industry – Successful industrial case studies (in Italian)
- February 9, 2024: "Chemometrics tools for process monitoring" School, Modena (Italy), reference: Prof. M. Cocchi (University of Modena).
Invited talk: From process chemometrics to process metaverse
- November 16, 2023: *8th Fil Rouge Meeting – Applications on Digitalization* (telematic meeting), AIDIC and ATI, Associazione Termotecnica Italiana
Invited talk: Digitalization in the (bio)pharmaceutical industry – How to accelerate the development and support the large-scale production of pharmaceutical products
- October 9, 2023: *IFPAC* (Cortona, Italy) - Manufacturing Innovation and the Global Regulatory Harmonization
Invited talk: Machine learning to support the revolution of the (bio)pharmaceutical Industry 4.0
- March 16, 2023: *Bioprocessing Summit Europe* (Barcelona, Spain), Cambridge Healthtech Institute.
Invited talk: Anticipated cell line selection in biopharmaceutical process development through machine learning on metabolomics and process dynamics
- February 16, 2023: *Advanced Processes in Pharma*, Pharma Education Center.
Invited talk: Machine learning for (bio)pharmaceutical industry 4.0 – Successful industrial applications
- December 4, 2020: *EFCE Spotlight Talks webinar*: Quality by Design tools for the optimization of (bio)pharma processes system modelling, machine learning and digital twins, European Federation of Chemical Engineering.
Invited talk: Accelerating biopharmaceutical process scale-up/down through machine learning
- March 19, 2019: *Seminars*, INFN - Istituto Nazionale di Fisica Nucleare (Legnaro, Italy), reference: Dr. H. Skliarova (INFN).
Invited talk: Data analytics and design of experiments - Successful industrial applications
- February 7, 2018: "Chemometrics tools for process monitoring" School, Modena (Italy), reference: Prof. M. Cocchi (University of Modena).
Invited talk: Industrial applications of the Quality-by-Design paradigm in the pharmaceutical and food industries
- May 24, 2017: *NIRS & PAT*, Milano (Italy), reference: Prof. M. Casale (University of Genova).
Invited talk: Building the product quality "by design" – Applications in the pharmaceutical and food industries
- October 3, 2014: "Chemometrics tools for process monitoring" School, Modena (Italy), reference: Prof. M. Cocchi (University of Modena).
Invited talk: Product and process design in the pharmaceutical industry.

September 21 – 25, 2014: *ENBIS 14*, Linz (Austria), reference: Prof. M. Reis (University of Coimbra)

Invited talk: On the effect of prediction uncertainty in the design of new pharmaceutical products.

May 23 – 24, 2013: *II International Workshop on Multivariate Image Analysis*, Valencia (Spain), reference: Prof. A. Ferrer (Polytechnic University of Valencia).

Invited talk: Applications of multivariate image analysis to the quality monitoring in the manufacturing of high value-added products.

CONGRESS PRESENTATIONS

May 28, 2024: *Italian Chemometrics Workshop, University of Bologna*, Ravenna (Italy)

Oral presentation: Recent activities of process chemometrics @ CAPE-Lab (UniPD)

August 6 - 9, 2019: *FOPAM 2019 - Foundations of Process Analytics and Machine learning*, Raileigh, NC (U.S.A.)

Poster: Scale-up/down of a monoclonal antibody manufacturing bioprocess using data analytics

February 25-27, 2019: *Italian Workshop on Chemometrics*, Bergamo (Italy)

Oral presentation: Accelerating biopharmaceutical process scale-up/down.

June 10-13, 2018: *ESCAPE 28 – 28th European Symposium on Computer Aided Process Engineering*, Graz (Austria)

Oral presentation: Artificial vision system for the online characterization of the particle size distribution of bulk materials on conveyor belts.

May 10-12, 2017: *EuroPACT 2017*, Potsdam (Germany)

Oral presentation: Multivariate statistical approaches to aid pharmaceutical processes: product development and process monitoring in a Quality-by-Design perspective.

February 15-17, 2017: *Italian Chemometrics Workshop*, Vietri a Mare (Italy)

Oral presentation: Process chemometrics activities @ CAPE-Lab (UniPD) + Particle size characterization of granular materials through multivariate image texture analysis.

November 10 – 11, 2015: *Workshop on Methods for Accelerating Scalable Bioprocess Development - QbD oriented methodology for efficient and robust development of biopharmaceutical processes*, Wien (Austria)

Poster: Biopharmaceutical process monitoring: an industrial case study in avian vaccine manufacturing.

September 12 – 14, 2016: *GRICU 2016 – Horizon 2020 in Chemical Engineering*, Anacapri (NA, Italy)

Oral presentation: Characterization of particle dimension in granulated materials – An artificial vision system (in Italian).

September 12 – 14, 2016: *GRICU 2016 – Horizon 2020 in Chemical Engineering*, Anacapri (NA, Italy)

Oral presentation: Towards the modellization of grain milling processes (in Italian).

June 14 – 17, 2015: *14th Scandinavian Symposium of Chemometrics*, Chia (Italy)

Oral presentation: Monitoring an industrial batch process for the manufacturing of avian vaccines through Quality-by-Design methodologies.

June 14 – 17, 2015: *14th Scandinavian Symposium of Chemometrics*, Chia (Italy)

Poster: On how product quality specifications determine input parameters in the manufacturing sector.

February 25 – 27, 2015: *Italian Chemometrics Workshop*, University of Roma, Roma (Italy)

- Oral presentation: Bracketing the design space within the knowledge space in pharmaceutical product development.
- June 30 – July 4, 2013: *VIII Colloquium Chemometricum Mediterraneum*, Bevagna (Italy).
Oral presentation: Transferring the manufacturing of a pharmaceutical nanoparticle product between different plants.
- June 30 – July 4, 2013: *VIII Colloquium Chemometricum Mediterraneum*, Bevagna (Italy).
 Poster: Toward species-independent foodstuff authentication from spectral data: the case of fresh and frozen-thawed fish.
- May 21 – 23, 2012: *Italian Chemometrics Workshop*, University of Pavia, Pavia (Italy)
Oral presentation: Transfer of multivariate statistical models for process monitoring between different plants.
- November 4 – 8, 2010: *IEEE sensors 2010* (Wikoloa, HI, USA)
Oral presentation: Soft sensor for the characterization of fibrous materials through multivariate and multiresolution image analysis.
- June 15, 2010: *Statistica in azienda, statistici in azienda 2010* (Padova, Italy)
 Poster: Realtime multivariate statistical quality monitoring in the manufacturing of high value-added products.
- May 27 – 28, 2010: *NIR on the go 2010* (Padova, Italy)
Oral presentation: Comparison between different standardization methods for the quality estimation of forages in portable NIR spectrometers.
- November 8 – 13, 2009: *AIChE Meeting 2009* (Nashville, TN - USA)
Oral presentation: Online maintenance of multivariate statistical soft sensor for quality monitoring in batch processes.
- November 8 – 13, 2009: *AIChE Meeting 2009* (Nashville, TN - USA)
Oral presentation: Surface characterization and quality monitoring of polymer nanofiber membranes using multivariate image analysis.
- May 8 – 9, 2009: *Agorà della ricerca e dell'innovazione*, University of Padova, Padova (Italy)
 Presentation of the research activity: Innovative techniques for the quality monitoring of processes and high value-added products (in Italian).
- September 14 – 17, 2008: *GRICU 2008* (Le Castella, KR - Italy)
Oral presentation: Multiscale and multivariate monitoring of photolithographic processes for the manufacturing of integrated circuits (in Italian).
- May 24 – 29, 2008: *EMCC5 2008* (Cetraro, CS - Italy)
 Poster: Virtual sensor can reduce lab analysis requirements in the industrial production of specialty chemicals.
- June 4 – 8, 2007: *DyCoPS 2007* (Cancun - Mexico)
Oral presentation: Multivariate statistical estimation of product quality in the industrial production of resins.

Teaching activity

INSTITUTIONAL ACADEMIC TEACHING ACTIVITY

From academic year 2023-2024: **Machine learning for process industry**, University of Padova (Italy)

- Course for the M.S. in Chemical and Process Engineering curriculum
- SSD: ICHI-01/C

From academic year 2022-2023: **Quality control and data analytics in food production**, University of Padova (Italy)

- Course for the M.S. in Food and Health
- SSD: ICHI-01/C

From academic year 2021-2022 and 2022-2023: **Transport phenomena**, University of Padova (Italy)

- Course for B.D. in Environmental Engineering

From academic years 2022-2023: **Agri-food products market economy and Statistical methodologies for risk analysis** (in Italian), University of Padova (Italy)

- Course for B. D. in Food sanitary hygiene safety
- Computer lab of statistics

From academic year 2018-2019 to 2022-2023: **Data analytics and design of industrial experiments**, University of Padova (Italy)

- Course for the M.D. in Chemical and Process Engineering curriculum
- SSD: ING-IND/26

Academic year 2021-2022: **Biological systems engineering**, University of Padova (Italy)

- Course for B. D. in Biomedical Engineering

Academic years 2019-2020 and 2020-2021: **Principles of food microbial ecology and Methodologies for risk management** (in Italian), University of Padova (Italy)

- Course for B. D. in Food sanitary hygiene safety
- Computer lab on statistics

Academic years 2005 – 2006 and 2007 – 2008: **support teaching activity** “Unit operations” (Impianti chimici 1), Prof. Barolo, Department of Chemical Engineering Principles and Practice, University of Padova, Padova (Italy)

Evaluation of the students in the last Academic year (2023/2024):

| course | satisfaction | efficacy | organization |
|---|--------------|----------|--------------|
| Machine Learning for process engineering | 8.00/10 | 8.09/10 | 8.73/10 |
| Quality control and data analytics in food production | 8.13/10 | 7.78/10 | 8.61/10 |
| Transport phenomena | 6.86/10 | 6.38/10 | 7.33/10 |
| Agri-food products market economy and Statistical methodologies for risk analysis | 6.75/10 | 6.75/10 | 7.13/10 |

Supervisor of PhD Thesis in Chemical Engineering, University of Padova:

- Stefan M. (2024-2026, Department of Industrial Engineering, University of Padova): Development of machine learning and hybrid models for soft sensing in cement industry
- Tamiazzo E. (2023-2025, Department of Industrial Engineering, University of Padova): Development of artificial intelligence and machine learning methodologies for the optimization of laboratory experimental protocols in nitrogen industry 4.0
- Botton A. (2022-2024). MODO 4.0 – MODelling and Optimization in Industry 4.0: development of machine learning approaches.
- Cenci F. (2020-2023, Department of Industrial Engineering, University of Padova): Estimability and confidence of system models for pharmaceutical manufacturing.
- Barberi G. (2019-2022, Department of Industrial Engineering, University of Padova): Digital models to support monoclonal antibodies development in the biopharmaceutical industry 4.0

Supervisor of Research Assistants (Chemical Engineering, Department of Industrial Engineering, University of Padova):

- Barberi G. (2023-2024, Department of Industrial Engineering, University of Padova): Development of multi-omics approaches for optimization in the feeding schedule in biopharmaceutical processes.
- Castaldello C. (January 2022 – December 2022). Development of machine learning methodologies for the in-depth understanding of biological and engineering features of cell cultures and the cell culture selection in biopharmaceutical process development and scale-up.
- Botton A. (October 2021 – December 2021). Analysis of Laboratory and Industrial scale in Chemical Environment – A Machine Learning approach to scale processes.
- Viviani A. (July 2021 - September 2021). Exploratory analysis, process understanding and data fusion in fine chemical manufacturing, University of Padova.
- Viviani A. (January 2021 - June 2021). Data-driven modelling for the characterization of reaction kinetics in pharmaceutical drug substance development, University of Padova.
- Sponton E. (January 2021 - June 2021). Optimization of nichel-free galvanic processes for eyewear industry through machine learning, under Research agreement Safilo for POR FESR Veneto 2014-2020 research grant, ID 10229137, University of Padova
- Sponton E. (January 2021 - June 2021). Sviluppo di sensori virtuali multivariati e multi-risoluzione per la stima delle qualità nell'industria biofarmaceutica, University of Padova
- Sartori F. (November 2019 – September 2020). DATA-BIOscale: Data Analytics Tools to Aid BIOpharmaceutical SCALE-up/down, under Research action: BIRD 2018, University of Padova.
- Cattaldo, M. (August 2018 – March 2019). Automatic maintenance of data-driven models for life-cycle product management in continuous pharmaceutical manufacturing (granted by GlaxoSmithKline under Research agreement: BIDS3000033979)

Supervisor of MD Thesis in Chemical Engineering, University of Padova:

- Burato N. (2024, *work in progress*).
- Nalio P. (2024, *work in progress*).
- Cotalini L. (2024). Development of Transfer Learning techniques for the scale-up of biopharmaceutical processes
- Brendolan M. (2024). Improving the predictive ability of drug solubility in in-vitro intestinal fluids through hybrid modeling strategies.
- Davanzo M. (2023). Development of a machine learning framework for the multivariate monitoring of a continuous direct compression manufacturing process.

- Tamiazzo E. (2023). Enhancing the understanding of CHO cell culture metabolic traits through integrated first-principles modelling and data-based parameter estimation
- Sinigaglia L. (2023). Development of machine learning methods for the characterization of the product quality in the production of resins – An industrial case study.
- Mattiello M. (2023). Formulation of polyurethane foams through multivariate machine learning (in Italian).
- Guerra G. (2022). De' Longhi logistic flux redefinition through a "just-in-time" strategy.
- Sammartano G. (2021). Process understanding of the centrifugation of an active principle for the production of antibiotics through machine learning
- Giacomuzzi C. (2021). Optimization on biopharmaceutical production protocols through dynamic Design of Experiments on digital twins.
- Botton A. (2021). Data augmentation through digital twins to support quality monitoring in the biopharmaceutical industry.
- D'Alessandro S. (2021). Development of an industrial process of low-delamination pharmaceutical glass vials forming.
- Zanette M. (2021). Development of deep learning methodologies to diagnose serious diseases.
- Manente (2020). LLDPE-C4 spot price prediction to plan the purchase strategies through machine learning (in Italian).
- Tonion L. (2020). Comparison between different multivariate regression techniques for quality real-time estimation of product quality in batch processes.
- Acerbi T. (2020). Development of multivariate statistical techniques for data reconciliation in refinery heat exchangers.
- Viviani A. (2020). Data-driven reaction modelling to accelerate drug substance development.
- Sponton E. (2020). Multivariate and multi-resolution soft-sensor development in fed-batch fermenters for the production of penicillin. (in Italian)
- Sartori F. (2019). On the equivalence of null space and orthogonal space in multivariate statistical latent variable models. (in Italian)
- Barbiero M. (2019). Real-time monitoring of the transesterification reaction in biodiesel production
- Barberi G. (2019). Characterization of high-pressure CO₂ pasteurized food through machine learning and deep learning image analysis
- Zenari C. (2018). Scale-up of a biopharmaceutical process by Data Analytics techniques

Supervisor of BD Thesis in Chemical Engineering, University of Padova:

- Pozzebon C. (2024, *work in progress*).
- Brentegani F. (2024). Understanding and monitoring of a process for wastewater metals precipitation through principal component analysis (in Italian).
- Marzolla I. (2023). Forecasting and monitoring of air pollutants (CO e NO_x) in gas-turbines power plants through multivariate statistical methods (in Italian)
- Catalani I. (2023). Application of multivariate statistical methodologies in the food industry quality monitoring (in Italian)
- Gonzato E. (2021). Development of an automatic system based on Near-Infrared Red spectroscopy to estimate microbial load in seafood products (in Italian)
- Meneghin T. (2020). Applications of experimental design in the biopharmaceutical industry (in Italian)
- Letter L. (2019). Process and recipe optimization through design of experiments in the production of pet food (in Italian)

- Sammartano G. (2019). Design-of-experiments data analysis: a comparison among different commercial software (in Italian)
- Viviani A. (2018). Experimental design in biotechnological and biopharmaceutical applications (in Italian)
- Sgaravato D. (2018). Development of codes for image analysis for the quantification of important characteristics in biological samples (in Italian)

Co-supervisor of PhD Thesis in Chemical Engineering:

- Sartori F. (2020-2023). Approaching process reliability through the smart use of sensor data in the Industry 4.0 era.
- Arnese Feffin E. (2020-2023). An Industry 4.0 approach to the optimization of biopolymer production processes in territory-integrated biorefineries.
- Zanella L. (January 2019 – March 2021). Data-based modelling the role of neuroblastoma-derived exosomes in cancer dissemination (under European Project ERC: Microbioreactor platforms as in vivo-like systems to probe the role of Neuroblastoma-derived Exosomes in cancer dissemination – MICRONEX; Principal investigator: Prof. Elisa Cimetta)
- Destro F. (2018-2021 Department of Industrial Engineering, University of Padova): Digitalizing pharmaceutical development and manufacturing: advanced mathematical modelling for operation design, process monitoring and process control.
- Bano G. (2016-2018, Department of Industrial Engineering, University of Padova): Pharmaceutical development and manufacturing in a Quality-by-Design perspective: Techniques for design space description
- Palaci-Lopez D. (2015-2018, Department of Applied Statistics, Operational Research, and Quality, Polytechnic University of Valencia): Quality-by-Design (QbD) through multivariate latent structures
- Dal Pastro F. (2014-2016, Department of Industrial Engineering, University of Padova): Grain process optimization by data-based modelling
- Meneghetti N. (2013-2015, Department of Industrial Engineering, University of Padova): Implementing "Quality by Design" in the pharmaceutical industry: a data-driven approach
- Ottavian M. (2011-2013, Department of Industrial Engineering, University of Padova): Latent variable modeling to assist product quality characterization in the food and pharmaceutical industries
- Tomba E. (2010-2012, Department of Industrial Engineering, University of Padova): Development of multivariate and multiscale techniques for scale-up and quality control in the design of pharmaceutical processes

Co-supervisor of Research Assistants (Chemical Engineering, Department of Industrial Engineering, University of Padova):

- Gasparini L. (January 2022 – October 2022). Development of machine learning methodologies to generate in-silico data for batch process monitoring under small-data scenarios.
- Zanella, L. (January 2019 – October 2019). Data-based modelling the role of neuroblastoma-derived exosomes in cancer dissemination (under European Project ERC: Microbioreactor platforms as in vivo-like systems to probe the role of Neuroblastoma-derived Exosomes in cancer dissemination – MICRONEX; Principal investigator: Prof. Elisa Cimetta)
- Bicego, M. (November 2018 – January 2020). Time expression of DNA/RNA sequencing data analysis for circadian rhythms identification (granted by Fondazione Istituto di Ricerca Pediatrica "Città della Speranza")

Co-supervisor of MD Thesis in Chemical Engineering, University of Padova:

- Gaiani L. (2024). Data-driven modeling approach to investigate the tableting properties of three powder blends for pharmaceutical product development

- Beccaro L. (2023). Accelerating pharmaceutical tablet development by transfer of compaction equipment across types and scales.
- Fracassetto A. (2022). Batch process monitoring using an assumption-free modeling methodology
- Marchetto A. (2021). Machine learning approaches to enhance biopharmaceutical process monitoring under small-data scenarios
- Giacetti A. (2021). Reliability improvement of an industrial process for the production of a polymer additive through data analytics (in Italian)
- Gubert A. (2020). Multivariate image analysis for the microalgae concentration estimation in micro-bioreactors (in Italian)
- Zuecco, F. (2019). Multivariate data analysis to approach process reliability through sensors-data smart use
- Benedetti, A. (2018) Data analytics for powder feeding modelling on continuous secondary pharmaceutical manufacturing processes
- Matos, L. (2018). Comparison among different response surface strategies for the statistical design of experiments. Mobility program Erasmus+ from Universidade de Coimbra (Portugal)
- Sbroggiò, S. (2018). Design of dynamic experiments for the identification of data driven dynamic models
- Soprana, M. (2017). Characterization of the particle size distribution in granulated mixtures through multivariate image analysis (in Italian)
- Zocca, M. (2016). Multivariate statistical modelling to support pharmaceutical process development: an industrial case study
- Ibrahim, A. (2016). Methodologies for the mismatch diagnosis of first principles models in dynamic systems (in Italian)
- Dal Pastro, F. (2013). Analysis of the uncertainty on product and process development (in Italian)
- Meneghetti, N. (2012). Product transfer between different pieces of equipment through multivariate statistical techniques: application to a process of production of nanoparticles (in Italian)
- Largoni, M. (2012). Transfer of monitoring models of continuous and batch processes through multivariate statistical techniques (in Italian)
- Boschetti, L. (2012). Monitoring the quality of foodstuff along the production chain: the case study of Italian Speck (in Italian)
- De Martin, M. (2012). Multivariate statistical monitoring of a continuous granulation process for pharmaceutical industry
- Prà, N. (2010) Characterization of nanofiber membranes through image analysis (in Italian)
- Costa, E (2009). Batch statistical process monitoring: a comparison between global models, evolving models and moving average models (in Italian)
- Tomba, E. (2009). Development of techniques for the monitoring of polymer nanofiber membranes through multivariate image analysis (in Italian)
- Turazza, D. (2009). Design of virtual sensors for the real-time prediction of the batch duration in the industrial production of polyester resins (in Italian)
- Faggian, A. (2008). Development of soft sensors for the online quality estimation in an industrial process for the production of resins (in Italian)
- Tonizzo, M. (2007). Methods for the selection of the input variables in the development of soft-sensors based on multivariate statistical techniques (in Italian)
- Prando, T. (2007). Artificial neural network for the quality monitoring in an industrial polymerization process (in Italian)

Co-supervisor of BS Thesis in Chemical Engineering, University of Padova:

- Scanferla, M. (2019). Clinical data analysis for the characterization of Von Willebrand disease (in Italian).
- Tonion, L. (2017). Statistical Design of Experiments to aid quality improvement in a fed-batch fermentation process for the production of penicillin (in Italian).

MASSIVE ONLINE OPEN COURSES

November 2022: **MOOC "4.0 shade of digitalization for chemical and process industry"**, University of Padova (Italy)

- Organization, coordination and lecturing
- Lessons on: Machine learning: unsupervised and supervised learning, Multivariate data dimensionality reduction, Multivariate process monitoring, Latent-variable modelling, Projection on latent structures.

SECOND-LEVEL MASTER COURSES

From academic years 2020-2021: **Master in "Quality technologist for pharmaceutical industrial processes"**, UniSMART, University of Padova (Italy)

- Introduction to the statistical approach for QbD and examples of industrial applications

PHD SCHOOLS

March 2021: **GrICU PhD School 2024**, National PhD School in Chemical Engineering (Bardonecchia, Italy)

- Lecture: Machine learning and multivariate statistics for process industry: theory and applications (January 18)

March 2021: **GrICU PhD School 2021 – Digitalization tools for the chemical and process industries**, National virtual PhD School in Chemical Engineering (Italy)

- Lecture 1: Introduction to the Design of Experiments (March 11)
- Lecture 2: Data analytics for regression and classification: Projection on Latent Structures (PLS) (March 12)

September 11 and 18, 2020: **IoT/Big Data Digital transformation in manufacturing and process industries**, Master in Sustainable Innovation for Glasses, Fashion and Sport Industries, Certottica (Longarone, Italy)

PhD School in Industrial Engineering, Department of Industrial Engineering, University of Padova (Italy)

- Course 1: Data Analytics fundamentals, July 10-13 2018
- Course 2: Introduction to Design of Experiments, July 24-27 2018
- Course 3: Machine Learning for Industry 4.0, June 29-July 7 2021

July 5 – 7, 2017: **Big Data summer school in Chemical Engineering 2017**, Bologna (Italy), **Invited lecturer**, reference: Prof. Cozzani (University of Bologna)

- Lecture 1: Laboratory on multivariate statistical methods
- Lecture 2: Laboratory on multivariate statistical methods in batch processes and non-standard applications
- Lecture 3: Industrial applications on multivariate statistical techniques

OTHER TEACHING ACTIVITIES

September 2020: **Artificial Intelligence and Machine Learning for Industry 4.0**, SMICT Competence center (Padova Italy)

- Lectures: machine learning and design of experiments

July 2020: **Machine learning and design of experiments for industry 4.0**, Safilo (Italy)

- Lecture 1: Machine learning and statistics in process industry (July 14)
- Lecture 2: Process understanding through principal component analysis (July 19)
- Lecture 3: Introduction to design of experiments (July 20)
- Lecture 4: Process data analytics & machine learning for Industry 4.0 (July 23)

September - October 2020: **Multivariate data analysis for R&D and industrial data – GSK Training Course 2020**, GlaxoSmithKline LLC (Wilmington, Delaware, USA)

- Lecture 1: Machine learning and multivariate statistics (September 22)
- Lecture 2: Process understanding through PCA (September 25)
- Lecture 3: Process and quality monitoring (September 29)
- Lecture 4: Prediction and classification through PLS (October 2)
- Lecture 5: Successful industrial applications (October 6)

June 2014 – July 2014: Introductory Lectures on “**Process dynamics and control and Statistical process control**”, FSE Action Research, Forema – Confindustria (Padova, Italy) and SIRCA S.p.A. (San Dono di Massanzago, Italy)

Other activities

ORGANIZATION OF INTERNATIONAL CONGRESSES

June 27-30, 2023: **"XI Colloquium Chemometricum Mediterraneum"**, Padova 2023:

- Full organization of the congress
- Website: <https://ccm2023.gruppochemiometria.it>

ORGANIZATION OF SEMINARS AND WORKSHOPS

October 21, 2022: **"DigiFarm 4.0 - Come la digitalizzazione può accelerare lo sviluppo e la produzione su larga scala di nuovi farmaci"**, DIGITALmeet 2022 (in Italian):

- "Come la digitalizzazione può accelerare sviluppo e produzione su larga scala di farmaci" P. Facco (University of Padova)
- "Ruolo della digitalizzazione nello sviluppo e produzione di nuovi farmaci: il caso GSK" G. Bano (GlaxoSmithKline)
- "Trasformazione digitale nel sito Teva di Santhià" G. Terranella (Teva Pharmaceuticals)

October 18, 2019: **Workshop "Verso Industria 4.0 - Digitalizzazione nell'industria chimica, di processo e manifatturiera"** (University of Padova):

- "SMACT –Il CompetenceCenter del Nord-Est" F. Dughiero (SMACT, University of Padova)
- "Utilizzo di metodi statistici per l'ottimizzazione di processi per la produzione di biopolimeri" D. Turati (Novamont, Novara)
- "Analytics di dati acustici per il controllo in linea della qualità" M. Toppano (Electrolux Italia)
- "Il programma #digitalSaras" G. Terranella (Saras)
- "Piattaforme collaborative che integrano realtà virtuale, realtà aumentata e intelligenza artificiale nello sviluppo di gemelli digitali per l'industria di processo" M. Rovaglio (Siemens)
- "La digitaltransformation di Versalis" E. Mantovani (EniVersalis)
- "Dai sensori ai big data – Dagli algoritmi avanzati alle azioni ottimali" M. Cicciotti and S. Hoerer (BASF)
- "Ruolo di digitalizzazione e data science per la progettazione di formulazioni in fase fluida e dei relativi processi produttivi" V. Guida (Procter&Gamble)

- “Smart Energy: come rendere l'energia e i processi industriali efficienti, sostenibili e al contempo cogliere i benefici fiscali proposti dal piano nazionale Impresa 4.0” A. Calabrese (Schneider Electric)

February 3, 2017: **Workshop “Quality by Design: un’opportunità per l’industria farmaceutica”** (University of Padova):

- “Aspetti regolatori del Quality by Design” F. Salvatore (Stabilimento Chimico Farmaceutico Militare, Firenze)
- “QbD come strumento di ingegnerizzazione della Qualità e del Business, al servizio del trasferimento tecnologico del processo di confezionamento farmaceutico” F. Marrani e T. Pernarella (AbbVie, Latina)
- “Data analytics per il Quality by Design: alcune applicazioni industriali” M. Barolo (Università di Padova)
- “Quality-by-Design nello sviluppo e scale-up di processi di liofilizzazione di farmaci” D. Fissore (Politecnico di Torino)
- “Quality-by-Design nell’industria biofarmaceutica: esperienze e casi studio dal mondo dei vaccini” F. Titta (GSK Vaccines, Siena)
- “Quality by design nell’ottimizzazione analitica, farmaceutica e di processo” S. Furlanetto (Università di Firenze)
- “Applicazione di disegni sperimentali per ottimizzare il processo produttivo e la qualità di polveri inalatorie” F. Buttini (Università di Parma–RCPE Graz)
- “Applicazione della spettroscopia Raman in-line nell’ottimizzazione di processi di cristallizzazione di principi attivi farmaceutici e loro intermedi sintetici” M. Stivanello (Lundbeck Pharmaceuticals Italy, Padova)

April 16, 2010: **Workshop - DIPIC 2010: “Model-based Innovation in the Process Industry”** (University of Padova):

- “Modelling of accidents in the process industry for the training of operators” Prof. Davide Manca (Politecnico di Milano)
- “Modelling and innovation for the development of a novel technology for the desulfurization of combustion gas” Mirko Garbero (Gesco S.r.l., SV)
- “CFD applications in the development of new processes and in the scale-up: examples and future perspectives” Prof. Antonello Barresi (Politecnico di Torino)
- “Examples of CFD applications in ENI” Fabrizio Podenzani (ENI Refining & Marketing, MI)

March-May, 2010: **DIPIC Seminars 2010 for PhD students** (University of Padova):

- “Monitoring and process Diagnostics” Prof. C. Scali (CPC-Lab, University of Pisa) - March 19, 2010
- “Process monitoring” Prof. A. Beghi (University of Padova) - March 26, 2010
- “Bioengineering” Prof. A. Serra (University of Cagliari) - April 23, 2010
- “Risk analysis” Prof. Valerio Cozzani (University of Bologna) and Giovanni Ugucioni (D'Appolonia S.p.A.) - April 23, 2010
- “Computational fluid dynamics” Prof. Pier Luca Maffettone (University Federico II of Napoli) and Prof. Francesco Paolo Di Maio (University of Calabria) - May 7, 2010
- “Empirical modelling on product formulation” Vincenzo Guida (Procter & Gamble) - May 12, 2010
- “Product Design” Prof. Mario Grassi (University of Trieste) and Massimo Bresciani (GlaxoSmithKline) - May 14, 2010

ATTENDANCE TO CONGRESSES AND WORKSHOPS

May 27-29, 2024: *ESCAPE 34 – PSE 24 – 28th European Symposium on Computer Aided Process Engineering – 24th Process Systems Engineering*, Firenze (Italy)

May 27-29, 2024: *Workshop Chemiometria*, University of Ravenna, Ravenna (Italy)

March 14-16, 2023: *Bioprocessing Summit Europe*, Barcelona (Spain)

August 6 - 9, 2019: *FOPAM 2019 - Foundations of Process Analytics and Machine learning*, Raileigh, NC (U.S.A.)

June 10-13, 2018: *ESCAPE 28 – 28th European Symposium on Computer Aided Process Engineering*, Graz (Austria)

October 1-5, 2017: *WCCE 10 – 10th World Congress on Chemical Engineering*, Barcelona (Spain)

May 24, 2017: *NIRS & PAT*, Milano (Italy)

May 10-12, 2017: *EuroPACT 2017*, Potsdam (Germany)

February 15-17, 2017: *Workshop Chemiometria*, Vietri a Mare (Italy)

November 10 – 11, 2016: *Workshop on Methods for Accelerating Scalable Bioprocess Development - QbD oriented methodology for efficient and robust development of biopharmaceutical processes*, Wien (Austria)

September 12 – 14, 2016: *GRICU 2016 – Horizon 2020 in Chemical Engineering*, Anacapri (Italy)

June 14 – 17, 2015: *14th Scandinavian Symposium of Chemometrics*, Chia (Italy)

February 25 – 27, 2015: *Workshop Chemiometria*, University of Roma, Roma (Italy)

September 21 – 25, 2014: *ENBIS 14*, Linz (Austria).

June 30 – July 4, 2013: *VIII Colloquium Chemometricum Mediterraneum*, Bevagna (Italy)

May 23 – 24, 2013: *II International Workshop on Multivariate Image Analysis*, Valencia (Spain)

September 16 – 19, 2012: *GRICU 2012 - Chemical Engineering from nanoscale to macroscale*, Montesilvano (PE, Italy).

July 17 – 20, 2012: *ESCAPE 22 - European Symposium on Computer Aided Process Engineering*, University College, London (UK)

May 21 – 23, 2012: *Workshop Chemiometria*, University of Pavia, Pavia (Italy)

June 22, 2010: *mcT Tecnologie for Food industries 2010*, Bologna (Italy)

June 15, 2010: *Statistica in azienda, statistici in azienda 2010*, University of Padova, Padova (Italy)

May 27 – 28, 2010: *NIR on the go 2010*, University of Padova, Padova (Italy)

May 11, 2010: *Pharmintech 2010: Designing quality, efficiency and sustainability into pharmaceutical processes*, Bologna (Italy)

December 2 – 3, 2009: *1st Mass Spectroscopy Food Day*, Barilla Lab, Parma (Italy)

November 8 – 13, 2009: *AIChE Meeting 2009*, Nashville, TN (USA)

October 21, 2009: *Industrial artificial vision, Panasonic Electric Works*, Bussolengo, VR (Italia)

June 11, 2009: *VforM – Vision for manufacturing 2009*, Milano (Italy)

June 14 – 17, 2008: *GRICU 2008: new frontiers of Chemical Engineering*, Le Castella, KR (Italy)

May 24 – 29, 2008: *EMCC5 2008: 5th Chemical Engineering Conference for Collaborative Research in Eastern Mediterranean Countries*, Cetraro, CS (Italy)

June 4 – 8, 2007: *DyCoPS 2007, 8th IFAC Symposium on Dynamics and Control of Process Systems*, Cancun (Mexico)

June 6 – 8, 2006: *PSE/ESCAPE 2006*, Process System Engineering and European Symposium of Computer Aided Process Engineering, Garmish-Partenkirchen (Germany)

ATTENDANCE TO COURSES AND SCHOOLS

August 5 – 6, 2019: Pre-conference Workshop on "Process Data Analytics and Machine Learning", FOPAM 2019 - Foundations of Process Analytics and Machine learning, Raileigh, NC (U.S.A.)

September 21 – 25, 2015: "School of Experimental Design", Prof. Leardi, (University of Genova), Genova (Italy)

June, 2014: "Introduction to Continuous and Mixed-Integer Optimization", Dr. Benoit Chachuat from Imperial College, London UK, University of Padova, Padova (Italy)

June 20 – 22, 2011: Course for the certification of Internal Auditor for the systems of the Quality evaluation, AICQ Triveneto, Mestre (VE, Italy)

March 24 – 25, 2011: Course of "Methods for the analysis of hyperspectral images", University La Sapienza, Rome (Italy)

March 14 – 16, 2011: School of "Chemometric methodologies for process monitoring", University of Modena and Reggio Emilia, Modena (Italy)

September 18 – 21, 2008: National PhD school "GRICU 2008: transport phenomena and process intensification", Le Castella, KR (Italy)

June 8 – 15, 2008: National PhD school "CIP 2008: industrial process control", Cagliari (Italy)

June 18 – 24, 2006: National PhD school "AMO 2006: data analysis, modelling and process optimization", Alba di Canazei, TN (Italy)

Academic year 2006 – 2007: class of "Filtering and estimation theory", Prof. Pinzoni, Department of Automation Engineering, University of Padova, Padova (Italy)

Academic year 2006 – 2007: class of "Statistical methods for quality control", Prof. Capizzi, Department of Statistics, University of Padova, Padova (Italy)

November 24 – 25 – December 2, 2005: intensive master "Statistical process control", Department of Statistics, University of Padova, Padova (Italy)

CONSULTANCY ACTIVITIES

December 2023 – January 2024: **Teva Pharmaceuticals** (Santhià, VC, Italy):

- Digital transformation in the pharma sector
- Referents: Giuseppe Terranella, Maurizio Gallina

TECHNICAL AND PERSONAL SKILLS

Very good attitude to communicate and to interact with people with different competences, optimal skills for leadership, teamwork and for working in atypical environments. Optimal attitude to conceive new research solutions for industrial and research problems, and great determination to study and to learn new techniques. Strong ability for real-word implementation of novel technologies.

Expertise: multivariate statistical techniques, latent variable modelling, pattern recognition methodologies, clustering, regression and classification techniques, deep-learning, soft-sensing, fault detection and diagnosis, image analysis techniques and artificial vision system, data mining, descriptive statistics, wavelet multiresolution decomposition and filtering, data fusion, data filtering and treatment, latent variables model inversion, statistical and model-based design of experiments.

Excellent knowledge of Matlab, JMP, Minitab and Office, ForTran, Aspen, Visual Basic.
 Certified Internal Auditor for the system of evaluation of Quality (ISO 9001).

AWARDS AND SCHOLARSHIPS

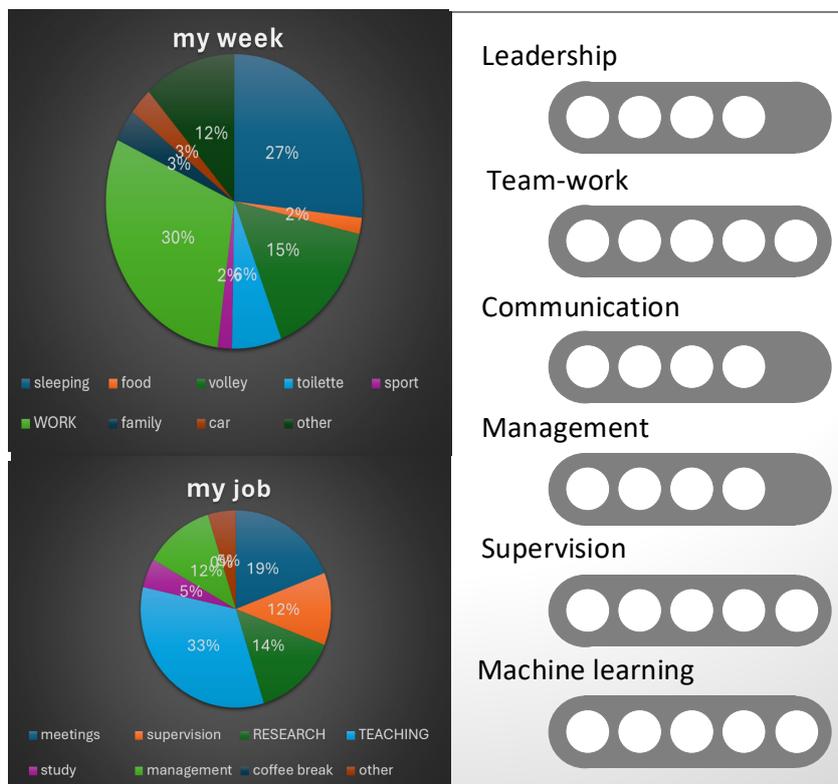
Call4ideas 2022 Award - SMACT Competence Center

- "Resilience farm to fork"

December 2010: "**Ing. Bruno Bruni**" award for the best PhD Thesis, AICQ (Italian Association for Quality Culture)

November 2006: "**Ing. Aldo Gini**" scholarship for studies abroad.

VISUAL SUMMARY ON MY WEEK AND MY JOB



HOBBIES

Volleyball: semi-professional volleyball trainer.

Cooking.

Hiking.

October 13rd, 2024
Pierantonio Facco