Alma Mater Studiorum – Università di Bologna
Dipartimento di Ingegneria Industriale

IRCCS Istituto Ortopedico Rizzoli
Laboratorio di Tecnologia Medica

Interdepartmental Doctoral Programme in Health
Sciences and Technologies

Doctoral course announcement

THE CRAFT OF SCIENTIFIC COMPUTING

12/01/2024 to 16/02/2024

Room TA-05, via Terrracini 24, 40131 Bologna (Bertalia District) and online

Brief Description

This series of seminars offered to all PhD students enrolled at the University of Bologna covers some core aspects of scientific computing and its application to biomedical science in particular and to any other interdisciplinary domain in general. The term craft means "exercise skill in making, typically by hand". Computational Science and engineering, when applied to the solution of problems that require interdisciplinary knowledge, requires a solid scientific background, a bit of artistic creativity, but most importantly a massive number of transferable skills, which usually characterise crafts. So rather than calling it the science or the art, I felt it appropriate to call this course the craft of scientific computing.

The course is organised in six seminars, each consisting of two hours of frontal teaching and one of discussion, Q&A, discussions of specific scientific computing problems you may have in your PhD project, etc.

After "Introduction to in silico medicine", an introduction to the challenges that the application of Computational Science and engineering to the solution of biomedical problems poses (what we call in silico medicine), we will focus on scientific communication: "How to write a scientific paper", and "How to give a scientific presentation". This might appear off-topic, but the biggest challenge that in silico medicine is facing is to ensure accurate and effective communication within a highly interdisciplinary domain, affected by considerable biases. I believe communicating well, precisely, and in a way tailored to the audience is vital in this context.

"What is a model? An evolutionary perspective" goes deep in trying to answer an apparently simple question: what is a model? The seminar is also an excuse for telling you stories about the use of computer modelling in biomedicine.

"Experimental validation of models" is a seminar we give regularly with my colleague and friend Prof Luca Cristofolini. For many years he and I worked together on the experimental validation of some computational models; this seminar is a way to share this experience and the lessons we learnt in the process, using some concrete guiding examples.

"How do we know? The foundation of decision-making" tackles what is probably the most delicate subject in *in silico* medicine: how can I trust a computer prediction when I am to take a life-death decision? To answer this, we need first to dig into how different scientific domains validate knowledge, and then go deep into the theoretical background of the so-called verification, validation, uncertainty quantification and applicability, the process we use to assess the credibility of mission-critical predictive models.

Timetable

#	Data	Aula	Orario	Contenuto (link a Teams)
1	12/01/24	TA05 and online	09:00 - 12:00	Introduction to in silico medicine
2	19/01/24	TA05 and online	09:00 - 12:00	How to write a scientific paper
3	25/01/24	TA05 and online	09:00 - 12:00	How to give a scientific presentation
4	02/02/24	TA05 and online	09:00 - 12:00	What is a model? An evolutionary perspective
5	09/02/24	TA05 and online	09:00 - 11:00	Experimental validation of models
6	16/02/24	TA05 and online	09:00 - 12:00	How do we know? The foundation of decision-making

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About the speaker

Marco Viceconti is a full professor of Computational Biomechanics in the Department of Industrial Engineering of the Alma Mater Studiorum – University of Bologna, Italy. He also has a joint appointment at the Medical Technology Lab of the Rizzoli Orthopaedic Institute. Before he was chair of computational biomechanics at the Department of Mechanical Engineering of the University of Sheffield, UK, he founded and led the prestigious Insigneo Institute for in silico Medicine for seven years. Prof Viceconti is an expert in neuromusculoskeletal biomechanics in general and in particular in using subject-specific modelling to support medical decisions. He is one of the key figures in the in silico medicine international community: he founded the VPH Institute, an international non-profit organisation that coordinates this research community, and drove the creation of the Avicenna Alliance, which represents the biomedical industry interests in this domain. He served as President of the European Society of Biomechanics and of the European Alliance for Medical and Biological Engineering and Science. He is currently one of 25 members of the World Council of Biomechanics. In 2018 he became a Fellow of the UK Royal Academy of Engineering; in 2021, he received the Huiskes Medal for Biomechanics. According to SCOPUS he published 377 papers (H-index = 55).

Luca Cristofolini is a Full Professor of Biomechanics at the University of Bologna since 2012. His research field covers experimental stress analysis and in vitro biomechanical simulations. He has continuing research collaboration with the Istituto Ortopedico Rizzoli, and with several foreign Research Institutions. He played a role in 26 national and 15 international research projects (mainly EU-funded, from FP4 onwards, including the coordination of a large HE project). He serves as a reviewer of 2 Italian and 5 international granting agencies. According to Scopus, he published over 200 papers in indexed peer-reviewed journals, with more than 9000 citations and an h-index=42). He is co-inventor of 4 international patents. He won the Clinical Biomechanics award in 2002. He is in the Editorial Board of several leading journals in the field of biomechanics. He is a member of the Italian Association for stress Analysis (AIAS) and of the Italian Society for Bioengineering (GNB). He is a member of the European Society of Biomechanics (ESB) since 2003, and of the European Orthopaedic Research Society (EORS) since 2013, and of the VPH institute since 2019. He served in the Council of the ESB from 2012 to 2020, serving as treasurer and vice-president.

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Link Teams

12/01/24TA05 and online 09:00 - 12:00   Introduction to in silico medicine

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NzM1YmNkNTctZTIwZC00YjhiLTlkMjYtYTA5YWE3ZWQzZjhm%40thread.v2/0?context=%7b%22Tid%22%3a%22e99647dc-1b08-454a-bf8c-699181b389ab%22%2c%22Oid%22%3a%223bed811d-612b-468f-af61-455efdc836c2%22%7d

19/01/24TA05 and online 09:00 - 12:00   How to write a scientific paper

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NDE4ZTQwZWYtMGY4ZS00YTUwLWI2ZjAtZjU2OGU4NzMxMGQ0%40thread.v2/0?context=%7b%22Tid%22%3a%22e99647dc-1b08-454a-bf8c-699181b389ab%22%2c%22Oid%22%3a%223bed811d-612b-468f-af61-455efdc836c2%22%7d

25/01/24TA05 and online 09:00 - 12:00   How to give a scientific presentation

https://teams.microsoft.com/l/meetup-join/19%3ameeting_Y2Y2MjdkOTctNDNiMy00ZDlhLThiY2QtM2U2YmE3ZjBlNmI4%40thread.v2/0?context=%7b%22Tid%22%3a%22e99647dc-1b08-454a-bf8c-699181b389ab%22%2c%22Oid%22%3a%223bed811d-612b-468f-af61-455efdc836c2%22%7d

02/02/24TA05 and online 09:00 - 12:00   What is a model? An evolutionary perspective

https://teams.microsoft.com/l/meetup-join/19%3ameeting_YWRlODE1ZjMtMWE0Mi00MDllLWFkNDctYzU0ZDIyZTRmNTA2%40thread.v2/0?context=%7b%22Tid%22%3a%22e99647dc-1b08-454a-bf8c-699181b389ab%22%2c%22Oid%22%3a%223bed811d-612b-468f-af61-455efdc836c2%22%7d

09/02/24TA05 and online 09:00 - 11:00   Experimental validation of models

https://teams.microsoft.com/l/meetup-join/19%3ameeting_YTg1NmVjYzctMTkyZi00YjRjLWE5ZTUtZWI2ZTY1NzBhODMz%40thread.v2/0?context=%7b%22Tid%22%3a%22e99647dc-1b08-454a-bf8c-699181b389ab%22%2c%22Oid%22%3a%223bed811d-612b-468f-af61-455efdc836c2%22%7d

16/02/24TA05 and online 09:00 - 12:00   How do we know? The foundation of decision-making

https://teams.microsoft.com/l/meetup-join/19%3ameeting_YWE3NTUxMzktNjY2My00YTRjLThmNGItMTM5YzgxN2ZlZWEz%40thread.v2/0?context=%7b%22Tid%22%3a%22e99647dc-1b08-454a-bf8c-699181b389ab%22%2c%22Oid%22%3a%223bed811d-612b-468f-af61-455efdc836c2%22%7d