



Short course on

Advanced Multivariate Process Data Analysis

4th – 5th June 2018

Aim

The aim of this course is to provide an overview and advanced insight into multivariate methodologies to analyze process data. Fundamental concepts to visualize high-dimensional and highly correlated process and product quality data, to identify the important process drivers as well as to forecast the process and product quality behaviour will be presented in lectures. Hands-on sessions and a team project will be used to solve case studies from the (biopharmaceutical) industry. After the course the participants will be aware of relevant techniques and literature for process data analysis and will be able to evaluate different analysis paths for a given problem.

Scope

- Introduction to multivariate data analysis
- Advanced multivariate analysis techniques for process data
- Data-driven process analysis and optimization
- Data-driven process monitoring and forecasting
- Analysis techniques for spectral process data
- Hybrid process modeling based on process data and process know-how

Who should attend

The target group of the course encompasses scientists and engineers from academia and industry who encounter or are working with (big) process data. The course shall motivate to utilize the presented techniques in ongoing and perspective projects. Previous experience in data analysis can be advantageous but is not mandatory to follow the course.

Format

The course takes the form of lectures, case studies and 'hands-on' workshops in a computer lab. Supervisors and graduate assistants will support the participants during the interactive workshops and data analysis sessions.

The course will be intense in content, interactive in learning and interdisciplinary in application and vision.

"There were 5 exabytes of information created between the dawn of civilization through 2013, but that much information is now created every 2 days."

Eric Schmidt, CEO of Google

Course Host



Massimo Morbidelli, Professor at Institute of Chemistry and Applied Biosciences (ICB), ETH Zurich.

A pioneer in modeling chemical and separation processes as well in continuous integrated bioprocessing,

Prof. Morbidelli has co-authored over 500 research articles and four books. He serves as associate editor for the Industrial & Engineering Chemical Research journal of the ACS and is the recipient of the 2005 RH Wilhelm award from the AIChE and of the 2014 Gerhard Damkoehler medal of DECHEMA.

Course Lecturers



Michael Sokolov, Postdoctoral fellow and Lecturer at ICB, ETH Zurich

Michael Sokolov is an expert in bioprocess modelling and regularly presents his work on international conferences and workshops. He co-authored multiple publications in the field of the selection, prediction, optimization, monitoring, forecasting and validation of cell culture processes.



Alessandro Butté, Ph.D., Lecturer at ICB, ETH Zurich

Besides a long-standing research experience in polymer, separation and biotechnological processes, Dr. Butté has several years of experience in the pharmaceutical industry and a MBA from St. Gallen. He is a co-author of more than 60 publications and 4 patents.



Moritz von Stosch, Ph.D., Senior manager Fermentation at GSK Vaccines, Belgium

Dr. von Stosch is an expert in bioprocess modelling and particularly in hybrid process models. Before joining the GSK Vaccines process development team, he worked as a Lecturer at the School of Chemical Engineering and Advanced Materials at Newcastle University. He co-authored more than 20 publications.

Supervisors and tutors

Fabian Feidl, Ph.D Candidate

Harini Narayanan, Ph.D. Candidate

Course Co-Organizers

Cosimo Caforio, Statsoft

Alexia Berchtold, ETH Zurich

Venue

The course will be held at ETH Zürich (ETH Hönggerberg site) at the modern and well-equipped chemistry building (full address on last page).

Zürich is the largest town in Switzerland and well-connected to the rest of Europe. ETH is minutes from both the main international railway station Zürich Hauptbahnhof and Zurich International Airport.

Course Program

Monday, June 4th

- 09:00 – 09:15 Welcome Greetings
- 09:15 – 09:35 Lecturer Intro & Course Overview
- 09:35 – 10:00 Participant Intro
- 10:00 – 10:20 Role of process data analytics in industry 4.0
- 10:20 – 10:40 Software landscape for process data analytics
- 10:40 – 11:00 Coffee Break
- 11:00 – 11:45 Theory: PCA, pre-processing, missing data treatment
- 11:45 – 12:30 Case Study 1: PCA for biosimilarity evaluation
- 12:30 – 13:30 Lunch
- 13:30 – 13:45 CS1: Wrap-Up
- 13:45 – 15:00 Theory: MLR, PCR, PLSR, Variable importance
- 15:00 – 15:20 Coffee Break
- 15:20 – 15:40 Theory & CS2 Intro: Decision Trees
- 15:40 – 16:20 CS2: Decision Trees vs MLR
- 16:20 – 16:35 CS2: Wrap-Up and Extension
- 16:35 – 17:00 Theory: Data unfolding, process data specialties
- 17:00 – 17:45 CS3: Unfolding, PLSR, Variable importance
- 17:45 – 18:15 CS3: Wrap-Up & Extension
- 18:15 – Wrap-Up Day 1 & Social Program

Tuesday, June 5th

- 09:00 – 09:30 Warm-Up: Industry Case Studies
- 09:30 – 10:00 Machine Learning vs. MVDA
- 10:00 – 10:20 Local PLSR models
- 10:20 – 11:05 Theory: Spectral data analysis
- 11:05 – 11:25 Coffee Break
- 11:25 – 12:20 CS4: Raman spectroscopy in bioprocessing
- 12:20 – 12:40 CS4: Wrap-up and extension
- 12:40 – 13:40 Lunch
- 13:40 – 14:15 Motivation for Hybrid Modelling
- 14:15 – 15:00 Theory: Hybrid Modelling
- 15:00 – 15:15 CS5: Hybrid modelling, Intro
- 15:15 – 15:35 Coffee Break
- 15:35 – 16:50 CS5: Solution & Wrap-Up
- 16:50 – 17:15 Hybrid modelling for chemical industry
- 17:15 – 17:45 Hybrid modelling for fermentation and cell cultures
- 17:45 – 18:15 Outlook towards model-supported process industry
- 18:15 – Wrap-Up Day 2 & Social Program

The two-day course program as well as the subsequent symposium can be subject to minor changes.

"Data is the oil of the 21st century, and analytics is the combustion engine."

Peter Sondergaard, Gartner Research

Course fees

The course fee is CHF 1'500 (CHF 900 for academia and 600 for students). This includes lecture and case study summaries in paper and electronic formats, internet access (WIFI), lunch and coffee breaks as well as two dinners. It does not include accommodation, travel costs or catering other than indicated above.

Terms of condition

Confirmation: A confirmation of participation will be provided to each participant after completing the course.

Number of participants: A minimum of 8 and a maximum of 20 participants will be accepted in the course.

Cancellation policy: Cancellation of registration must be submitted in writing or via email and is valid only with acknowledgement of receipt by the course officer. Cancellations made after 1st May 2018 will be subject to a 50% cancellation fee. Cancellations made after 15th May 2018 will be subject to the total fee. A colleague or associate may be substituted without penalty. Full refunds will be made in the case that the course is cancelled due to insufficient enrolment.

Validity: The registration is valid for the *Short Course on Advanced Multivariate Process Data Analytics* only, which is organized independently of the *Symposium on Big Data Analytics and Digitalization for Biotech and Pharma* (on 6 June 2018). The participant will be offered free participation at this symposium.

Accommodation

Travel and accommodation are not included in the course fee; however we have sourced a special accommodation rate at the following 3* town hotels:

Hotel Leoneck (www.leoneck.ch)

single room @ CHF 155, double room @ CHF 195

Hotel Sunnehus (www.hotelsunnehus.ch)

single room @ CHF 169.50

All prices indicated are per night and breakfast included. To benefit from a special discount, use the code "**ETH Big Data**" while booking your room (offer valid until April 30th, 2018).

Disclaiming statements

ETH and the course organisers will not assume responsibility for medical expenses of participants or damage caused by participants.

All participants are urged to ensure that they are covered by their own travel, health and liability insurance policies while traveling to and from and while attending the course.

ETH and the course organisers are not responsible for private possessions lost or stolen at a course.

Registration

Please contact bigdata@chem.ethz.ch for registration. Registration is only complete after payment. Registration is binding unless the minimum of participants cannot be reached.

Early bird discount until March 31st: -15%.

To register past the early bird deadline, please write to the course officer at alexia.berchtold@chem.ethz.ch to check if places are still available.

The online registration is in German only. On request, the course officer will send you a manual in English that guides you through the application process.

Sponsors



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