Applied Course on

# Advanced Process Data Analytics

## 23rd – 25th June 2025

### 3 days, in person @ ETH Zurich

## Aim

The aim of this course is to provide an overview and advanced insight into data analytics and modeling methodologies for 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 forecast the process and product quality behaviour will be presented in lectures. Hands-on coding and brainstorming sessions 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

- Special analysis techniques for process data
- Introduction to multivariate data analysis
- Introduction to machine learning techniques
- Hybrid process modeling based on process data and process know-how
- Model-based process understanding & optimization
- Model-based process monitoring & forecasting
- Application of techniques to industrial cases

## Who should attend?

The target group of the course encompasses scientists and engineers from academia and industry who encounter or are working with (bio)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.

## Format

This is an in-person course, hosted at ETH Zurich. The course takes the form of lectures, industry examples, and case studies as well as hands-on sessions with software tasks (Different software packages will be provided to the participant). Supervisors and graduate assistants will support the participants during the interactive workshops and data analysis sessions.

Participants have a unique opportunity to **join the DataHow Symposium on the 26th of June**, at no extra cost. Network and exchange with industry professionals and extend this learning opportunity.

## Principal Lecturers

**Michael Sokolov,** Ph.D., MBA
COO of DataHow and Lecturer at ETH Zurich



Michael is an expert in bioprocess modelling and a regular speaker on the potential of smart digital pharma solutions at international conferences. He conducted his research in close collaboration with the pharma industry and co-authored more than 25 publications.

**Alessandro Butté,** Ph.D., MBA
CEO of DataHow & Lecturer at ETH Zurich



Besides a long-standing research experience in polymer, separation, and biotechnological processes, Alessandro has several years of experience in the pharma industry. He is a co-author of more than 70 publications and 4 patents.

**Moritz von Stosch,** Ph.D.
Chief Innovation Officer of DataHow

Moritz is one of the leading experts for hybrid modelling of bioprocesses. He combines an academic career path with several years of experience in the pharma industry. He is a co-author of more than 50 publications on microbial and mammalian upstream as well as downstream processing.

## Further Lecturers and Tutors

- **Fabian Feidl**, Ph.D., CTO of DataHow and bioprocess digitalization expert
- **Prof. Massimo Morbidelli**, Thought leader bioprocessing.
- **Adam Szalkowski**, Ph.D., IT infrastructure expert

## Venue and Organization

The course will be offered as an interactive presentation through Microsoft Teams. Group activities will be handled in small virtual rooms. The provided software from DataHow as well as the open-source packages can be used during and after the course. Despite the limitations of such a teaching format, it is our clear intention to deliver the content in similar comprehensibility to an in-person event and allow for many questions and discussion content.

**The participants are welcome to provide their own case studies to be solved in the brainstorming sessions as well as in dedicated Q&A sessions.**

## Course date and program

A preliminary program will be provided and the course outline is available at the link:
https://datahow.ch/courses/summer2025_program/
The course will be distributed over **3 days.**

## Course fees

The course fees are:

- Industry: CHF 2'950.00 This course is tailored to professionals in (bio)processing spanning process development through manufacturing.
- Academia: CHF 1'750.00 The course is accessible to educators and researchers affiliated with universities.
- Students: CHF 700.00 The course is available to students upon request. Please send your request with confirmation of your university to our course management – **d.kolev@datahow.ch**

The fee includes lecture and case study summaries in electronic formats as well as the cost of all communication platforms and software packages used in the course.

## Terms and Conditions

Confirmation: A signed confirmation of completion will be delivered to each participant after the course.
Number of participants: A minimum of 8 will be accepted in the course.
Cancellation policy: Cancellation of registration must be submitted in writing or via email to **d.kolev@datahow.ch**

Cancellations made later than 3 weeks before the course start will be subject to a 30% cancellation fee. A colleague may be substituted without penalty. Full refunds will be made in the case that the course is cancelled, e.g., due to insufficient enrolment.

## Registration

Registration is binding unless the minimum of participants cannot be reached. When registering you agree to receive any information regarding the course and other marketing campaigns of DataHow.

In case of questions or for additional information please contact:

**David Kolev**
Course Responsible
E-mail: **d.kolev@datahow.ch**

We are looking forward to numerous registrations, a great knowledge transfer, and a great exchange with our experts.

Your DataHow-team.

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# Agenda of the Advanced Process Data Analytics Course
## Agenda of Summer 2025 Edition:

### Monday, June 23: Advanced Course (Day 1)
| | |
|---|---|
| 08:30 – 12:30  CET | **Multivariate Data Analysis (MVDA) Methods** |
| 08:30 – 09:00 | Introduction of the lecturing team and participants |
| 09:00 – 10:00 | Motivation for MVDA and Process data specialties |
| 10:15 – 11:30 | PCA and Missing Data Handling |
| 11:30 – 12:30 | Hands-on Experience & Industrial Use Cases |
| | |
| 13:30 – 18:30  CET | **Advanced MVDA Methods** |
| 13:30 – 14:15 | Multivariate Regression – MLR, PCR, PLSR |
| 14:15 – 15:15 | PLS2 and Variable Importance |
| 15:35 – 16:20 | Decision Trees, Software landscape for process digitalization |
| 16:20 – 17:00 | Why do we need non-linear process models? |
| 17:15 – 18:30 | Hands-on Experience & Industrial Use Cases |
| 18:30 - | Social Program |

### Tuesday, June 24: Advanced Course (Day 2)
| | |
|---|---|
| 08:30 – 12:30  CET | **Machine Learning (ML) Methods** |
| 08:30 – 09:30 | Introduction to Machine Learning |
| 09:30 – 10:30 | Examples of Machine learning tools |
| 10:45 – 11:30 | Gaussian Processes |
| 11:30 – 12:30 | Hands-on Experience & Industrial Use Cases |
| | |
| 13:30 – 18:00  CET | **Combination of Data- and Knowledge-driven Approaches** |
| 14:00 – 15:00 | Basic Principles of Hybrid models |
| 15:15 – 16:45 | Examples of Hybrid models (USP and continuous processes) |
| 17:00 – 18:00 | Hands-on Experience & Industrial Use Cases |

### Wednesday, June 25: Advanced Course (Day 3)
| | |
|---|---|
| 08:30 – 12:30  CET | **Applications of smart digital solutions in bioprocessing** |
| 08:30 – 09:00 | Digital Twins in bioprocessing |
| 09:00 – 10:00 | Examples of Hybrid models (DSP) |
| 10:00 – 11:15 | Machine Learning models for Spectral Data, Kalman and Particle Filters |
| 11:15 – 12:30 | Hands-on Experience & Industrial Use Cases |
| | |
| 13:30 – 18:00  CET | **Smart digital solutions to support decision taking** |
| 13:30 – 14:15 | Bayesian Inference and model-based experimental design |
| 14:15 – 15:00 | Application for parallel and robotic reactor systems |
| 15:15 – 16:00 | Robustness analysis and model-based process optimization |
| 16:00 – 18:00 | Mini Hackathon |
| 18:00 – 18:15 | Feedback & Certificates |

------------------------- Symposium participation is included for course participants.--------------------------

### Wednesday, June 25: DataHow Preconference Networking BBQ Dinner @ ETH Zurich
18:00 – 22 :00 CET     See: https://datahow.ch/news-and-events/symposium/

### Thursday, June 26: DataHow Symposium @ ETH Zurich
08:30 – 18 :00 CET     See: https://datahow.ch/news-and-events/symposium/