# Incubator Summer Academy - Next Level Data Science

# Report of Contributions

Contribution ID: **1** Type: **not specified**

# Opening event

*Monday 18 September 2023 09:00 (1 hour)*

In the opening event, Christian Beilmann (HIDA coordinator) and Otmar D. Wiestler (President Helmholtz Association) will first welcome everyone to the 2nd Incubator Summer Academy (9 - 9:15am).

Then, Dirk Werth from the August-Wilhelm Scheer Institut will give a keynote on "Could AI become the better scientist? Understanding how digital science impacts our life in science, education and business." (9:15 - 10am).

Keynote abstract:
Some people say: AI is the new big data and digitalization is just another kind of automation technologies. But they neglect the fact that in recent years, society has encountered the beginning of a massive transformational process that is mainly induced by digitalization and especially AI and that also affects the science domain. In this talk, Dirk Werth will provide interdisciplinary insights on working mechanisms of digitalization and how AI demands new problem solving approaches. Based on real examples, the presentation will indicate the upcoming and partially already ongoing shift of behavior in various domains, such as science, education and business, and how to prepare and benefit from the new possibilities.

**Presenters:** BEILMANN, Christian (HIDA coordinator); WERTH, Dirk (AWS Institut); WIESTLER, Otmar D. (President Helmholtz Association)

**Session Classification:** General

Contribution ID: **4** Type: **not specified**

# Introduction to Open Science and Reproducibility

*Monday 18 September 2023 10:10 (30 minutes)*

In this talk the Helmholtz Open Science Office will focus on digital reproducibility and its importance for open and robust science.
Research is reproducible when it is possible to (independently) recreate the same results from the same data and same code/analysis as used by the original researcher or team of researchers. Reproducibility enhances collaboration and transparency in science and supports reusability of scientific products. This closely links with the open science endeavor towards the cultural change in science and science communication.
To truly enable reuse underlying data sets of research results are published in a FAIR
manner for instance. The FAIR principles can be transferred to research software with some adaptations and also define important prerequisites in the context of reproducibility in order to be able to reproduce results. On the other hand, doing actual reproduction attempts (meaning success / failure) need to be an integral part of scholarly communication and should be incentivized accordingly.

**Presenter:** SCHRADER, Antonia (Helmholtz Open Science Office)

**Session Classification:** Course Package 1 (HIDA/ HIFIS)

Contribution ID: **5** Type: **not specified**

# Lecture: Reproducibility in Science

*Monday 18 September 2023 10:45 (1h 30m)*

The lecture will introduce the topic of reproducibility in science: what is reproducibility, why does it matter and why is to hard to achieve? I will discuss abstract requirements for reproducibility and try connect these to concrete measures we can take in day-to-day research to make our (computational) results more reproducible. The potential of Jupyter Notebooks and the Jupyter ecosystem is explored.

**Presenter:** FANGOHR, Hans (MPSD)

**Session Classification:** Course Package 1 (HIDA/ HIFIS)

Contribution ID: **6** Type: **not specified**

# Repro hack

*Thursday 21 September 2023 09:30 (6 hours)*

The ReproHack reproducibility hackathon is a hands-on event where you can practice reproducible research with real-world data and research software (R or Python). We will suggest two scientific publicatios from the ReproHack repository (www.reprohack.org) with publicly available code and data you can choose from. During the event, you aim to reproduce the scientific results (figures and statistical results) detailed in the published paper. Feel free to either join the one of the three teams: Beginners (re-run the original R code), Advanced (re-implemented the R code in a Python Jupyter notebook), or Experts (implement the analysis in a Docker container). The ReproHack will give you the opportunity to understand the importance of careful documentation of the entire analysis workflow. You will learn from other researchers from different domains and levels of experience.

**Presenters:** EGGERT, Anja (FBN Dummerstdorf); KRÜGER, Frank (HS Wismar); SCHROEDER, Max (University of Rostock)

**Session Classification:** Course Package 1 (HIDA/ HIFIS)

Contribution ID: **7** Type: **not specified**

# Workshop - Playing Lean

*Friday 29 September 2023 09:30 (3 hours)*

Join us for a session of Playing Lean, an engaging hands-on "flight simulator" for Lean Startup and innovation. The creators of the game have partnered up with Alexander Osterwalder, inventor of the Business Model Canvas and one of the great minds of Lean Startup. The Playing Lean board game teaches highly valuable lessons on Lean Startup, creates interest in Business Model Canvas, goes deep on the Value Proposition Canvas or running lean with the Lean Canvas. Playing Lean is turn based and players in competing teams advance a fictional strategy, competing in the same industry. Playing Lean deploys a number of gamification practices: storytelling, social learning, motivation and reward structures, competition - all supported by a trained facilitator.

**Presenter:** KAMMERMEIER, Klaus

**Session Classification:** Course Package 2 (HIDA/ Helmholtz AI)

Contribution ID: **8** Type: **not specified**

# Lecture: Introduction to Lean Methodology for Startups

*Friday 29 September 2023 09:00 (30 minutes)*

We'll introduce the principles and methodologies of the lean startup approach covering the crucial topics including conducting customer research, creating a minimum viable product (MVP), and reiterative development cycles. We'll emphasise the importance of user feedback, rapid experimentation, and agile continuous improvement to build successful innovations.

**Presenter:** KAMMERMEIER, Klaus

**Session Classification:** Course Package 2 (HIDA/ Helmholtz AI)

Contribution ID: **9** Type: **not specified**

# Introduction to Python (Part 1)

*Monday 18 September 2023 10:00 (7 hours)*

We get to know our programming tool and develop a fundamental understanding how writing Python code works.
Supervised exercises allow to consolidate the new knowledge.

**Presenter:** ERXLEBEN, Fredo (Helmholtz-Zentrum Dresden-Rossendorf)

**Session Classification:** Course Package 3 (HIFIS)

Contribution ID: **10** Type: **not specified**

# Introduction to Pandas

*Wednesday 20 September 2023 09:00 (8 hours)*

An introduction to the popular data processing framework.
Hands-on-exercises allow to solidify the gained knowledge.

**Presenter:** ERXLEBEN, Fredo (Helmholtz-Zentrum Dresden-Rossendorf)

**Session Classification:** Course Package 3 (HIFIS)

Contribution ID: **11** Type: **not specified**

# Introduction to Matplotlib

*Thursday 21 September 2023 09:00 (8 hours)*

Learn how to use the popular plotting framework to generate graphs from data sets.
Additional exercises allow to gather experience with different kinds of visualizations..

**Presenter:** ERXLEBEN, Fredo (Helmholtz-Zentrum Dresden-Rossendorf)

**Session Classification:** Course Package 3 (HIFIS)

Contribution ID: **12** Type: **not specified**

# Introduction to Git and GitLab (Part 1)

*Monday 25 September 2023 09:00 (6 hours)*

We get to know the basics of version control with Git. The live coding approach allows you to directly apply your new knowledge in practice.

**Presenter:** SCHLAUCH, Tobias (DLR / HIFIS)

**Session Classification:** Course Package 4 (HIFIS)

Contribution ID: **13** Type: **not specified**

# Introduction to Git and GitLab (Part 2)

*Tuesday 26 September 2023 09:00 (6 hours)*

We get to know the basics of GitLab as well as how to combine Git, GitLab issues and GitLab merge requests to form an effective contribution workflow. The live coding approach and the team exercise allow you to directly apply your new knowledge in practice.

**Presenter:** SCHLAUCH, Tobias (DLR / HIFIS)

**Session Classification:** Course Package 4 (HIFIS)

Contribution ID: **15** Type: **not specified**

# Using containers in science

*Wednesday 27 September 2023 09:00 (4 hours)*

Containerized solutions can be helpful in the testing stage of continuous integration. This day will focus on how to use containerized solutions for scientific projects using Docker as an example.

**Presenters:** Mr HUESER, Christian (Helmholtz-Zentrum Dresden-Rossendorf (HZDR)); ZIEGNER, Norman (UFZ); HUSTE, Tobias (Helmholtz-Zentrum Dresden-Rossendorf)

**Session Classification:** Course Package 5 (HIFIS)

Contribution ID: **16** Type: **not specified**

# Continuous Integration in GitLab (Part 1)

*Thursday 28 September 2023 09:00 (6 hours)*

With continuous integration in GitLab, you can automate the building, testing, and deploying of your code. This day will focus on creating an initial GitLab CI pipeline.

**Presenters:** Mr HUESER, Christian (Helmholtz-Zentrum Dresden-Rossendorf (HZDR)); ZIEGNER, Norman (UFZ); HUSTE, Tobias (Helmholtz-Zentrum Dresden-Rossendorf)

**Session Classification:** Course Package 5 (HIFIS)

Contribution ID: **17** Type: **not specified**

# Continuous Integration in GitLab (Part 2)

*Friday 29 September 2023 09:00 (6 hours)*

Building on day 2, you will learn advanced concepts of GitLab CI useful for optimizing the pipeline.

**Presenters:** Mr HUESER, Christian (Helmholtz-Zentrum Dresden-Rossendorf (HZDR)); ZIEGNER, Norman (UFZ); HUSTE, Tobias (Helmholtz-Zentrum Dresden-Rossendorf)

**Session Classification:** Course Package 5 (HIFIS)

Contribution ID: **18** Type: **not specified**

# Fundamentals of Scientific Metadata (Part 1)

*Tuesday 26 September 2023 09:00 (3h 30m)*

You will learn:

- about the differences between and the importance of data & metadata
- to annotate your research data with structured metadata
- to find and evaluate a suitable metadata framework and data repository
- to use basic Markdown / JSON / XML
- which tools are already available to level up your metadata annotation game
- why structured metadata is important and how it can increase your scientific visibility

organized by HMC Hub Information & HMC Office

**Primary author:** GERLICH, Silke (HMC Hub Information)

**Presenters:** GERLICH, Silke (HMC Hub Information); TRÖSCH, Mirl (HMC Office)

**Session Classification:** Course Package 6 (HMC)

Contribution ID: **19** Type: **not specified**

# Fundamentals of Scientific Metadata (Part 2)

*Wednesday 27 September 2023 09:00 (3h 30m)*

You will learn:

- about the differences between and the importance of data & metadata
- to annotate your research data with structured metadata
- to find and evaluate a suitable metadata framework and data repository
- to use basic Markdown / JSON / XML
- which tools are already available to level up your metadata annotation game
- why structured metadata is important and how it can increase your scientific visibility

organized by HMC Hub Information & HMC Office

**Primary author:** GERLICH, Silke (HMC Hub Information)

**Presenters:** GERLICH, Silke (HMC Hub Information); TRÖSCH, Mirl (HMC Office)

**Session Classification:** Course Package 6 (HMC)

Contribution ID: **20** Type: **not specified**

# Metadata consulting

*Wednesday 27 September 2023 13:30 (3 hours)*

This is a hands-on session where you can bring your own (meta)data to discuss consult about your questions and challenges.

**Primary author:** GERLICH, Silke (HMC Hub Information)

**Presenters:** TRÖSCH, Mirl (HMC Office); GERLICH, Silke (HMC Hub Information)

**Session Classification:** Course Package 6 (HMC)

Contribution ID: **21** Type: **not specified**

# Lecture: Common Pitfalls in ML-based Image Analysis

*Friday 22 September 2023 13:30 (45 minutes)*

The success of Machine Learning has revolutionized the field of medical image analysis in the past 5 years. This talk will give an introduction to relevant concepts in machine learning with a focus on computer vision. Subsequently, several example applications in the biomedical domain will be discussed to study the current state of research and the associated challenges and opportunities. We will end the package with a hands on tutorial in which we go step by step through using nnU-Net from training to visualization of the resulting 3D-segementation maps.

**Presenter:** JÄGER, Paul (Helmholtz Imaging, DKFZ)

**Session Classification:** Course Package 7 (Helmholtz Imaging)

Contribution ID: **22** Type: **not specified**

# Lecture: Introduction to Machine Learning- based Image Analysis

*Friday 22 September 2023 11:30 (1 hour)*

The success of Machine Learning has revolutionized the field of medical image analysis in the past 5 years. This talk will give an introduction to relevant concepts in machine learning with a focus on computer vision. Subsequently, several example applications in the biomedical domain will be discussed to study the current state of research and the associated challenges and opportunities. We will end the package with a hands on tutorial in which we go step by step through using nnU-Net from training to visualization of the resulting 3D-segementation maps.

**Presenter:** JÄGER, Paul (Helmholtz Imaging, DKFZ)

**Session Classification:** Course Package 7 (Helmholtz Imaging)

Contribution ID: **23** Type: **not specified**

# Tutorial: nnU-Nnet: A self-configuring image segmentation method

*Friday 22 September 2023 15:30 (1h 15m)*

The success of Machine Learning has revolutionized the field of medical image analysis in the past 5 years. This talk will give an introduction to relevant concepts in machine learning with a focus on computer vision. Subsequently, several example applications in the biomedical domain will be discussed to study the current state of research and the associated challenges and opportunities. We will end the package with a hands on tutorial in which we go step by step through using nnU-Net from training to visualization of the resulting 3D-segementation maps.

**Presenter:** KAHL, Kim-Celine (Helmholtz Imaging, DKFZ)

**Session Classification:** Course Package 7 (Helmholtz Imaging)

Contribution ID: **26** Type: **not specified**

# Introduction to Python (Part 2)

*Tuesday 19 September 2023 09:00 (8 hours)*

We get to know additional code structures and language features and learn how to apply them for solving various problems.
Supervised exercises offer additional problems to gather experience with the learned skills.

**Presenter:** ERXLEBEN, Fredo (Helmholtz-Zentrum Dresden-Rossendorf)

**Session Classification:** Course Package 3 (HIFIS)

Contribution ID: **27** Type: **not specified**

# Meet the Helmholtz Incubator Platforms

*Tuesday 19 September 2023 09:30 (1 hour)*

Get to know the Helmholtz Incubator Platforms and see what they can do and mean for you! Next to posters, presentations, and discussions by and with the platforms, you can also meet fellow participants of the Summer Academy. Do not miss out on the opportunity to expand your network!

**Session Classification:** General

Contribution ID: **28** Type: **not specified**

# Introduction to Machine Learning (Part 1)

*Tuesday 19 September 2023 09:00 (7h 30m)*

This course will introduce participants to the concepts of AI and Machine Learning, covering clustering and clasifications fundamentals as well as practical experience with standard methods for both techniques. Lastly, participants will gain an insight on best practises for evaluating a machine learning model's performance (ROC curve, FPR etc.)

**Presenters:** BAZAROVA, Alina; CEA, Donatella; CAMPI, Francesco; WANG, Jiangtao (FZ Jülich); STEINBACH, Peter (HZDR); STARKE, Sebastian (HZDR); SCHMERLER, Steve (HZDR)

**Session Classification:** Course Package 8 (Helmholtz AI)

Contribution ID: **29** Type: **not specified**

# Introduction to Machine Learning (Part 2)

*Wednesday 20 September 2023 09:00 (7h 30m)*

This course will introduce participants to the concepts of AI and Machine Learning, covering clustering and clasifications fundamentals as well as practical experience with standard methods for both techniques. Lastly, participants will gain an insight on best practises for evaluating a machine learning model's performance (ROC curve, FPR etc.)

**Presenters:** BAZAROVA, Alina; CEA, Donatella; CAMPI, Francesco; WANG, Jiangtao (FZ Jülich); STEINBACH, Peter (HZDR); STARKE, Sebastian (HZDR); SCHMERLER, Steve (HZDR)

**Session Classification:** Course Package 8 (Helmholtz AI)

Contribution ID: **30** Type: **not specified**

# Introduction to Machine Learning (Part 3)

*Thursday 21 September 2023 09:00 (7h 30m)*

This course will introduce participants to the concepts of AI and Machine Learning, covering clustering and clasifications fundamentals as well as practical experience with standard methods for both techniques. Lastly, participants will gain an insight on best practises for evaluating a machine learning model's performance (ROC curve, FPR etc.)

**Presenters:** BAZAROVA, Alina; CEA, Donatella; CAMPI, Francesco; WANG, Jiangtao (FZ Jülich); STEINBACH, Peter (HZDR); STARKE, Sebastian (HZDR); SCHMERLER, Steve (HZDR)

**Session Classification:** Course Package 8 (Helmholtz AI)

Contribution ID: **31** Type: **not specified**

# Introduction to Machine Learning (Part 4)

*Friday 22 September 2023 09:00 (7h 30m)*

This course will introduce participants to the concepts of AI and Machine Learning, covering clustering and clasifications fundamentals as well as practical experience with standard methods for both techniques. Lastly, participants will gain an insight on best practises for evaluating a machine learning model's performance (ROC curve, FPR etc.)

**Presenters:** BAZAROVA, Alina; CEA, Donatella; CAMPI, Francesco; WANG, Jiangtao (FZ Jülich); STEINBACH, Peter (HZDR); STARKE, Sebastian (HZDR); SCHMERLER, Steve (HZDR)

**Session Classification:** Course Package 8 (Helmholtz AI)

Contribution ID: **32** Type: **not specified**

# Course Package 9 (Helmholtz AI): Introduction to eXplainable AI

*Friday 22 September 2023 13:30 (4 hours)*

During this course participants will get an introduction to the topic of Explainable AI (XAI). The goal of the course is to help participants understand how XAI methods can help uncover biases in the data or provide interesting insights. After a general introduction to XAI, the course goes deeper into state-of-the-art model agnostic interpretation techniques as well as a practical session covering these techniques. Finally, we will focus on two model specific post-hoc interpretation methods, with hands-on training covering interpretation of random forests and neural networks with imaging data to learn about strengths and weaknesses of these standard methods used in the field.

**Presenters:** CEA, Donatella; GEORGII, Elisabeth (Helmholtz Zentrum München); KOFLER, Florian (HAI); CAMPI, Francesco; SUBRAMANIAN, Harshavardhan; PELIN, Helena; BARROS DE ANDRADE E SOUSA, Lisa (Helmholtz AI); VALIZADEH, Mahyar (Helmholtz AI consultacy health unit); BENASSOU, Sabrina; WILLEM, Theresa

**Session Classification:** Course Package 9 (Helmholtz AI)

Contribution ID: **34** Type: **not specified**

# Lecture: Applications of AI in Medical Imaging

*Friday 22 September 2023 14:30 (45 minutes)*

The success of Machine Learning has revolutionized the field of medical image analysis in the past 5 years. This talk will give an introduction to relevant concepts in machine learning with a focus on computer vision. Subsequently, several example applications in the biomedical domain will be discussed to study the current state of research and the associated challenges and opportunities. We will end the package with a hands on tutorial in which we go step by step through using nnU-Net from training to visualization of the resulting 3D-segementation maps.

**Presenter:** KLEIN, Lukas (Helmholtz Imaging, DKFZ)

**Session Classification:** Course Package 7 (Helmholtz Imaging)

Contribution ID: **35** Type: **not specified**

# Introduction to Deep Learning (Part 1)

*Monday 25 September 2023 09:00 (7h 30m)*

This is an hands-on introduction to the first steps in Deep Learning, intended for researchers who are familiar with (non-deep) Machine Learning.

The use of Deep Learning has seen a sharp increase of popularity and applicability over the last decade. While Deep Learning can be a useful tool for researchers from a wide range of domains, taking the first steps in the world of Deep Learning can be somewhat intimidating.

We start with explaining the basic concepts of neural networks, and then go through the different steps of a Deep Learning workflow. Learners will learn how to prepare data for deep learning, how to implement a basic Deep Learning model in Python with Keras, how to monitor and troubleshoot the training process and how to implement different layer types such as convolutional layers.

**Presenters:** BAZAROVA, Alina; CEA, Donatella; CAMPI, Francesco; STEINBACH, Peter (HZDR); SCHMERLER, Steve (HZDR)

**Session Classification:** Course Package 10 (Helmholtz AI)

Contribution ID: **36** Type: **not specified**

# Introduction to Deep Learning (Part 2)

*Tuesday 26 September 2023 09:00 (7h 30m)*

This is an hands-on introduction to the first steps in Deep Learning, intended for researchers who are familiar with (non-deep) Machine Learning.

The use of Deep Learning has seen a sharp increase of popularity and applicability over the last decade. While Deep Learning can be a useful tool for researchers from a wide range of domains, taking the first steps in the world of Deep Learning can be somewhat intimidating.

We start with explaining the basic concepts of neural networks, and then go through the different steps of a Deep Learning workflow. Learners will learn how to prepare data for deep learning, how to implement a basic Deep Learning model in Python with Keras, how to monitor and troubleshoot the training process and how to implement different layer types such as convolutional layers.

**Presenters:** BAZAROVA, Alina; CEA, Donatella; CAMPI, Francesco; STEINBACH, Peter (HZDR); SCHMERLER, Steve (HZDR)

**Session Classification:** Course Package 10 (Helmholtz AI)

Contribution ID: **37** Type: **not specified**

# Introduction to Deep Learning (Part 3)

*Wednesday 27 September 2023 09:00 (7h 30m)*

This is an hands-on introduction to the first steps in Deep Learning, intended for researchers who are familiar with (non-deep) Machine Learning.

The use of Deep Learning has seen a sharp increase of popularity and applicability over the last decade. While Deep Learning can be a useful tool for researchers from a wide range of domains, taking the first steps in the world of Deep Learning can be somewhat intimidating.

We start with explaining the basic concepts of neural networks, and then go through the different steps of a Deep Learning workflow. Learners will learn how to prepare data for deep learning, how to implement a basic Deep Learning model in Python with Keras, how to monitor and troubleshoot the training process and how to implement different layer types such as convolutional layers.

**Presenters:** BAZAROVA, Alina; CEA, Donatella; CAMPI, Francesco; STEINBACH, Peter (HZDR); SCHMERLER, Steve (HZDR)

**Session Classification:** Course Package 10 (Helmholtz AI)

Contribution ID: **38** Type: **not specified**

# Lecture: Regularization in Image Reconstruction: From Model to Data Driven Methods

*Thursday 28 September 2023 13:30 (45 minutes)*

In this course, we are going to provide the participants with knowledge about the typical mathematical tasks and caveats of image reconstruction problems. This covers advanced forward models and uncertainty, regularizing the reconstruction in order to prevent artifacts caused by noisy data and model errors, and eventually computational tasks. The participants will get the chance to test different image reconstruction and regularization schemes in the hands-on tutorial session.

**Presenters:** KUGER, Lorenz; BURGER, Martin; KABRI, Samira; ROITH, Tim

**Session Classification:** Course Package 11 (Helmholtz Imaging)

Contribution ID: **39** Type: **not specified**

# Tutorial: Regularization in Image Reconstruction: From Model to Data Driven Methods

*Thursday 28 September 2023 14:30 (2 hours)*

**Presenters:** KUGER, Lorenz; BURGER, Martin; KABRI, Samira; ROITH, Tim

**Session Classification:** Course Package 11 (Helmholtz Imaging)

Contribution ID: **40** Type: **not specified**

# Lecture: Fairness in machine learning

*Friday 22 September 2023 10:00 (1 hour)*

// Level: BEGINNER ///
In this talk we survey the role of machine learning methods in questions of social justice and discrimination. First, we take a bird's eye view on which domains may be particularly affected, how machine learning can sustain or even promote inequalities, and whether there are also opportunities for ML to help reduce or prevent discrimination in practice. Via a deep dive into automated data-driven decision-making in consequential scenarios, we learn about the interactions of technical aspects with societal questions and introduce a broader perspective of the life-cycle of ML methods. Throughout, we try to give concrete examples of ML models arguably acting "unfair" and try to distill potential mindsets and techniques to avoid such failure modes in the future.

**Presenter:** KILBERTUS, Niki

**Session Classification:** Course Package 9 (Helmholtz AI)

Contribution ID: **41** Type: **not specified**

# Lecture: Introduction to Statistical Learning (Part 1)

*Monday 18 September 2023 10:00 (1 hour)*

The course package covers foundations and recent advances of machine learning techniques, including:
● Basic concepts: Linear regression, nearest neighbour, parametric vs. non-parametric methods, Bayesian classifiers, the curse of dimensionality, model accuracy, bias-variance trade-off
● Linear classifiers: linear regression for classification (discriminative model), linear discriminant analysis (generative model)
● Nonlinear classifiers with Ensemble learning: Decision trees, random forests, boosting
● Unsupervised learning: Gaussian mixture models, k-means
Our course aims to provide participants with not only a theoretical foundation, but also the practical skills needed to use and develop effective machine learning solutions to a wide variety of problems. We illustrate the use of the models in the tutorial throughout the course with methods implemented in Python.

**Presenter:** PENG, Tingying (Helmholtz Munich)

**Session Classification:** Course Package 12 (Helmholtz AI)

Contribution ID: **42** Type: **not specified**

# Tutorial: Statistical Learning (Part 1)

*Monday 18 September 2023 11:15 (1 hour)*

The course package covers foundations and recent advances of machine learning techniques, including:
● Basic concepts: Linear regression, nearest neighbour, parametric vs. non-parametric methods, Bayesian classifiers, the curse of dimensionality, model accuracy, bias-variance trade-off
● Linear classifiers: linear regression for classification (discriminative model), linear discriminant analysis (generative model)
● Nonlinear classifiers with Ensemble learning: Decision trees, random forests, boosting
● Unsupervised learning: Gaussian mixture models, k-means
Our course aims to provide participants with not only a theoretical foundation, but also the practical skills needed to use and develop effective machine learning solutions to a wide variety of problems. We illustrate the use of the models in the tutorial throughout the course with methods implemented in Python.

**Presenter:** BASSADOK, Alaa (Helmholtz Munich)

**Session Classification:** Course Package 12 (Helmholtz AI)

Contribution ID: **43** Type: **not specified**

# Rendering 3D datasets

*Thursday 28 September 2023 09:00 (2 hours)*

In the course, we will discuss visualization of spatial datasets in general and then transform 3D segmentations into effectful Blender renderings.

**Presenter:** SCHMIDT, Deborah

**Session Classification:** Course Package 14 (Helmholtz Imaging)

Contribution ID: **44** Type: **not specified**

# Lecture: Introduction to Statistical Learning (Part 2)

*Monday 18 September 2023 13:30 (1 hour)*

The course package covers foundations and recent advances of machine learning techniques, including:
● Basic concepts: Linear regression, nearest neighbour, parametric vs. non-parametric methods, Bayesian classifiers, the curse of dimensionality, model accuracy, bias-variance trade-off
● Linear classifiers: linear regression for classification (discriminative model), linear discriminant analysis (generative model)
● Nonlinear classifiers with Ensemble learning: Decision trees, random forests, boosting
● Unsupervised learning: Gaussian mixture models, k-means
Our course aims to provide participants with not only a theoretical foundation, but also the practical skills needed to use and develop effective machine learning solutions to a wide variety of problems. We illustrate the use of the models in the tutorial throughout the course with methods implemented in Python.

**Presenter:** PENG, Tingying (Helmholtz Munich)

**Session Classification:** Course Package 12 (Helmholtz AI)

Contribution ID: **45** Type: **not specified**

# Tutorial: Statistical Learning (Part 2)

*Monday 18 September 2023 14:45 (1h 30m)*

The course package covers foundations and recent advances of machine learning techniques, including:
● Basic concepts: Linear regression, nearest neighbour, parametric vs. non-parametric methods, Bayesian classifiers, the curse of dimensionality, model accuracy, bias-variance trade-off
● Linear classifiers: linear regression for classification (discriminative model), linear discriminant analysis (generative model)
● Nonlinear classifiers with Ensemble learning: Decision trees, random forests, boosting
● Unsupervised learning: Gaussian mixture models, k-means
Our course aims to provide participants with not only a theoretical foundation, but also the practical skills needed to use and develop effective machine learning solutions to a wide variety of problems. We illustrate the use of the models in the tutorial throughout the course with methods implemented in Python.

**Presenter:** BESSADOK, Alaa (Helmholtz AI)

**Session Classification:** Course Package 12 (Helmholtz AI)

Contribution ID: **46** Type: **not specified**

# Lecture: Instance segmentation and tracking

*Tuesday 26 September 2023 13:30 (1 hour)*

**Presenter:** Dr KAINMÜLLER, Dagmar (MDC Berlin)

**Session Classification:** Course Package 13 (Helmholtz Imaging)

Contribution ID: **47** Type: **not specified**

# Tutorial: hands-on instance segmentation challenge in colab

*Tuesday 26 September 2023 14:30 (1 hour)*

**Presenter:** Dr KAINMÜLLER, Dagmar (MDC Berlin)

**Session Classification:** Course Package 13 (Helmholtz Imaging)