Martin **Meinel**

PHD CANDIDATE · MACHINE LEARNING FOR HEALTH

✉ martin.meinel@helmholtz-munich.de | 🏠 meinma.github.io | ⬡ meinma | in martinmeinel | 🎓 Martin Meinel

Profile

I am a highly motivated machine learning researcher passionate about translating machine learning research to healthcare, particularly in the context of inflammatory skin diseases. One of my main contributions during my PhD so far has been the development of SAFARI, a framework for sparse biomarker detection for rare diseases, which I was honored to present at the ML4H workshop in New Orleans. My current research focuses on leveraging genetics and single-cell expression data to uncover causal risk factors for hereditary diseases, such as rheumatoid arthritis.

Education

PhD Candidate in Computational Biology
Munich, Germany

HELMHOLTZ CENTER MUNICH | TECHNICAL UNIVERSITY MUNICH | LMU MUNICH
Oct 2021 - Present

- Supervised by Dr. Michael Menden & Dr. Natalie Garzorz-Stark.

M. Sc. in Data Engineering & Analytics
Munich, Germany

TECHNICAL UNIVERSITY OF MUNICH
Oct 2018 - Nov 2020

- Relevant courses: Machine Learning, Machine Learning for Crowd Modeling & Simulation, Information Retrieval, Applied Regression, Foundations of Data Analysis, Foundations of Data Engineering.

B. Sc. in Applied Computer Science
Bayreuth, Germany

UNIVERSITY OF BAYREUTH
Oct 2014 - Oct 2017

- Major in Computer Science and Minor in Engineering Science.

Research Experience

SAFARI - Sparse biomarkers for rare diseases
Helmholtz Center Munich

PHD STUDENT
Feb 2021 - Present

- Developed SAFARI, a model-agnostic framework designed to identify sparse and robust biomarkers for rare diseases, enabling clinical translation by operating directly on the gene space.
- Ensuring high expression levels of genes, SAFARI simplifies their detection in clinical applications.
- Applied SAFARI to address the critical clinical challenge of distinguishing cutaneous T Cell lymphoma from eczema. Three biomarkers were extracted from a pool of 20,000 genes within bulk RNA-seq data, facilitating early diagnosis and proper treatment.
- Leveraged the three discovered biomarkers to achieve a sensitivity score of 85 % and a specificity score of 93 %, using a logistic regression model on an imbalanced dataset.

Identification of diagnostic markers enabling precision medicine for psoriasis
Helmholtz Center Munich

PHD STUDENT
Apr 2021 - Present

- Imputed missing therapy response data of patients, enabling the analysis of complete patient datasets.
- Created an objective metric to assess therapy response, allowing for more accurate in-between patient comparisons and categorizations.
- Implemented statistical tests identifying best drug target per endotype.

Risk factor discovery of inflammatory skin diseases exploiting single-cell expression data and genetics.
Helmholtz Center Munich

PHD STUDENT
October 2023- Present

- Leveraged Mendelian Randomization to infer causal associations between cell-type specific gene expression levels and inflammatory skin diseases.
- Implemented a pipeline to detect cis eQTLs of single-cell expression data from peripheral blood mononuclear cells.

Efficient implementation of deep convolutional Gaussian Processes
TU Munich

RESEARCHER
Jan 2020 - Nov 2020

- Implemented deep convolutional Gaussian processes as an alternative to convolutional neural networks (CNNs), to obtain uncertainty estimations for predictions on the MNIST dataset, aimed at enhancing computation speed (Thesis available here).
- Conducted a thorough evaluation of multiple imputation algorithms to determine their efficiency in approximating the kernel matrix and achieving optimal performance on test data.
- Accomplished a substantial 40% reduction in training time by using only 20% of the original training data while maintaining a high classification accuracy of 86% on the MNIST dataset (compared to 98% accuracy with the entire training set).

Publications

- Garger, D., **Meinel, M.**, Dietl, T., Hillig, C., Garzorz-Stark, N., Eyerich, K., de Angelis, M., Eyerich, S., Menden M.P. (2023).The impact of the cardiovascular component and somatic mutations on ageing. *Aging Cell*https://doi.org/10.1111/acel.13957.
- Fischer, F., Doll, A., Uereyener, D., Roenneberg, S., Hillig, C., Weber, L., Hackert, V., **Meinel, M.**, Farnoud, A., Seiringer, P., et al. (2023). Gene expression based molecular test as diagnostic aid for the differential diagnosis of psoriasis and eczema in formalin fixed and paraffin embedded tissue, microbiopsies and tape strips. *The Journal of Investigative Dermatology*, S0022-202X(23)00156-2. https://doi.org/10.1016/j.jid.2023.02.015.
- Farnoud, A., Ohnmacht, A. J., **Meinel, M.**, & Menden, M. P. (2022). Can artificial intelligence accelerate preclinical drug discovery and precision medicine?. *Expert opinion on drug discovery*, 17(7), 661–665. https://www.tandfonline.com/doi/epdf/10.1080/17460441.2022.2090540.

Working experience

Opitz Consulting GmbH
Munich, Germany

SOFTWARE ENGINEER WORKING STUDENT
Oct 2019 - Oct 2020

- Built a docker skeleton for Apache Zeppelin, enabling users to start a docker container running Apache Zeppelin on openShift with one click.
- Created a web application for Allianz IDS GmbH, allowing employees to track, assign, and rate investment orders within the department.

REHAU Industries SE & Co. KG
Bayreuth, Germany

SOFTWARE ENGINEER WORKING STUDENT
Feb 2018 - Mar 2019

- Developed ALEXA skill for the 2018 FRONTALE window exhibition, demonstrating several features of the smart window.
- Implemented a web app for Medi Bayreuth to assess player fatigue after training and track performance during regular fitness checks, contributing to injury prevention.

REHAU Industries SE & Co. KG
Rehau, Germany

SOFTWARE ENGINEER INTERN
Nov 2017 - Jan 2018

- Developed a plugin for the open-source smart home system openHAB, enabling users to connect their automated sensor-based garden watering system with other IoT devices.

Skills

Programming	Python, Java, R, shell
Libraries / Frameworks	NumPy, Pandas, PyTorch, scikit-learn, Spring, scanpy, DESeq2, edgeR
Tools / Platforms	AWS, Docker, Git, SQL, LaTeX, slurm
Languages	German, English

Honors & Awards

2023	**ML4H Workshop Presentation,** Presented findings paper at the "Machine Learning for Health" workshop.	*New Orleans, US*
	Patent Inventor, Registered a patent titled "Differential Diagnosis of Mycosis Fungoides: Method and System" for the discovery of biomarkers distinguishing Eczema from cutaneous T-cell lymphoma using SAFARI.	*Munich, Germany*
	Featured Speaker, Delivered a presentation on "Biocomputational Analysis of Big Data" at the EADV-ESDR Summer Research Workshop: Big Data and Translation in Dermatology.	*Freiburg, Germany*
	Participant, Selected as a participant for the OxML - MLxHealth summer school.	*Oxford, UK*
2021	**MuDS PhD Program,** Selected as a member of the Munich School for Data Science (MuDS).	*Munich, Germany*

Extracurricular Activity

TUM MINGA Mentoring Program
Munich, Germany

MENTOR
Oct 2019 - Oct 2020

- Assisted incoming master students from abroad with navigating TU Munich and life in Germany by offering guidance on university procedures, exam preparations, and insights on local resources and cultural differences.

Lern-Fair
Munich, Germany

MATH TEACHER
Feb 2021 - Jul 2021

- Delivered personalized online math lessons to 9th-grade students during the COVID-19 home-schooling period, promoting understanding and growth in mathematical concepts.
- Developed and curated exercise sheets to reinforce knowledge, deepen understanding, and facilitate independent practice.