Martin **Meinel**

PhD Candidate · Machine Learning

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Profile

Highly motivated machine learning researcher with a passion for translating machine learning research to healthcare, primarily focused on inflammatory skin diseases. Developed SAFARI a framework for sparse biomarker detection for rare diseases. At the moment leveraging genetics in combination with single-cell expression data to identify causal risk factors.

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*

- GPA: 1.7
- 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*

- GPA: 2.1

Research Experience

SAFARI - Sparse bIomarkers For rARe dIseases.

Helmholtz Center Munich

PhD Student — *Feb 2021 - Present*

- Developed the model agnostic framework SAFARI to identify sparse & robust biomarkers for rare diseases.
- SAFARI works directly on the gene space, enabling clinical translation.
- SAFARI ensures high expression levels of genes, simplifying their detection in clinical applications.
- Applied to the essential clinical problem of distinguishing cutaneous T Cell lymphoma from eczema, I extracted three potential biomarkers out of 20,000 genes from bulk RNA-seq data, empowering early diagnosis and proper treatment.
- Leveraging the three discovered biomarkers, I achieve a sensitivity and specificity score of 85 % and 93 %, respectively, using a logistic regression model on an imbalanced data set.

Identification of diagnostic markers enabling precision medicine for psoriasis

Helmholtz Center Munich

PhD Student — *Apr 2021 - Present*

- Developed a linear imputation solution for 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 categorization of patients.
- Implemented statistical tests identifying best drug target per endotype.

Leveraging single-cell expression data with genetics to discover risk factors in inflammatory skin diseases

Helmholtz Center Munich

PhD Student — *October 2023- Present*

- Leveraging Mendelian Randomization to infer causal associations of cell-type specific gene expression levels and inflammatory skin diseases.
- Implemented 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 to mimic convolutional neural networks (CNNs) to obtain uncertainty estimations for predictions of the MNIST dataset with the goal of faster computation (see here).
- Conducted a comprehensive evaluation of various imputation algorithms to determine their ability to efficiently approximate the kernel matrix and deliver optimal performance on test data.
- Accomplished a substantial 40% reduction in training time by using only 20% of the original training data while obtaining a high classification accuracy of 86% on the MNIST dataset (98% accuracy using the entire training set).

Machine Learning on Graph and Sequential Data — *TU Munich*

Master student — *Apr 2020 - Aug 2020*

- Implemented variational autoencoder generating MNIST digits.
- Trained Word2Vec embeddings on a review dataset to showcase embeddings store language characteristics.
- Implemented spectral clustering to users on the social network Yelp. Clustered users based on food preference similarity. A comprehensive evaluation was conducted to minimize the ratio cut and the normalized cut of the graph regarding how this affects spectral clustering.
- Implemented a graph convolutional neural network performing semi-supervised node classification on the CORA ML citation network. Analyzed how oversmoothing affects the network. Implemented approximate personalized propagation of neural predictions to overcome this problem.

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 skills for the 2018 FRONTALE window exhibition, demonstrating several features of the smart window.
- Implemented a web application for Medi Bayreuth to assess players' fatigue after training sessions and their performance during regular fitness checks to visualize and track their development and prevent injuries.

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

Honors & Awards

2023	**Poster at ML4H**, Accepted Findings Paper at "Machine Learning for Health" workshop	*New Orleans, US*
2023	**Inventor**, Registered patent "Differential diagnosis of mycosis fungoides, method and system" for discovered biomarkers to distinguish Eczema from Cutaneous T Cell lymphoma using SAFARI	*Munich, Germany*
2023	**Speaker**, Selected Speaker about "Biocomputational analysis of big data" at EADV-ESDR Summer Research Workshop: Big Data and Translation in Dermatology.	*Freiburg, Germany*
2023	**Participant**, Selected as participant for summer school OxML - MLxHealth.	*Oxford, UK*
2021	**PhD**, Selected as a member of 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.