CHARLOTTE LANGE

Machine Learning for Climate

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EDUCATION

M.Sc Environmental Science

Universität Freiburg

October 2024 – Freiburg, DE

In the interdisciplinary *Environmental Modelling and Data Science* major, I focus on applying machine learning to environmental challenges, with coursework in sustainability, ecological systems, and preservation strategies.

Full masters scholarship with the Konrad Zuse School of Excellence in Learning and Intelligent Systems (ELIZA)

B.Sc. Cognitive Science

Universität Osnabrück

October 2018 – April 2023 Osnabrück, DE

In this highly interdisciplinary program, my personal focus lay on Deep Learning, Machine Learning, Neuroinformatics and Neuroscience. Final Grade: 1.2 (GPA 3.8)

Thesis: "Improving Physical Consistency in ML-driven Radiative Transfer Parameterization for Climate Model Emulation" Supervisors: Dr. Chirstoph Irrgang (RKI, Berlin), Prof. Dr. Gordan Pipa (IKW, Osnabrück), Grade 1.0 (GPA 4.0)

A Levels

Jacob-Grimm-Schule

August 2015 – July 2018 Kassel, DE

Focus on English and Mathematics. Final Grade: 1.1 (GPA 3.9) Receiver of the school's graduate extinction in mathematics and physics. First place with the German team in an international physics competition (AYPT 2016).

TEACHING

Lecture: Implementing Artificial Neural Networks with Tensorflow

University of Osnabrück

WS 20/21 & WS 21/22 Osnabrück, DE

Co-lecturing this course, my teaching covered topics from the basics of ANNs to current state-of-the-art networks such as Transformers. Course contents and homework tasks are self-designed. This is a graded 8 ECTS course, eligible for Bachelor and Master, under the patronage of Prof. Dr. Michael Franke (20/21) and Prof. Dr. Gordon Pipa (21/22).

Lecture: Deep Reinforcement Learning

University of Osnabrück

WS 20/21 Osnabrück, DE

Tutoring this 2-week intensive block course, I developed a framework for students to easily and efficiently implement reinforcement learning algorithms. I also helped revise content, designed educational graphics and gave coding support. The methods covered stretched from basic reinforcement learning to state-of-the-art trust-region methods. This is a graded 8 ECTS course, eligible for Bachelor and Master, taught by Leon Schmid under the patronage of Prof. Dr. Elia Bruni.

PRACTICAL EXPERIENCE

- Independent Research Assistant

  May '23 - July '24 MILA, remote

  As part of an interdisciplinary, international project at the intersection of causal machine learning and climate physics, I handled coding, academic writing, method development, and management tasks.

- Tutor

  since April '23 SFN, Kassel

  At the Schülerforschungszentrum (SFN) I tutor high school students to follow their own research projects, advising them in programming, AI and climate science questions and problems. My protegee Lilly Schwarz won with the best interdisciplinary project at the "Jugend Forscht" national competition in 2024.

- Self-organized Research Internship

  Aug - Dec '22 MILA, Montreal

  During my stay at the Quebec Institute of AI, I worked on acquiring and preprocessing large-scale climate model data for machine-learning purposes in the context of a joint research project by MILA and Intel. Under Supervision of Prof. David Rolnick.

- Self-organized Research Internship

  June - July '22 GFZ, Potsdam

  During my stay at the Helmholtz Institute for Geophysics in the Geodesy Department (Section 1.3. Earth System Modelling) I explored their research projects and the prospects of applying machine learning. Supervised by Dr. Christoph Irrgang.

- DAAD funded Research Internship

  Aug - Nov '21 UKZN, Pietermaritzburg

  Developing an automated dataset collection system and prototyping a deep learning based individual recognition software. Supervised by Dr. Mandlenkosi Gwetu.

- Research Assistant

  SS '21 IKW, Osnabrück

  As a research assistant in the Cognitive Modelling Group I worked on Context-Aware Image Captioning. Assisting Prof. Dr. Michael Franke.

PUBLICATIONS

Kaltenborn, J., Lange, C., Ramesh, V., Brouillar, P., Gurwicz, Y., Runge, J., Nowack, P., & Rolnick, D. (2023). ClimateSet: A Large-Scale Climate Model Dataset for Machine Learning. *Proceedings of the Thirty-Seventh Annual Conference on Neural Information Processing Systems, (NEURIPS 2023), New Orleans, USA, 10-16 December 2023*.

SKILLS

Python

TensorFlow
PyTorch

end-to-end machine learning pipelines · distributed computing

Linux (Ubuntu)

setting up and configuring systems · virtual environments · problem-solving

LaTeX

R

RESEARCH INTERESTS

physics-informed deep learning · theory-guided machine learning · climate model emulation

LANGUAGES

German
English
French

HOBBIES

hiking · exploring · poetry · dancing · nutrition-science · reading · creative writing · arts ·

FURTHER EDUCATION

- International Summer School on Renewable Energies

  August 2019 FH Aachen, Jülich

  Completed a certified two-week international summer school on renewable energies.
  Grade: 2.0 (GPA 3.0)

COMMITMENT

University

- Student rep. for the appointment committee for the prof. in Neuromorphic Computing

  Jan 2022 - Aug 2022

- Member of the Institute of Cognitive Science's Mentoring Team

  Aug 2020 - May 2022

- Student rep. for the appointment committee for the prof. in Machine Learning

  June 2020 - June 2021

- Elected vice- and president of the student parliament as a member of the Green Party

  May 2019 - October 2020