Summer School 2024
"Application of AI/ML techniques in Atmospheric Science"

The University of Helsinki (UH), Institute for Atmospheric and Earth System Research (INAR), Lappeenranta-Lahti University of Technology (LUT), Department of Computational Engineering and the Lahti University Campus are pleased to announce the summer school "Application of AI/ML techniques in Atmospheric Science, 12th to 16th of August 2024 in Lahti, Finland.

Time
12th (12 am) to 16th (3 pm) of August 2024

Location
University of Helsinki Lahti-campus, Niemenkatu 73, 15140 Lahti, Finland

The scientific content of the course
Gas-phase oxidation reactions and aerosols that are formed from their products have a profound impact on atmospheric air quality and climate change. Successfully mitigating the adverse effects of air pollution on society and the environment necessitates a comprehensive understanding of the underlying processes. Artificial intelligence (AI), or more precisely, machine learning (ML), has emerged as a valuable tool to address model limitations arising from extended computation times. ML leverages knowledge of specific meteorological, physical, or chemical processes to enhance large-scale models. For example, statistical emulation facilitates rapid predictions in various domains, including high-resolution land surface models, detailed cloud simulations, and accurate ambient ozone predictions.

This course will provide introductory lectures on relevant atmospheric topics (e.g., atmospheric chemistry, aerosol dynamics, Earth System models and numerical weather prediction) and computational methods (for data science and machine learning). Additionally, we will form mixed groups with different scientific backgrounds for the hands-on training, covering about half of the course time. Each group will use previously created atmospheric datasets in the exercises to train an end-to-end neural network, like LSTM, RNN, and Transformer. The students will learn basic GPU settings (Google Colab or local machines) and cuda-enable deep learning frameworks (PyTorch). We also provide advanced topics for highly motivated students, including data visualisation, analysis, and model optimisation. At the end of the course, each group will present their outcome and discuss the dis- and advantages of the applied method.

What will you learn in this course?
This new course will be organised for the first time and will bridge two scientific areas: computational and atmospheric science. Students will receive a basic background on the various options in machine learning and how to apply these

methods to different topics in atmospheric science. The course will consist of lectures and group work, and we will ensure that each group (4-5 people) will have equally many students from both scientific backgrounds. Hence, working intensely together with students from computational science for several days, students with backgrounds in atmospheric science will experience an entirely new way to tackle scientific tasks, like writing a neural network for a chemistry scheme. Conversely, students of computational sciences learn to apply their knowledge in an interdisciplinary group, which will be the default case for their working life.

Requirements

A basic knowledge of programming in some computer languages (e.g., Fortran, C++, Python and Matlab) is required. You will also need to bring your own laptop.

Exam and assessment

Each student group will write a scientific report based on the results of their model simulations and send the report and their developed numerical code to the teachers.

Credits

3 ECTS, UH and LUT (no grades – only Pass or Fail)

Social activities

- Get together / Outdoor activities & Picnics depending on the weather
- A dinner will be arranged for all course participants on the last evening
- Additional events are in planning and will be organised

Course fee

This course is free and includes for all accepted participants:

- All academic and social programs during the course
- Lunch and coffee breaks on all course days

Not included are:

Travel expenses to and from Lahti, accommodation, personal health, civil liability insurance, and personal expenses.

Insurance

The course organisers cannot accept liability for personal accidents or loss or damage to the private property of attending students that may occur during or arise from the course. Participants are, therefore, advised to arrange their own appropriate insurance coverage.

Application

Applicants must register for the course by the 31st of May 2024 by filling out the form below. We welcome applications from participants from all over the world.

Registration: https://elomake.helsinki.fi/lomakkeet/128529/lomake.html

If you have any questions concerning the course, please don't hesitate to contact Michael Boy (michael.boy@helsinki.fi).