FLOW Winter School on
Machine Learning and Data-Driven Methods

December 2-5, 2019
Linné FLOW Centre, KTH Mechanics
Royal Institute of Technology
Stockholm, Sweden

https://www.flow.kth.se/flow-graduate-school/2019-flow-school-on-machine-learning-and-data-driven-methods-1.936985

Scope:

With the advancement of computer architectures and power, together with the related increase in the rate of data generation, new computational methods are required to exploit the vast wealth of available information. In particular, new approaches to classification, as well as new algorithms for modelling and prediction, can be developed through data-driven methods and machine learning. Fuelled by advances in computer science and through the contribution of large companies such as Google and Amazon, these new approaches are making their way into all disciplines of science, including fluid mechanics and turbulence. Despite the potential of these methods, it is essential to be aware of their limitations in order to identify the areas in which they can be applied successfully. Therefore, this Winter School is aimed at providing the participants with an introductory overview of machine-learning methods, including neural networks, reinforcement learning, and uncertainty quantification, applied to problems relevant to engineering and fluid dynamics.

Invited lecturers:

Josephine Sullivan, Computer Vision/CVAP, School of Computer Science and Communication, KTH, Stockholm, Sweden

Luca Magri, Applied Thermofluids, Department of Engineering, Cambridge University, UK

Jean Rabault, Department of Mathematics, University of Oslo, Norway

Saleh Rezaeiravesh, Linné FLOW Centre, School of Engineering Sciences, KTH, Stockholm Sweden

Topics:

The school is intended to give the students an overview of both general and more specific topics within the area of machine learning and data-driven methods, including aspects of on-going research. For the hands-on sessions, you will need a laptop with installed Python, preferably running Linux. The schedule is:

- Monday (2/12)
    Welcome, organisation of the school, administration
    Josephine Sullivan: Introduction to Machine Learning
    Luca Guastoni: Hands-on Machine Learning
    Saleh Rezaeiravesh: Introduction to Uncertainty Quantification
- Tuesday (3/12)
    Josephine Sullivan: Neural Networks
    Luca Magri: Physics-constrained data-driven methods for chaotic flows
- Wednesday (4/12)
    Luca Magri: continuation
    Luca Guastoni: Hands-on Neural Networks
    Saleh Rezaeiravesh: Hands-on Uncertainty Quantification
- Thursday (5/12)
    Jean Rabault: Deep Reinforcement Learning
    Wrap-up of school, projects, school dinner

Administrative details:

Lectures will be given December 2-5, 2019 in the seminar room of KTH Mechanics (room Faxén) located on the KTH main campus, close to the city centre of Stockholm. The FLOW graduate school will provide lunches to the registered participants. The programme includes a school dinner on Thursday night in a restaurant within walking distance from KTH. A project will be performed by pairs of students and sent electronically to the school organisers for the final evaluation, worth 3.5 ECTS points (if requested).

The course is free of charge and includes lunches plus the school dinner. Interested PhD students are invited to contact Philipp Schlatter (pschlatt@mech.kth.se, use **"[ML2019] …"** in the subject line) for registration. Participation is on a first-come first-serve basis. For further information visit the school homepage on www.flow.kth.se.

Contact and organiser:

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