

# Introduction to Machine Learning

– HILARY 2020 –

## General information

Lecturer: Fabian Ruehle  
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Course material: [https://github.com/ruehle/ML\\_Oxford\\_Hilary2020/](https://github.com/ruehle/ML_Oxford_Hilary2020/)  
Video of lecture: TBA

## Lectures

Lectures in weeks 5-8 of Hilary 2020  
Mondays, 3:00PM - 5:00PM  
Martin Wood Lecture Theater, 20 Parks Rd, Oxford OX1 3PB

## Prerequisites

Linear algebra I and II, Analysis I and II

Literature The introductory chapters of F. Ruehle, *Data science applications to string theory*, Physics Reports, 2019 [<https://doi.org/10.1016/j.physrep.2019.09.005>].

## Syllabus

Introduction to Neural Networks (feed forward / recurring / convolutional NNs), activation / loss / regularization functions, Supervised Machine Learning and training, Reinforcement Learning, Unsupervised Machine Learning for clustering / anomaly detection / feature selection, Genetic Algorithms

## Abstract

Machine Learning techniques, in particular neural networks, have become an integral part of our lives. Due to their versatile nature, they are applied in the private and academic sector with tremendous success. In these lectures, I will first review the basic building blocks of neural networks and how they are trained. I will then discuss popular neural network architectures and how they are used in supervised and reinforcement learning. I will also introduce machine learning techniques for unsupervised learning for clustering / anomaly detection / feature selection, as well as other data science techniques, such as genetic algorithms. Voluntary exercises and solutions will be provided in which the material of the course is illustrated and applied to problems in physics.