

Applied statistics and Machine learning in Python with subsurface applications

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What are we talking about?

Artificial Intelligence (AI): A field of computer science dedicated to creating systems capable of performing tasks that require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

Machine Learning (ML): A subset of AI that involves the development of algorithms and statistical models that enable computers to perform tasks. A model is tuned in a learning phase and it can then make inferences from unseen data.

AI contains ML.

Is it possible to master Machine Learning in Python in two days?

No.

What is the point then?

ML is an immense field, up to the point that developers are specialising more and more on particular aspects, losing the overall view of the domain. ML can be thought as a very large toolset. Each tool is aimed to solve a particular type of problem. It is up to an user to frame a task (using the domain expertise) as a problem that can be then solved with a ML approach.

The aim of this course is exactly this. We will thus get an overview on what questions can be answered with ML, how data might be used and what output can be obtained.

Why Python?

Most ML/AI developers have released their code as Python packages. By using Python, we can actually use various algorithms that are currently available.

This means that, with python, we will be able use and test the newest ML software. We then will be able to make the necessary adaptations for various tasks.

What to expect?

A good and solid introduction to Machine Learning. An introduction to the major ML python libraries available. A set of hands-on exercises and tutorials, with applications in geophysics and other areas.

About this course

My objective with this course is to show how to formulate questions that can be effectively addressed using machine learning approaches. Through various examples, we will explore how data can be gathered, refined, and ideally utilized to train machine learning algorithms. We will also discuss the realistic expectations and limitations of such methods. Moreover, the course will guide you in developing your own Python code to tackle various, manageable ML challenges. We will create ML programs using generative AI and other freely available code repositories within the Python ecosystem.

Online Machine Learning python libraries

We will use a set of machine learning libraries:

sklearn Originally developed in affiliation with Google, it is the most used open source Python module for machine learning built on top of SciPy.

pytorch Originally developed by Meta AI and now part of the Linux Foundation umbrella. It is free and open-source software.

TensorFlow Developed and owned by Google, is a free and open-source software library.

Deeptime A Python library for analysis of time series data. In particular, methods for dimension reduction, clustering, and Markov model estimation (scikit-learn based).

Keras Keras is a deep learning API based on pytorch and sklearn.

There is plenty of material online that is worth to be checking for further learning. I personally recommend:

Applied machine learning

Machine learning with python