

Data-driven Modeling : Machine Learning

Course outline

(1) Lecture plan

(2) Laboratory exercises plan

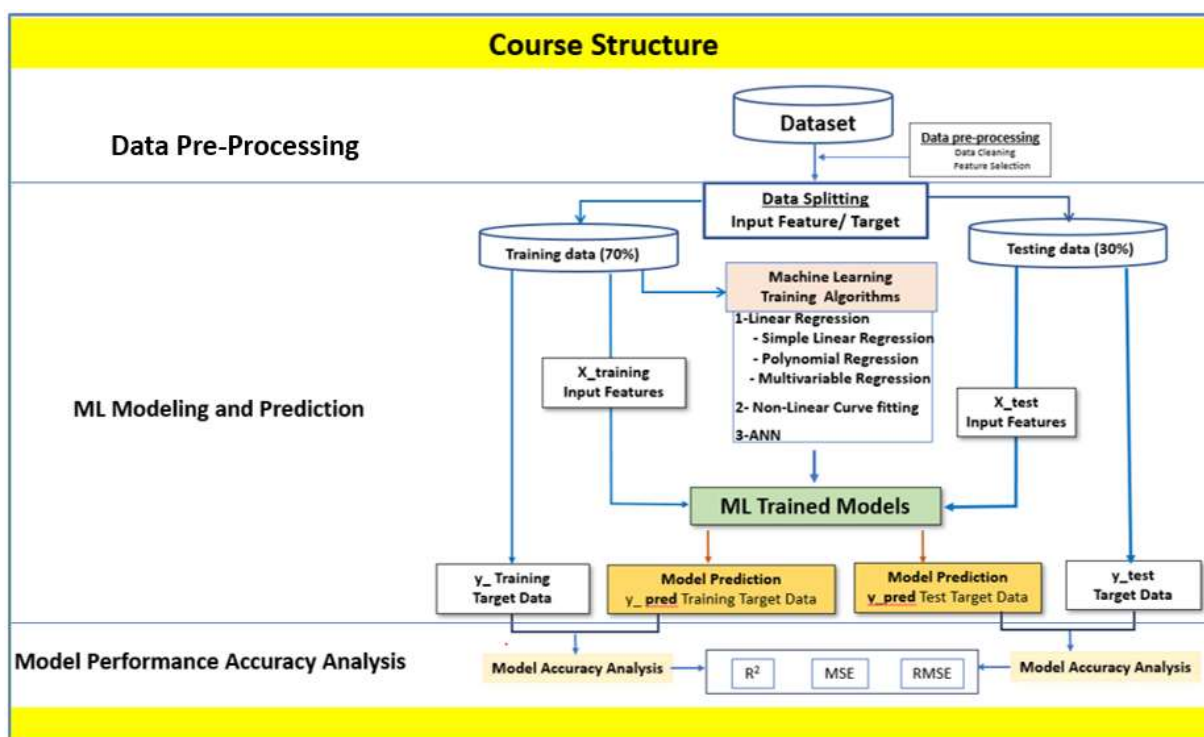
Course Outline Of Data-Driven Modeling

Introduction

The figure outlines the course structure that will be covered during Data-Driven Modelling.

Machine Learning deals with three basic steps

- Data Preprocessing/Feature engineering
- Machine Learning Modeling and Prediction
- Model Performance Accuracy Analysis



Lecture Plan

Lecture #1 Data-Preprocessing/Feature Engineering

Lab #1 Python based pre-processing

Lecture #2: Mathematics and Statistics for Machine Learning

- Modeling
- Model performance analysis

Lab #2. Python based Modeling/analysis

- From the Scratch
- Using sklearn python library

Lecture #3 Python library based Modeling/Analysis

(3a) Multivariable Regression

Theory + Lab #3

(3b) Polynomial Regression

Theory + Lab #4

(3c) Non-Linear Regression

Theory + Lab #5

Lecture #4: ANN Modeling

→ Concepts how it work

- Perceptron
- Activation function
- Multilayer Perceptron
 - Forward feed
 - Backward propagation
 - gradient descent
 - optimizers

→ Lab #7: ANN modeling / Analysis

Project: Using the lectures/Labs, do your project works. Your work should reflect the above Lab-works

Outline of the Laboratory works

#1 Data preprocessing.

Here, we will work on

(a) Synthetic data:- generated from Physics

(b) Field data that contains noises.

#2. Simple Linear Regression modelling

(a) Implement parameter determination from SCRATCH

→ Method 1: Matrix inversion

- Method 2: Implementing the derived functions

(b) Sklearn → Python library.

→ Compare results of (a) and (b)

#3 Multivariable Regression

(a) Matrix inversion Method

(b) Sklearn Python library

→ Compare the results.

#4 Polynomial Regression

(a) Matrix inversion

(b) Sklearn Python library

- Compare the results.

#5 Non-linear Regression

(a) Scipy / optimize library

#6 ANN - Keras library based modelling

(a) Synthetic data

(b) Field data