

Computational Mathematics for Learning and Data Analysis

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A.A. 2021/22

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0.1 Introduction

Exam: project (groups of 2) + oral exam.

This course's goal is to make sense of the huge amounts of data, take something big and unwieldy and produce something small that can be used, a **mathematical model**.

The mathematical model should be accurate, computationally inexpensive and general, but generally is not possible to have all three. General models are convenient (work once, apply many), they are parametric so we need to learn the right values of the parameters. Fitting is finding the model that better represents the phenomenon given a family of possible models (usually, infinitely many). Is an optimization model and usually is the computational bottleneck. ML is better than fitting because fitting reduces the training error, the empirical risk, but ML reduces the test error, so the generalization error.

Solve general problem $\min_{x \in S} f(x)$, with Poloni solve $\min_{x \in R^n} \|Ax - b\|_2$ which is easier and can be solved exactly.

Quick recap of linear algebra