Mathematical Methods for Machine Learning
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[Tie20] Vũ Hữu Tiệp. *Machine Learning Cơ Bản*.

[DFO23] Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong. *Mathematics for Machine Learning*. 2023.

Audiences & Goals

Target Audience. Mainly: Engineering- & CS undergraduate students. Note: Mathematics undergraduate students, especially academic-oriented (researchers), need much more rigorously theoretical mathematical foundations for ML.

Goal/Objective

Learn enough mathematics to be able to balance our comprehension in both mathematical- & technical (engineering) aspects of Machine Learning: Adjust "suitable" coefficients $\alpha, \beta, \gamma \in (0, 1)$ s.t. $\alpha + \beta + \gamma = 1$ &

$$\boxed{\text{Maximize } \mathrm{Goal}(\mathrm{What}, \mathrm{How}, \mathrm{Why}) := \alpha\mathrm{What} + \beta\mathrm{How} + \gamma\mathrm{Why}.} \quad (1)$$

where the functional $\mathrm{Goal}(\mathrm{What}, \mathrm{How}, \mathrm{Why})$ depends on your target job(s) & purpose(s).

Audiences & Goals

Distinguish 2 different perspectives/orientations for a CS student: Engineering-oriented & Mathematics-oriented.

Engineering perspective

Engineers need to learn various What (definitions, tools) & mainly focus on How (technicalities, tools), "practical Why" & a little bit on "theoretical Why".

E.g.: *Why does this algorithm/model work? Why does(n't) my code work?*

Mathematics perspective

Mathematicians have to learn & build various What (definitions, concepts), mainly focus on "theoretical Why" (logic, rigorous proof), then on How (mathematical tools)

E.g.: *Why is this model "optimal" in mathematical sense?*

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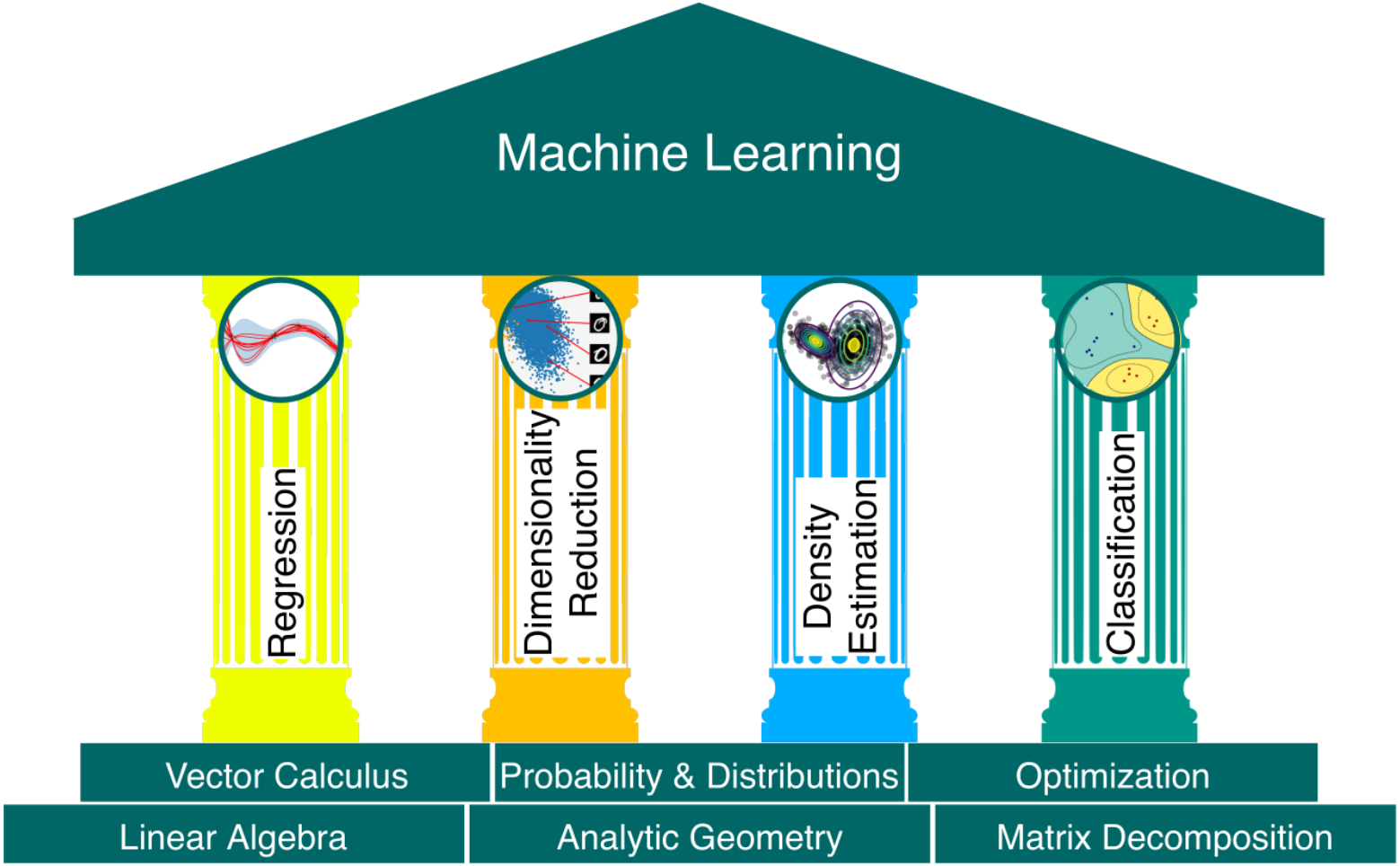
Prerequisites



Hình: Foundations & 4 pillars of ML. Source: [DFO23, Fig. 1.1, p. 14].

Prerequisites

Linear Algebra

Probability

Statistics

Artificial Neural Networks (ANNs)