Deep Learning

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1 Introduction

1.1 Formulation

dimension of input — # known input-output data pairs — available known input data — available known output data

Let(d, M $\in \mathbb{N} = \{1, 2, 3, \dots\}$, $\mathcal{E} \in C(\mathbb{R}^d, \mathbb{R})$, $x_1, x_2, \dots, x_{M+1} \in \mathbb{R}^d$, $y_1, y_2, \dots, y_M \in \mathbb{R}$) satisfy for all $m \in \{1, 2, \dots, M\}$ that $y_m = \mathcal{E}(x_m)$

With $\mathcal{E} : \mathbb{R}^d \to \mathbb{R}$, unknown function which relates input and output

1.2 Goal

The Learning Problem goal is to use the knowledge of M input-output data:

Pair 1 (not using $\mathcal{E}$) — Pair 2 (not using $\mathcal{E}$)

$$(x_1, y_1) = (x_1, \mathcal{E}(x_1)),\ (x_2, y_2) = (x_2, \mathcal{E}(x_2)),\ \dots,\ (x_M, y_M) = (x_M, \mathcal{E}(x_M)) \in \mathbb{R}^d \times \mathbb{R}$$

References

[1] Arnulf Jentzen, Benno Kuckuck, Philippe von Wurstemberger. (2023). Mathematical Introduction to Deep Learning: Methods, Implementations, and Theory `https://arxiv.org/abs/2310.20360`