thws
Technical University
of Applied Sciences
Würzburg-Schweinfurt

Magda Gregorová
magda.gregorova@thws.de

Introduction to Deep Learning

Intro

December 25, 2025

Outline

thws
Technical University
of Applied Sciences
Würzburg-Schweinfurt

Measures and probability

Measures - assigning mass to sets

thws
Technical University
of Applied Sciences
Würzburg-Schweinfurt

Measurable space $(S, \mathcal{S})$

- S - set (e.g., $\mathbb{R}^d$, discrete set, etc.)
- $\mathcal{S}$ - σ-algebra on S (collection of measurable subsets of S)
  - closed under complements and countable unions
  - contains $\emptyset$ and S

Measure μ on $(S, \mathcal{S})$ - function $\mu : \mathcal{S} \to [0, \infty]$

- $\mu(\emptyset) = 0$
- countable additivity: for disjoint $\{A_i : i \in I\} \subseteq \mathcal{S}$, $\mu\left(\bigcup_{i \in I} A_i\right) = \sum_{i \in I} \mu(A_i)$

Examples:

- counting measure: $\#(A)$ = number of elements in A
- Lebesgue measure on $\mathbb{R}^d$: $\lambda(A)$ = volume of A