



UniTs - University of Trieste

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# Advanced Deep Learning and Kernel Methods

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September 24, 2025

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# Preface

- **Kernel Methods**
- **Neural Tangent Kernel and Neural Networks**
- **Biologically inspired ANNs for Visual Cortex**
- **Geometric Deep Learning**
- **Adversarial Attacks and ANNs Implicit Bias**

# Contents

# Kernel Methods

## 1.1 Math of Kernels

### 1.1.1 Aronszajn's Theorem

(Aronszajn 1950)  $K$  is a p.d. kernel on the set  $\mathcal{X}$  **if and only if** there exists a Hilbert space  $\mathcal{H}$  and a map  $\phi : \mathcal{X} \rightarrow \mathcal{H}$  such that

$$K(x, x') = \langle \phi(x), \phi(x') \rangle_{\mathcal{H}} \quad \forall x, x' \in \mathcal{X}$$

where  $\langle \cdot, \cdot \rangle_{\mathcal{H}}$  is the inner product in  $\mathcal{H}$ .

# Bibliography

- [1] David Goldberg. “What every computer scientist should know about floating-point arithmetic”. In: *ACM computing surveys (CSUR)* 23.1 (1991), pp. 5–48.
- [2] *High Performance Computing* — *digital-strategy.ec.europa.eu*. <https://digital-strategy.ec.europa.eu/en/policies/high-performance-computing>.