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On Imprecise Generalisation: From Invariance to Heterogeneity

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The ability to generalise knowledge across diverse environments stands as a fundamental aspect of both biological and artificial intelligence (AI). In recent years, significant advancements have been made in out-of-domain (OOD) generalisation, including the development of new algorithmic tools, theoretical advancements, and the creation of large-scale benchmark datasets. However, unlike in-domain (IID) generalisation, OOD generalisation lacks a precise definition, leading to ambiguity in learning objectives.

In this talk, I aim to clarify this ambiguity by arguing that OOD generalisation is challenging because it involves not only learning from empirical data but also deciding among various notions of generalisation. The intersection of learning and decision-making poses new challenges in modern machine learning, where distinct roles exist between machine learners (e.g., ML engineers) and model operators (e.g., doctors).

To address these challenges, I will introduce the concept of imprecise learning, drawing connections to imprecise probability, and discuss our ICML 2024 paper (<https://arxiv.org/abs/2404.04669>) in the context of domain generalisation (DG) problems. By exploring the synergy between learning algorithms and decision-making processes, this talk aims to shed light on the complexities of OOD generalisation and pave the way for future advancements in the field.