# Neural Controlled Differential Equations and Diffrax

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**Abstract:**

This seminar will introduce recent work on two topics within the field of neural differential equations. First, we discuss "neural controlled differential equations", which are an extension to neural ODEs to handle time-varying inputs. They can be thought of as a "continuous time limit" of RNNs, and establish links between well-establish deep learning and well-established mathematics. The RNN structure implies high-capacity function approximation; the diffeq structure implies a strong inductive bias. Applications include time series classification and the training of GANs. Second, we introduce "Diffrax", a state-of-the-art new library for numerical differential equations solvers. It is implemented in the JAX framework, introduces several new technical ideas (e.g. solving ODEs and SDEs in a unified manner) and benchmarks as much as 20 times faster as comparable (e.g. PyTorch) libraries.
Paper links: On Neural Differential Equations https://arxiv.org/abs/2202.02435
Code links: Diffrax https://github.com/patrick-kidger/diffrax