Equation Learning and Exact Recovery of Sparse Multivariate Polynomials

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Abstract

Equation learning, sometimes also referred to as *symbolic regression*, describes the data-driven process of exactly recovering a function f in its symbolic form or at least constructing an approximate $\tilde{f}$ sharing some structural properties with f. This is in contrast to standard machine learning techniques that usually only aim to find a good approximator for f from some function class. While finding an approximation can be sufficient, in many applications like physics *interpretability* is more important, which is a notorious weak spot of neural networks.

This talk starts out with an overview of the field of symbolic regression and presents some recent ideas that try to utilize neural networks for equation learning. Afterwards, we focus on a specific equation class: *Sparse multivariate polynomials*. We will introduce a new type of *polynomial neuron* that can represent arbitrary monomials and thereby is able to exactly recover multivariate polynomials in a neural network setup. The successful application of this novel neuron type will be showcased in the natural task of multivariate polynomial interpolation. To conclude, possible extensions and application to an broader area of problems will be discussed.