Representing First-Order Knowledge by Artificial Neural Networks

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Artificial intelligence paradigms based on logic-based knowledge representation are very different from those employing connectionist methods/artificial neural networks. Efforts to integrate these paradigms into single systems - for theoretical or practical reasons - have so far been of relatively little success. At the heart of these investigations is the question how to represent logical, i.e. symbolic, knowledge by means of connectionist systems, and it appears to be particularly difficult to represent symbolic knowledge over first-order languages including function symbols: These recursive structures bear an infinitary component, while a connectionist system in general has only finitely many nodes, or neurons.

In this talk, we will first give a brief historic overview of the integration of logic and connectionism. In the second part we will discuss recent results obtained by the author, in partial collaboration with Sebastian Bader, Steffen Hoelldobler, and Anthony K. Seda, on the representation and approximation of first-order logic programs by standard neural network architectures.