Learning Distributed Representations of Conceptual Knowledge*

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ABSTRACT

We argue that distributed representations must satisfy 5 criteria in order to serve as an adequate foundation for constructing and manipulating conceptual knowledge. These criteria are: automaticity, portability, structure encoding, semantic micro-content, and convergence. In our approach, distributed representations of semantic relations (i.e. propositions) are formed by recirculating the hidden layer in recurrent PDP networks. Our experiments show that the resulting distributed semantic representations (DSRs) satisfy all of the above 5 criteria. We believe that DSRs can help supply an important building block in developing more complex connectionist architectures for higher-level inferencing, such as required in natural language processing.

HANDLING KNOWLEDGE IN HIGH ORDER NEURAL NETWORKS: THE COMBINATORIAL NEURAL MODEL

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ABSTRACT

In this paper we describe the Combinatorial Neural Model, a high order neural network suitable for classification tasks. The model is based on the fuzzy sets theory, neural sciences studies and expert knowledge analysis results. The model presents interesting properties such as: modularity, explanation capacity, knowledge and data representation, high speed of training, incremental learning, generalization capacity, processing of uncertain and incomplete data, ability to reason non-monotonically when representing only relevant evidences, graceful decay.

COMPUTATION OF THE DISTRIBUTED ASSOCIATIVE MEMORY AND NUMERICAL STABILITY OF THE GENERALIZED INVERSE MATRIX

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ABSTRACT

Learning performance can be enhanced using recursive algorithms which do not require repeating previous data. A new recursive (R) algorithm to calculate the Recursive Generalized Inverse (GI) needed to learn some Distributed Associative Memory (DAM) is introduced. We show that the new RGI algorithm provides better numerical stability when compared with Greville's algorithm. The new RGI has been applied successfully to fault-tolerant information retrieval tasks.

EXPERIMENTS ON LEARNING IN RECURSIVE NEURAL NETWORKS

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We present here explorations on training a network with recursive connections. We find that we can reliably train recursive networks employing the generalized delta rule of error backpropagation of Rumelhart, Hinton, and Williams on the stationary states of the recursive network. The present method for training recursive networks is a truncated form of the recursive error backpropagation algorithm developed by Pineda and Almeida.

A PARALLEL IMPLEMENTATION OF THE HOPFIELD NETWORK ON GAPP PROCESSORS

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Abstract

A parallel hardware implementation of the popular Hopfield neural network is described. The design utilizes the Geometric Arithmetic Parallel Processor (GAPP), an SIMD machine consisting of 72 processing elements. Memory requirements and processing times are analyzed based upon the number of nodes in the network and the number of exemplar patterns. Compared with other digital implementations, this design yields significant improvements in runtime performance.