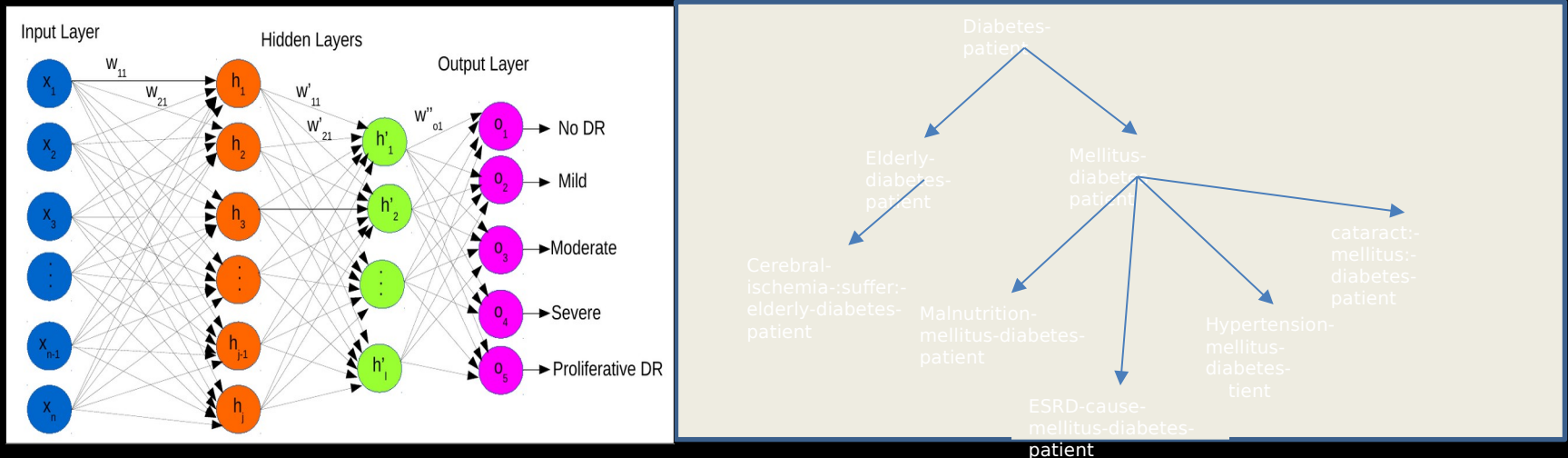


NeuroSymbolic Learning Ontologies: Track C

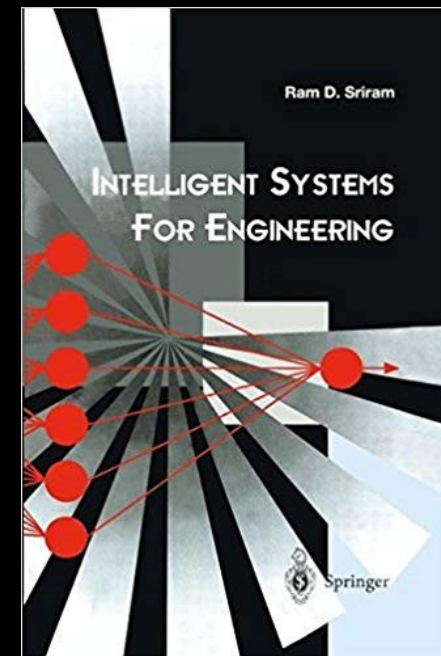


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2021-02-03

From Chapter 8, Neural Networks (1997)

- **Connectionist expert systems.** Neural networks have two advantages over KBES: 1) a solution is always produced; and 2) if a solution is not correct then the network can be made to learn new patterns. However, neural networks also suffer from the following disadvantages: 1) the learning process may be computationally very slow; and 2) it is extremely hard to trace the reasoning process. Integration of neural networks with traditional rule based systems is an interesting and important research area. Learning of rules from examples will be useful in tackling the problem of knowledge engineering bottleneck in expert system development. There are several ways KBES and neural networks can be combined. For example, the output nodes and the input nodes from an inference network (or any other network used in a KBES) are mapped onto the corresponding nodes in the neural network. The hidden layers, connections, weights, and other network parameters are generated by the appropriate neural network generator. The neural network is trained by using the input/output associations of the inference network. During a typical consultation, a user can correct the output of the KBES. All traces are saved in a file and are used to train the neural network. This training is typically done when the KBES is not in operation. A related approach developed by Towell and Shavlik converts individual rules into subnetworks and combines these subnetworks into a larger global network, with appropriate weights assigned to links [77]. Eventually, the global network is converted into a neural network.



Neurons Vs Symbols

- Neural Networks
 - Good at tacit or implicit knowledge
 - Explaining reasoning is hard
 - Requires considerable computational power
- Symbolic Networks or Knowledge Networks
 - Good at explicit knowledge
 - Can encode commonsense knowledge
 - Generating knowledge networks (KNs) is not easy

What Does this Mean For Ontologies

- Generation of ontologies by NN learning techniques
- Using ontologies to develop better NN models
- Symbiosis of NNs and Ontologies (KNs)

Schedule for Track C

- February 24th, 2021
 - Artur Garcez, City University of London, Topic: Introduction to NeuroSymbolic Computing
 - Pascal Hitzler, Kansas State University, Topic: Neural-Symbolic Integration and Ontologies
- April 7th, 2021
 - Henry Kautz, National Science Foundation, Topic: Research Directions in NeuroSymbolic Computing
 - Amit Sheth, University of South Carolina, Topic: Semantics of Black Box: Using Knowledge-Infused Learning to Make AI Systems more Interpretable and Explainable
- May 5th, 2021
 - Pavan Kapanipathi, IBM, Topic: Getting AI to Reason: Using NeuroSymbolic AI for Knowledge-based Question Answering
 - Spencer Breiner, NIST, Topic: OKNs and NNs meet through Predictive Encoding

Titles are tentative