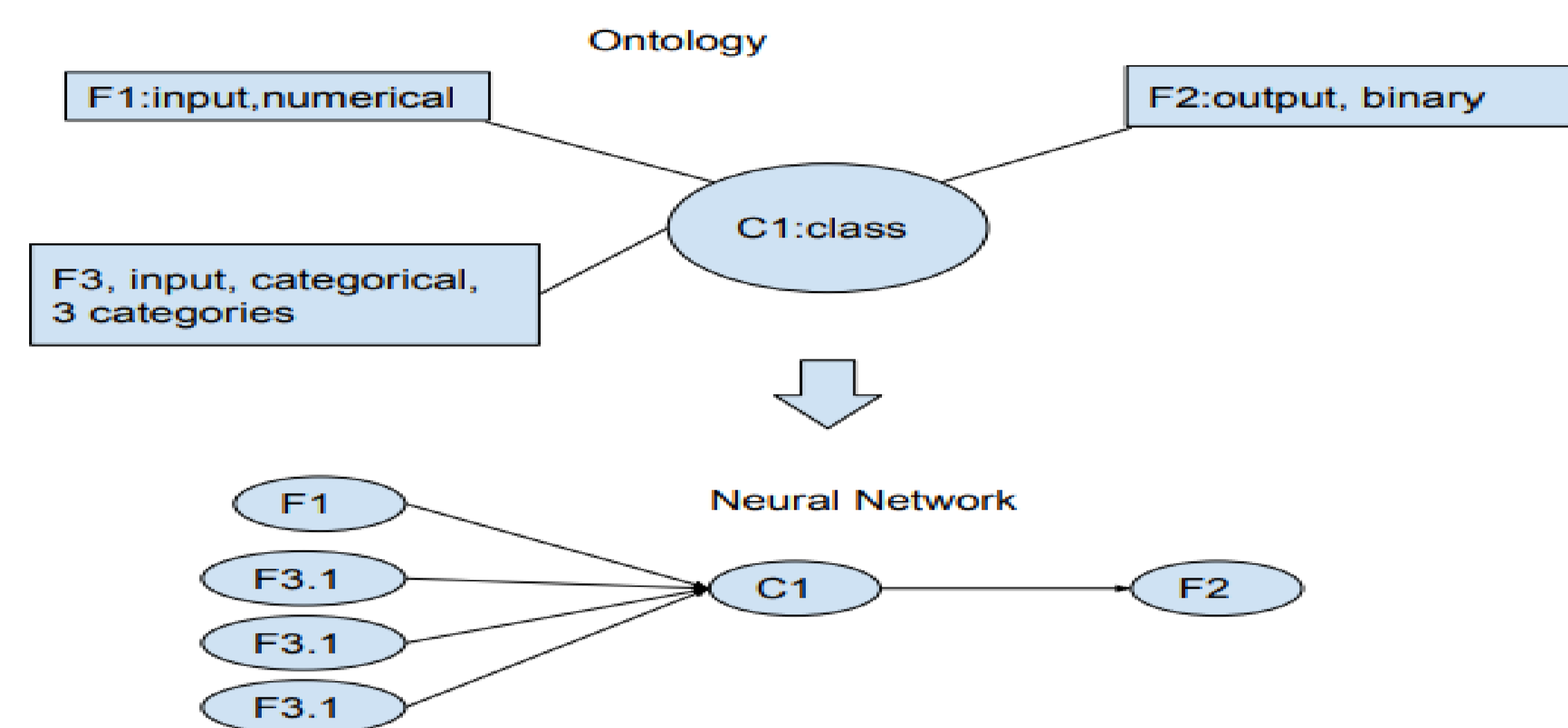


Semantic Artificial Neural Networks

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The Problem: How to build an interpretable Neural Network
 The proposed solution: Map Neural Network structure to a Knowledge Graph structure



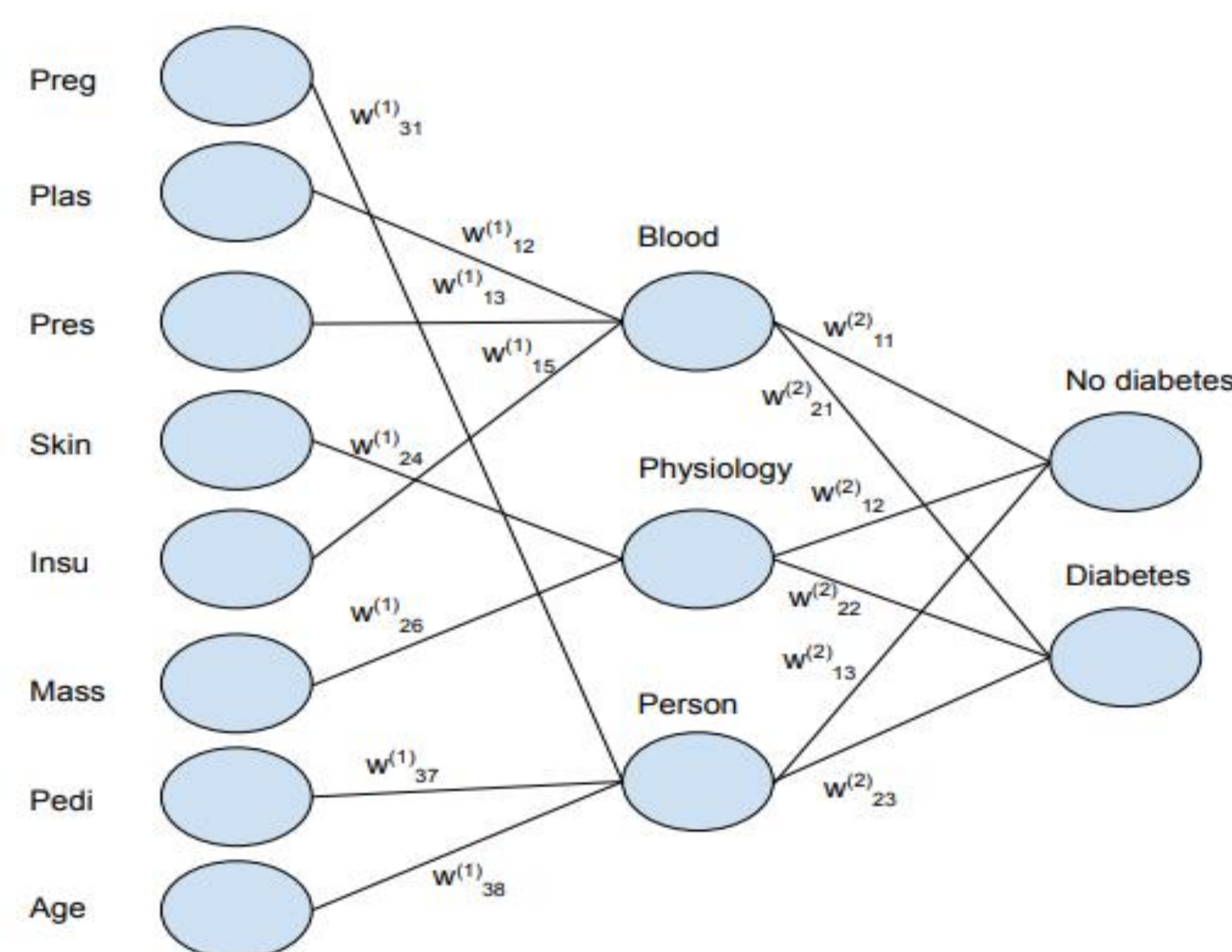
The algorithm

Algorithm 1 Semantic Artificial Neural Networks Construction

Require: Dataset D ,
Require: Ontology (Domain Conceptualization) O

- 1: Create empty Neural Network Graph G
- 2: **for all** output features $o_j \in D$ **do**
- 3: Map $o_j \in D$ to concepts or attributes $c_j^o \in O$
- 4: Add corresponding $c_j^o \in O$ into G
- 5: **end for**
- 6: **for all** input features $i_j \in D$ **do**
- 7: Map $i_j \in D$ to concepts or attributes $c_j^i \in O$
- 8: Add corresponding $c_j^i \in O$ into G
- 9: **end for**
- 10: **while** $\exists c_j^o \in G$ not connected to $c_j^i \in G$ **do**
- 11: **for all** nodes $c_j \in G$ **do**
- 12: Find concept(s) $c_k \in O$ connected to node(s) $c_j \in G$
- 13: Add node(s) c_k in G
- 14: Add arc(s) connecting c_j, c_k
- 15: **end for**
- 16: **end while**
- 17: **return** Graph G

The result: A Neural Network with labeled hidden layer nodes.
 Each level can be interpreted by means of regression over the previous layer



Semantic Artificial Neural Network for UCI Diabetes dataset - Classification.

Evaluation:

Table 1. Comparison between SANNs and dense neural networks - average performance for classification (5 datasets) and regression (5 datasets)

Dataset/Metric	Multilayer perceptron	Semantic Artificial Neural Network
Classification/Accuracy	81.94	81.76
Regression/Correlation coefficient	0.659	0.697

Semantic Artificial Neural Networks are interpretable and have performance comparable to that of dense and more complex Neural Networks.