Self Learning and Similarity Recognition by Highly Parallel Working Simplest Nodes

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Abstract: At Johannes Kepler University a neural-net-similar associative model has been developed. The basic model consists of very simple nodes with just two attributes, a binary stamp and a ternary charge. The connections between the nodes do not have any additional information such as weights. Nevertheless it was possible to construct a system consisting of such elementary components which is able to perform parallel and serial association. Moreover, it is a self learning system which needs no explicit training phase.

Since the beginning of this research about 30 years ago the model has been enhanced into several directions. One major improvement was the change from ternary respectively binary to real charge and stamp values. Thus, quite good similarity recognition could be achieved without loosing the self learning capability. The introduction of regular network architectures eliminated one of the main handicaps which had been the growth of the network at each learned pattern.

The recent research result was the so called selective association. By adopting charge and stamp value calculation within a node the network showed a behavior in which in undetermined cases (i.e. when two or more learned patterns have the same similarity to the actual network input) the similarity recognition chooses the best known pattern. That means the pattern which has been presented more often will be recognized better. The main idea was to interpret a node stamp value as a weight which corresponds to the frequency of the pattern to which this particular node belongs. After this all other dynamic aspects were adjusted to that principle.

In this contribution first the basic model - it was called Neunet - will be introduced. After a brief overview of the major developments and an integration of Neunet into the context of other actual neural network and associative memory approaches the presentation will focus on selective association. The algorithm itself, the calculations of charge- and stamp-adjustment in nodes and, test results will be presented in detail. As such networks can become quite large also parallel and high performance computing aspects are relevant and will be discussed.

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