Genetic Artificial Neural networks (GANN) modeling.

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Genetic algorithms and neural networks have received great acclaim in the computer science research community since the 1980s. For the most part, this results from successful applications of these new computing models, but also, because the concepts share the spirit of a movement that goes beyond science. The major principle of this movement is the idea that for a broad set of complex problems self-organization, the exploitation of the interaction of independent small units, is stronger than central control. The effect of this principle can be observed in several phenomena of human life like in politics, economics, in the human organism itself, etc. Both ANN and GA were invented in the spirit of a biological metaphor. The biological metaphor for neural networks is the human brain. Like the brain, this computing model consists of many small units that are interconnected. These units (or nodes) have very simple abilities. Hence, the power of the model derives from the interplay of these units. It depends on the structure of their connections. The biological metaphor for genetic algorithms is the evolution of the species by survival of the fittest, as described by Charles Darwin. In a population of animals or plants, a new individual is generated by the crossover of the genetic information of two parents. The genetic information for the construction of the individual is stored in the DNA.

Neural networks and genetic algorithms demonstrate powerful problem solving ability. They are based on quite simple principles, but take advantage of their mathematical nature: non-linear iteration. Neural networks with backpropagation learning showed results by searching for various kinds of functions. However, the choice of the Basic parameter (network topology, learning rate, initial weights) often already determines the success of the training process. The selection of these parameters follows in practical use no rules, and their value is at most arguable. Genetic algorithms are global search methods, which are based on principles like selection, crossover and mutation. The general idea of combining GA and NN is the following: Information about the neural network is encoded in the genome of the genetic algorithm. At the beginning, a number of random individuals are generated. The parameter strings have to be evaluated, which means a neural network has to be designed according to the genome information. Its performance can be determined after training with back-propagation. Then, they are evaluated and ranked. The fitness evaluation may take more into consideration than only the performance of the individual. Finally, crossover and mutation create new individuals that replace the worst - or all - members of the population. This general procedure is quite straight-forward. The problem of combining GA and NN, however, lies in the encoding of the network. The new ideas and concepts of GA

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and NN bring new life into Artificial Intelligence research. This work examines how genetic algorithms can be used to optimize the architectural and learning parameters of neural networks. At present a research tool is been implemented, using the programming language C++.

Keywords: ANN, GA, Optimization.