GANN

Combining Genetic Algorithms and Neural Networks: The Encoding Problem

Philipp Koehn of The University of Tennessee, Knoxville published the paper in 1994 highlighting the importance of Genetic Neural Networks as both Genetic Algorithms and Neural Networks received great acclaim in computer science research community, and how they combined together demonstrate powerful problem-solving ability.

Neural networks combined with feed forward validation along with backpropagation show a great new computation model inspired by nature, the power of self-organization of interdependent units. This all happens with an all different approach from classical computer programming, the non-declarative programming paradigm, feeding large amount of training patterns which are instances of the problem to a training framework. These systems are more fault tolerant and adaptable to new data, whereas traditional programs are not.

Genetic Algorithms being based on principals of selection, crossover and mutation start from a global and truly random search space and evolve that set into a global optimal solution taking into account all the variation. Genetic Algorithms are a good object for parallelization as the crossover, mutation and evaluation of individuals are independent of each other, which will allow high population sizes without increase in time.

The synergy of GANN greatly improves the learning time for networks, results in greatly boosted accuracy and overcomes the shortcomings of backpropagation, where initial parameters greatly determine the success of training process. By combining these two, the genetic algorithm finds initial parameters and applies a natural algorithm which is very successful, as we humans have evolved in a similar way on earth.

Combining Genetic Algorithms and Neural Networks involves encoding the information about the neural network in the genome of the genetic algorithm. Starting with generating a number of random individuals in the beginning, the parameter strings are evaluated to return a fitness value, which determines their rank in the pool. Encoding the Neural Network is the main focus of the paper and various strategies are discussed. Incorporating the network size in evaluation is significant to finding efficient networks. The Problem of Overfitting is another such issue that results after excessive training, decreasing generalization. Using the combination of search strategies of GA and NN, we get the best of both worlds. GA performs a more global search than NN with Back Propagation, but Back Propagation reaches an optimal solution more precisely. GA fail to locate the exact point due to limitations caused by mutation in this effect.