A Hybrid System Composed of Neural Networks and Genetic Algorithms

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ABSTRACT

Neural networks are known for their ability to recognize patterns of noisy, complex data and to estimate a nonlinear relationship between them. But the design of neural networks is very complex because it works on the principle of “black box.” The application of genetic algorithms in neural networks with hybrid systems can improve a network's ability to make predictions. Hybrid systems involve the use of combined techniques, issues and different models in order to achieve the overall performance better than those offered by each solution considered separately. Projections made by hybrid systems have smaller errors and constructed systems are able to automatically select the variables necessary to function effectively. This is possible due to the principle of selective biological function of genetic algorithms. They select from a large population of neural networks the best generations, made their exchange of elements and even mutations to get the most advanced networks. For an evolving and performance changes economic environment are necessary tools that can help make faster optimal decisions and increase the business efficiency.

Keywords: Algorithm, Business Forecasting, Genetic Algorithms, Hybrid Systems, Neural Network

1. INTRODUCTION

For any participant in economic activity, the dynamics of different phenomena or market indicators is essential. For this reason we need fast and efficient ways to conduct economic forecasts. An analysis technique is based on data for previous periods and can be achieved using neural networks. They have the ability to learn from the evolution of prices in a market, for example, to estimate their future values. But it is very difficult to effective conceive a neural network because of the “hidden” specific way of work. Thus, in neural network design can be used technology of genetic algorithms to get better results. Genetic algorithms can be used to find an optimal architecture for a neural network to design an optimal training algorithm control parameters and optimization.

2. REASONS FOR USING HYBRID SYSTEMS

The motivation of using intelligent hybrid systems is simple: although various intelligent techniques (neural networks, genetic algorithms, fuzzy logic, evolutionary computation, expert

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systems) offers encouraging results in solving problems with high degree of customization, complex problems can be solved through a single intelligent techniques. For example, neural networks are successfully used in making economic forecasts, but cannot provide an explanation regarding the decision.

To compare the performance of intelligent systems is necessary to define their properties. Knowledge acquisition represents a crucial stage in the development of intelligent systems. As a process, involves the interpretation and representation of knowledge for a specific area. In the case of expert systems, requires a long time, is expensive and sometimes unreliable. From this point of view, techniques such as neural networks or genetic algorithms that can learn directly from the input shook have certain advantages.

Given the distributed way of knowledge representation, neural networks have some advantages in this respect. Even if some of the neurons are no longer operational, the remaining neural network will work independently and provide to some extent the right response.

Fuzzy systems deal with the fragility of a specific approach to knowledge representation and reasoning methods. Knowledge is represented by fuzzy sets that allow the introduction of vague boundaries between concepts. This representation of data, in conjunction with fuzzy reasoning mechanism allows processing of incorrect or partially correct data.

The existence of processes of information processing, parallel and low level, respectively sequential and high level was highlighted in human behavior by different researchers. Expert systems have proved plausible models to describe high-level cognitive tasks (e.g., generating and understanding language). In contrast, neural networks have complementary properties: pattern recognition model is suitable, for example in visual processing tasks, but are unable to model sequential high-level cognitive tasks.

Possibility of providing to the user explanations reasoning the process is an important feature of intelligent systems. Explanations are necessary to validate by the user of solutions generated by intelligent systems, for example, the automatic generation of medical diagnostics. In fuzzy logic, the final decision is generated by aggregating the final decision making all the rules of inference based on existing rules. In such systems to obtain the chain of inference is not easy, but the rules of the form “if-then” are easily understood by the user. Genetic algorithms, in particular, for the classification systems can build models of reasoning in the form of rules. As with expert systems, it is possible to follow the chain of inferences and provide a degree of explanation about the thinking process. In contrast to the systems mentioned above, neural networks are not generally able to offer explanations, because knowledge are not explicit, knowledge are transferred in the form of distributed weights the entire neural network.

3. ARTIFICIAL NEURAL NETWORKS

Artificial neural networks are computer reproduction of the human nervous system (Michałewicz, Schmidt, Michalewicz, & Chiriac, 2007; Gorunescu, 2011). An artificial neural network contains several layers of artificial neurons: input layer, hidden layer and output layer. They are connected and to build a neural network architecture is a complex activity.

A neural network model can be applied to economic forecasting using back-propagation method. The algorithm back-propagation neural network consists of several stages. First, you select a network input vector. It may comprise a series of values specific for an economic indicator. These values can be represented by observations in discrete time (days, weeks, quarters) or can be obtained in continuous time data. Thus, with a time series: \( \xi_t \),
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