NEUROCOMPUTING APPROACH TO RESIDENTIAL PROPERTY VALUATION

Ming-te Lu
St. Cloud State University

Debra H. Lu
St. Cloud State University

This article introduces neurocomputing—the application of neural networks to problems in business. It describes important characteristics of problems appropriate for neurocomputing. An application to market valuation of residential properties is presented to elucidate neurocomputing project development. The back propagation network paradigm in a PC package is used with training and testing sets selected from data of properties sold in a Midwestern city. A description of the training and testing of the network is presented together with an assessment of the network’s performance. Advantages and disadvantages of the neurocomputing approach are discussed.

Expert systems (ES) have been acclaimed as the first practical application of artificial intelligence (AI) in business in recent years. Many applications of ES technology have been in the areas of medicine, engineering and sciences, and, more recently, in management and finance (Lu and Guimaraes, 1989). Most of the existing ES are of rule-based systems which require a difficult and time consuming knowledge acquisition process. In this process, expertise is extracted from domain expert(s). In addition, the knowledge base in such a system needs to be updated on a regular basis. In the last few years, neurocomputing has emerged as the second wave in the application of AI to real world problems. In neurocomputing, a neural network represents knowledge implicitly within its structure and applies inductive reasoning to process knowledge (Zahedi, 1991). Learning takes place within the network; knowledge acquisition is unnecessary. Professionals are currently applying neurocomputing to a wide variety of problems in engineering, business, mathematics, and sciences, including adaptive ES in finance, process control, robotics, and signal processing (Caudill and Butler, 1990, 241-259; Klimasauskas, 1989; Marose, 1990; Noaker, 1988; Rochester, 1990; VerDuin, 1990). Recently introduced low cost PC-based neural network packages have made experimentation in applying neurocomputing practical for individuals and...
small businesses. Popular packages at the current time include NeuroShell by Ward Systems Group, Inc., BrainMaker by California Scientific Software, ExploreNet 3000 by HNC, and NeuralWorks by NeuralWare, Inc. The significance of neurocomputing is highlighted by Hecht-Nielsen’s (1990, p. 1) statement that it “is the first alternative to ‘programmed computing’ which has dominated information processing for the last 45 years.” Following the introduction section, part two of this article introduces neurocomputing as a new kind of information processing method and also discusses general characteristics of its applications. Part three describes how neurocomputing is used to assess market values of residential properties in a Midwestern city. Part four presents the entire project development based on the phases in the neurocomputing systems development life cycle (SDLC). Part five evaluates the performance of neurocomputing against the current property value assessment system. Characteristics of neurocomputing are also compared with other methods. Part six includes concluding remarks.

**Neural Computing**

Neurocomputing is the application of neural networks (or nets) to practical problems. It employs information processing systems (neural networks) that autonomously develop operational capabilities in an adaptive response to its information environment (Hecht-Nielsen, 1990, p. 1). Thus, it can be used to develop an adaptive ES without relying on the knowledge acquisition process associated with traditional ES development.

**Neural Network**

A neural network, inspired by the structure of biological neural systems, consists of neuron-like processing elements in a densely interconnected network (Caudill and Butler, 1990, 13-21; Caudill, I-VIII, 1987-89) (See Figure 1).

Memories are stored or represented in a neural network in the pattern of variable interconnection weights among the processing elements. A processing element accepts input from a large number of similar processing elements, processes these inputs, and sends copies of its single output to other processing elements over a network of interconnects. A neural network can be trained by a training set which contains a number of training cases. Each training case consists of input data and the associated output data, similar to an observation in a statistical sample. The output data correspond to the dependent variables, while the input data correspond to the independent variables. During the training session, the network attempts to minimize the magnitude of errors between the actual output and the expected output by changing its many interconnection weights. With adequate training data and proper design, a neural network will be able to generate the correct output given the input data.

Neural networks may be used as standalone systems. They may also be integrated with other information processing systems. Several loosely-coupled, tightly-coupled, and fully-integrated system architectures have been suggested (Bailey and Thompson, II, 1990). In a loosely-coupled system, a neural network communicates...