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The present paper has the objective to inform the public regarding the use of new techniques for the modeling, simulate and forecast of system from different field of activity. One of those techniques is Artificial Neural Network, one of the artificial intelligence branch, is widely use in several field and the researchers are trying to extend these fields, considering new types of networks. Considering the financial crisis the authors concentrate the attention on specific field from the economical domain. After a short presentation, several types of ANN are presented and also a few examples are revealed.

Keywords: artificial neural network, economics, simulate, artificial intelligence

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1. Introduction

1.1. Artificial neural network (ANN)

First researched in 1943, the real use of ANN starts in 1959 with the development of computers and the incipient models ADALINE and MADALINE (Multiple ADAptive LINear Elements, Bernard Widrow and Marcian Hoff - Stanford). Even with the setbacks determined by not trusting the artificial intelligence, the ANN gained step by step their place between the new techniques of simulating and forecast certain problems that involve a rate amount of heterogeneous data characterized by the nonlinearity [1].
The ANN tries to copy the human brain capacities and behavior considering the smallest unit: the neuron (figure 1) who is replaced by mathematical relations characterized by different function (figure 2) [1].

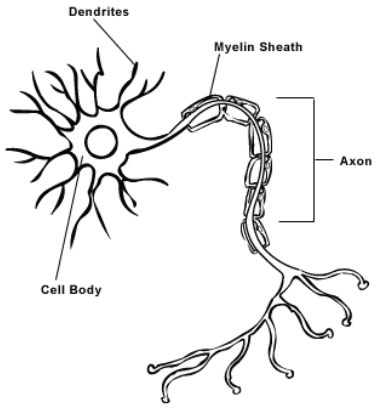

Figure 1. Human neuron.

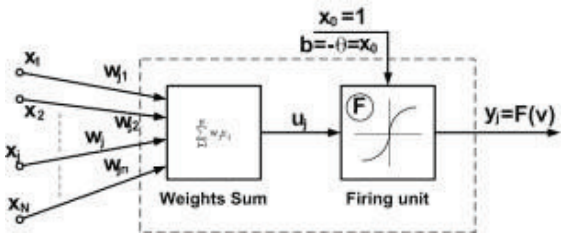

Figure 2. Artificial neuron.

Were: xi – input vectors;
- wji – weights vectors (synaptic);
- wjo = +b – bias (tendencies) – constant weight;
- Θ = -b – firing value;
- V – artificial neuron potential;
- F(v) – activation function.

$$v = u_j + b = \sum_{i=1}^{n} w_j x_j - \Theta = \sum_{i=0}^{n} w_j x_j$$

The activation function can vary depending on the algorithm used for training.
The ANN consists in several layers build from many artificial neurons connected by weights in different combinations determined by the ANN type and the data considered (figures 3.). Thus the ANN is trained in order to learn or to find the relations between the input data and the output data and to use those results for the future sets of data in order to simulate or forecasts [1].

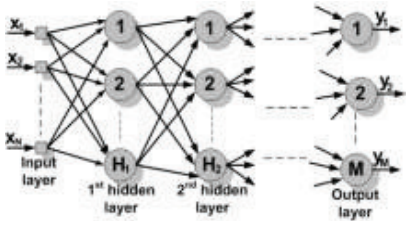

Figure 3. ANN example.

Whatever the objectives of ANN use is the next phases are always presented:
a. ***data analysis*** – represents the process that organizes the data in conformity with the user specifications based on the data characteristics and problem type;
b. ***preprocessing of data*** – consist in the use of several methods that prepare the data in order to be much easily used by the ANN in the training process;\
c. ***ANN structure*** – the structure of ANN is defined: the number hidden neurons and hidden layers are calculated or simulated in order to determine the best training;
d. ***training process*** – process in which the ANN determines the internal elements and values of structures like weights.
e. ***testing*** – the last phase consist in validating and testing the result of training using new sets of data.
ANN types are determined by various criteria but the most common clusters are: feedforward ANN, recurrent – feedback ANN and cellular ANN. Another important way to divide the ANN's type is based on the algorithm that is used. The most used algorithm is Levenberg- Marquardt's backpropagation used for the feedforward ANN.

1.2. The economical applications of ANN

For the last few years the ANN is mostly used in patter recognition and forecasting especially in the fields of economics (financial) and medicine, but also in other fields. A better presentation of ANN usage follows:
- *pattern recognition and identification*: oil extraction, imaging, identification of fingerprint and car number;
- *classification and appreciation*: medical diagnostic, credit risks, fruits classification, nondestructive testing, product price sensitivity analysis, quality control for stocks exchange;
- *monitoring and control*: medical instruments, dynamic processes, chemical manufacturing, bioprocesses control;
- *forecast and prevision*: stock exchange dynamics, prevision of holyday preferences, forecast of future business requests;
- *sensors and visual analysis*: automatic industrial inspection, postal envelope sorting, visual inspection of railway or bridge structure.
Current, ANN demonstrates more and more the superiority of ANN over the classic methods and techniques used for forecast and simulation of economical activities. The huge number of data that can be processed and the ***synthesis quality*** that offer the possibility that ANN trains itself even in the presence of incomplete data or the presence of noise.
In the economical field the ANN are present in activities such as:
- tendencies of the market;
- market exchange dynamics;
- decision making based on the forecast of the clients demand or the market tendencies;
- price evolution for certain products;
- the risks regarding the offer of credits and loans;
- financial forecast;
- other economical activities with major impact over the company's activities.
In the following some examples will be shown.

2. Examples

Use of ANN in the credit card fraud.
The ANN was used starting from the early 90's in order to determine the possible credit card fraud. After the usage of the ANN software (Falcon Fraud Manager) the frauds were in significance reducing as shown in figure 4 [1].

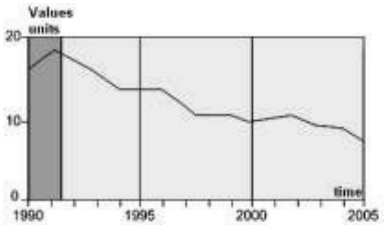

Figure 4. Card fraud evolution.

Forecast of the closing stock exchange.

Using a simple feedforward ANN (NeuroXl – AnalyzerXL LLC) and the backpropagation algorithm the next day stock exchange value were provisioned with a error of 3.28 units (points) or 6.21% of the real value. The results of the training are presented in figure 5 and the difference between the simulated value and the real value in figure 6 [1].

Use of ANN for the sales analysis [2]

The ANN demonstrates to be useful for the management decision considering the dynamics of market when it is necessary to react to the sales reduction. The manger must consider facts and information like prognoses and predictions, what-if analyses, calculations and optimizations. The ANN is capable to learn from the past evolution of business' indexes patterns, rules and models, to compare them with the actual situation, to find the proper one and to offer to the manager a possible future evolution and even to give him a possible and virtual decision that can be implemented.

ANN can be, in some cases, the ideal tool for a manager trying to solve a business problem.

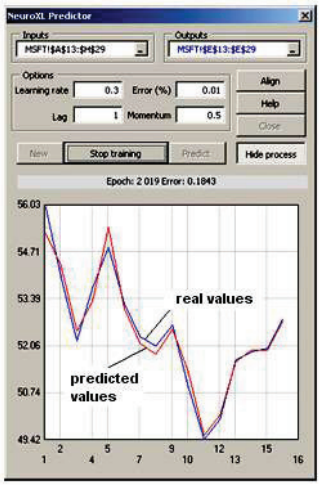

Figure 5. Target vs. Output.

28	07.06.2002	49.89	52.60	49.86	51.98	48917200	0.32	41.67
29	10.06.2002	51.65	53.30	51.46	52.82	35912700	0.92	39.98
30					49.54			
31								

Prediction

Figure 6. Target vs. Output - Values.

Consumer choice prediction using ANN [3]

The subject of the prediction was the consumers' banking choices between electronic banking and non-electronic banking. Starting with an analysis obtained through a mail survey sent to 1,960 household in New Zealand the ANN was trained using as input data as service quality dimensions, perceived risk factors, user input factors, price factors, service product characteristics, and individual factors, in addition to those the demographic variables including age, gender, marital status, ethnic background, educational qualification, employment, income, and area of residence are considered were considered. The result of the prevision is shown in table 1.

Table 1: Out-of-Sample Forecast

	Non-electronic banking users	Electronic banking users	Overall (n = 105)
Correct (%)	96.00	100.00	99.05
Incorrect (%)	4.00	0.00	0.95

Since neither the consumers' choices are always binary nor the neural network is limited to the binary choice classification problem, the research on the predictive power of the neural networks on the multiple level classifications would be an area for further research, particularly on the consumers' choice prediction

Consumer Loan Classification Using ANN [4]

The network was used as a "second level" filter, by supplying it with data of loans that already had been approved by the bank officers. To train an ANN were presented 400 loan applications cases and their corresponding repayment history. The ANN thus configured is then used for the evaluation of the risk of 600 loans, where the prediction of the ANN is compared with the loan repayment history. The ANN classifies 597 of those loans correctly detecting 35 of them (that the bank had granted) as having problems in their repayment schedule. In figure 7 and figure 8 are shown the input and output variables and respectively the loan classification by ANN.

	Input variables	Variable value
1	N° of relatives	from 1 to total components
2	N° of relatives with job	from 0 to total components
3	Telephone number	0,1
4	Real estate	0,1
5	Residence seniority	from 0 to date of loan request
6	Other loans	0,1,2
7	Payment method	0,1
8	Job type	0,1,2,3
9	Job seniority	from 0 to date of loan request
10	Net monthly earnings	integer value
11	Collateral	0,1,2
12	Loan type	0,1,2,3
13	Amount of loan	integer value
14	Amount of installment	integer value
15	Duration of loan	integer value
	Computed output variable	
1	Repayment probability	from 0 to 100
	Desired output variable	
1	Real result of grant loan	0 if repayment irregular or null 100 if repayment on schedule

Figure 7. Input and output variables.

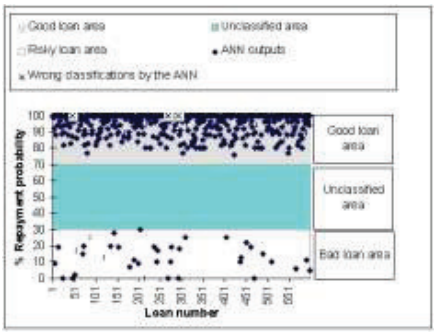

Figure 8. Loan classification by ANN.

This research showed that an ANN can be a valid tool to discriminate among loan applications.

While the purpose was that of providing support to bank officers, the results were so promising that the ANN could be used autonomously in cases. By leaving a sufficiently wide band of uncertainty, one can make sure that human intervention is required only for borderline cases. In this case, the ANN would provide a first level filter, granting or denying most loan applications autonomously. Since the ANN evaluation (once it has been trained) is not computationally very expensive, the entire process could be carried out on a computer at the store location where the customer is submitting his application, resulting in immediate approval or denial of most cases, with only a fraction of the applications having to be referred to the bank officers for more in-depth analysis.

Computation of the daily of bank share [5]

The goodness and the accuracy of techniques based solely on the neural network estimates of the conditional quintile is illustrated throughout the computation of the daily VaR (Value at risk) of a holding consisting of one share of DEUTSCHE Bank. As explanatory variables, we use the daily closing prices of BASF, SIEMENS, COMMERZBANK and DAX30 traded on the stock exchange of Frankfurt. Beside the fact, the simulation takes relatively longer time before delivering the ANN VaR estimate, the proposed method provides better back testing results compared to the historical simulation VaR approach.

3. Conclusion

The examples provided above are just an insignificant number from the real economical applications that ANN are implemented in, but offer information about the importance given to new more efficient and cheaper than other techniques or software generally, and to ANN importance especially. The effectiveness of implementation and accuracy of results are also good reasons for the continuous research and implementation of the ANN in various activities and several fields.

Working with ANN made as understand the future possibilities and applications, but also the need of future research in order to find new types of ANN, new training algorithms and even new artificial neurons for a better implementation and for new perspectives of use.

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