SOME ASPECTS OF APPLICATION OF INTELLIGENT SYSTEMS IN REAL-LIFE TASKS

Leanid U. Vaitsekhovich
Brest state technical university

1. Artificial immune systems for malware (computer viruses) and intrusion detection.

At present large majority of commercial antivirus decisions are based on signature analysis. Signature-based approach has acceptable detection rate for well known viruses and relatively low false positives. Unfortunately the ability of signature-based systems to detect new viruses is extremely poor.

Artificial Immune System (AIS) is an approach inspired by biological immune systems. It can be defined as computational system based on principles of biological immune systems. Different models of AIS exist for computer virus detection. Though there are some problems to use this approach for virus detection. As a rule AIS uses binary or real strings as detectors. In this case it is difficult to train such a detector to perform quality virus analysis. As a result such a system has high computational complexity and is not good enough to detect novel viruses. To overcome these problems we propose neural networks as detectors for AIS. The key idea is to integrate advantages of artificial immune systems and neural networks to create self organizing system for virus (attack) detection and recognition which has ability to self-evolution. Such a system can perform recognition of novel viruses (attacks) with low false negative (positive) rates.

2. Intelligent Neural Systems in Medical Diagnostics.

2.1. Detection and Prediction of Epileptic Activity.

The proposed system is based on chaos theory and forecasting neural networks. The epilepsy detection is performed using calculation of largest Lyapunov's exponents. We propose neural network approach for computing largest Lyapunov exponent (that can be consided as a measure of chaos). It permits to decrease complexity and to define Lyapunov exponent using small experimental data set. The system provides perfect accuracy and permits to increase quality of treatment. This research work is developed in close collaboration with medical establishments.

2.2. Transient Ischemic Attacks Diagnostics.

The proposed approach is based on integration of the NPCA neural network and multilayer perceptron. The real dataset from clinic have been used for experiments. Combining two different neural networks (NPCA and MLP) it is possible to produce efficient performance in terms of detection and recognition transient ischemic attacks. The main advantages of using neural network techniques are the ability to recognize "novel" transient ischemic attack (TIA) instances and quickness of work which is especially important in the real time mode. Neural network technique permits to reduce the diagnostic time and the number of misdiagnosis, as well as to assist the doctor in making decision.

3. Multi-Agent Adaptive Robotics based on Reinforcement Learning.

Intelligent Information Technologies Department (IIT) has a profound experience in robotics with in accordance with the following platforms: Basic robotics, Reactive Robotics, Arduino platform, Stereovision, Robot Pattern Recognition, Tracking, Radio connection, IrDA, Analysis of static/dynamic obstacles and robot position from camera.

IIT has experience in Simulation, Machine Learning, Artificial Neural Networks, Multi-Agent Systems, Camera Vision, Computer Vision, Adaptive Behavior and Pattern Recognition. Experimental Robotics Platforms: Hovercraft, Screw-propelled vehicle; Experimental Cognitive Systems for Autonomous Robot: Adaptive Mapping using ANN and Model of Complemented Sensors; Decision Making based on Graphs Planning.