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The Design of Hybrid Neural Networks by Means of Genetic Programming
Bogdan Burlacu and Lavinia Ferariu



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This paper presents a new genetic programming based approach for the design of feed forward hybrid neural models. A special encryption of the neural model as a **directed acyclic graph** (DAG) is suggested, intended to exploit the modularity of the neural topology. This allows for a flexible development of partially interconnected neural structures, having heterogeneous layers with both Gaussian and perceptron neurons. Customized compatible genetic operators, aimed to work simultaneously on the neural architecture and parameters, provide an efficient exploration of the search space. Additionally, the algorithm makes use of a back-propagation procedure, employed as a local Lamarckian optimization, for a faster computation of model parameters. The performances of the suggested approach are illustrated on the identification of an industrial subsystem from the Sugar factory of Lublin, Poland.

Key words: genetic programming, neural network, optimization, nonlinear system identification.

2000 Mathematics Subject Classification: 53B25, 53C15.

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Image Segmentation Based on Clustering Techniques

Pohoățã Andrei and Lavinia Ferariu



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The paper extends the facilities of MATLAB Image Processing Toolbox, by introducing a set of functions meant to perform clustering-based image segmentation. To provide a robust detection of visual objects, the suggested algorithm exploits both the color and the position of the pixels, therefore ensuring a correct elimination of small/narrow objects and isolated points, assumed to be distortions of the acquired photography or undesired parts. The output image can be interpreted with different levels of granularity. For each cropped object, the method draws a map of sub-clusters, useful for further geometric features' extraction. The experimental results illustrate that the proposed segmentation scheme features increased flexibility and feasibility, in comparison with two other common techniques.

Key words: computer vision, image segmentation, clustering, feature extraction, pattern recognition.

2000 Mathematics Subject Classification: 65D18, 65D19, 68U10.

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Comparative Study of Multiobjective Genetic Algorithms

Mihaela Simona Cîrciu and Florin Leon



[Full text](#)

The objective of this paper is to study three algorithms for solving multiobjective optimization problems. The first algorithm is a weight-based genetic algorithm, which consist in the application of a scaling function to the weighted sum of objectives. This is the simplest extension of a simple genetic algorithm. The determination of weights that the user must choose and the impossibility to discover all the solutions for problems with non-convex Pareto-optimal front are the main disadvantages of this algorithm. Vector evaluated genetic algorithm (VEGA) was the first genetic algorithm proposed for multiobjective optimization. This is a non-Pareto approach based on the selection of some relevant groups of individuals, each group being assigned an objective. The method tends to “gather” results around the extremes of the solution space producing a sub-optimal Pareto-optimal front convergence. The third algorithm NSGA-II is based on Pareto dominance to exploit the search space towards the optimal front. It is an efficient algorithm used in many studies. The algorithms are implemented in an application that allows solving any multiobjective problem with one of the three algorithms presented above and therefore can be used as a framework for a comparative study regarding the performance of different optimization methods.

Key words: multiobjective optimization, genetic algorithms, VEGA, NSGA-II.

2000 Mathematics Subject Classification: 80M50, 58E17.

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New Geometries for 3D Laser Sensors with Projection Discrimination

Mihai Bulea



[Full text](#)

Laser sensors are widely used for precision measurement of the distances. They all include one or more laser sources and one or more cameras and, using triangulation, they provide a precise measurement of the distance between the sensor (laser(s) plus camera(s)) and the target. The principle is simple: the laser creates a light spot on the target, while the camera takes a snapshot of the spot [1], [2]. Measuring the position of the spot projection in the image, the distance to the target can be measured. This paper presents a set of new geometries for multi-planar laser sensor, so that the location of each laser plane projection is uniquely determined in the projection plane. We will start with an analysis of the existing 2D sensors and 2D+ sensors (with camera offset), and continue with a set of new geometries for a 3D sensor. Finally, some discussions regarding the multi-point and multi planar sensors are presented. Simulation results for all the geometries are also presented here.

Key words: laser sensors, multi-point sensors, geometries, camera.

2010 Mathematics Subject Classification: 51M15, 74P20.

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Patient Monitoring Using a Low Power Wireless Personal Area Network of Sensors

Cristian Rotariu, Vasile Ion Manta and Hariton Costin



[Full text](#)

Recently, the applications of wireless systems in medical area have been rapidly increasing. Advances in wireless sensor network technology, the overall miniaturization of their associated hardware low-power integrated circuits and wireless communications have enabled the design of low-cost, miniature, and intelligent physiological sensor modules with applications in the medical. These modules are capable of measuring, processing, communicating one or more vital parameters, and can be integrated into a wireless personal area network. Portable devices such as ECG monitors, pulseoximeters, thermometers and blood pressure monitors are essential instruments for monitoring the vital signs. The use of wireless sensor is suitable for continuous long-time monitoring as a part of a diagnostic procedure, can achieve medical assistance of a chronic condition, or can be supervised during recovery from an acute event or surgical procedure. For instance, the computer-assisted rehabilitation involves unwieldy wires between sensors and monitoring devices that are not very comfortable for normal activity. Continuous monitoring of vital signs is necessary, but continuous transmission is expensive in terms of power consumption for battery operated portable systems. In this paper we propose a wireless personal area network, based on low power microcontrollers and RF transceivers that perform the measurements and transmit the data to a patient Personal Server. Personal server, in form of a Personal Digital Assistant (PDA) that running a monitor application, receives the information from wireless sensors, activates the alarms when the measured parameters are above the limits, and communicates periodically the recorded data to a database server by using WiFi or GSM/GPRS connection.

Key words: patient monitoring, wireless sensors, personal area network, telemedicine.

2000 Mathematics Subject Classification: 53B25, 53C15.

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QCL Implementation of Quantum Search Algorithms

Simona Caraiman



[Full text](#)

As quantum computing devices are not available outside research labs, simulation of quantum problems using classical hardware represents an important instrument in quantum computing. In this paper we address the simulation of the quantum algorithms formulated for the search problem: Grover's algorithm, min/max search and the approximate counting algorithm. We use the QC-lib quantum simulator which requires the implementation of the simulated algorithms in a quantum programming language, Quantum Computation Language (QCL). In order to formulate the QCL implementation of these algorithms, we analyze the computational process from the software engineering point of view using the formalism of quantum gates and decompose the computational process into elementary operations.

Key words: quantum search, quantum programming language, quantum simulation.

2000 Mathematics Subject Classification: 81P68, 68Q05.

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