Buletinul Institutului Politehnic din Iaşi
Tome LIX (LXIII)
Fasc. 2, 2013

AUTOMATIC CONTROL and COMPUTER SCIENCE Section

CONTENTS

The Efficiency of Using Genetic Algorithms to Map Tasks with Priorities, Deadlines and Dependencies

Adrian Alexandrescu

Full text

An important problem in computational systems is the processing of a large number of tasks in an efficient manner. There are several methods of determining good solutions to this problem but their efficiency depends on several factors, which are discussed in this paper. Genetic algorithms have been applied to solving the task mapping problem because these methods can determine near-optimal solutions in a very large search-space. This paper makes an analysis on the situations where it is efficient to use genetic algorithms to map tasks according to the performance of existing algorithms and depending on the types of tasks that have to be mapped (e.g., with priorities, deadlines, dependencies). Also, it is proposed a variation of the classic genetic algorithm that uses a fitness function that is better suited for the considered task characteristics. The tests that have been performed showed that the genetic algorithm approach is better than traditional approaches in situations where a very short duration of the mapping process is not imperative. Also, based on the task characteristics, several optimizations are suggested to be applied to the genetic algorithm in order to significantly speed-up and improve the solution.

Key words: genetic algorithm, task mapping.

2010 Mathematics Subject Classification: 68M14, 68M20, 68T20.

top

Medical Image Processing by Means of Some Artificial Intelligence Methods

Hariton Costin and Cristian Rotariu

Full text

Medical images are increasingly being used within healthcare for diagnosis, planning treatment, guiding treatment and monitoring disease progression. Technically, medical imaging mainly processes uncertain, missing, ambiguous, complementary, inconsistent, redundant contradictory, distorted data and information has a strong structural character. As a general approach, the understanding of any image involves the matching of features extracted from the image with pre-stored models. The production of a high-level symbolic model requires the representation of knowledge about the objects to be modeled, their relationships, and how and when to use the information stored within the model.
This paper reports new (semi)automated methods for the segmentation and classification of medical images using artificial intelligence, i.e. soft computing techniques (e.g. fuzzy logic and genetic algorithms), information fusion and specific domain knowledge. Fuzzy logic acts as a unified framework for representing and processing both numerical and symbolic information ("hybridization"), as well as structural information constituted mainly by spatial relationships in biomedical imaging. Promising results show the superiority of the soft computing and knowledge-based approach over best traditional techniques in terms of segmentation errors. The classification of different anatomic structures is made by implementing rules yielded both by domain literature and by medical experts. Though the proposed methodology has been implemented and successfully used for model-driven in the domain of medical imaging, the deployed methods are generic and applicable to any structure that can be defined by expert knowledge and morphological image analysis.

Key words: medical image processing, artificial intelligence, soft-computing, knowledge-based processing.

2010 Mathematics Subject Classification: 92C55, 97R40**.**

top

Tremor and Gait Screening and Rehabilitation System for Patients With Neurodegenerative Disorders

Oana Geman and Hariton Costin

Full text

Parkinson's disease is a severe neurodegenerative disorder, and "benefits" from the classical triad of motor symptoms: rigidity, akinesia and resting tremor. Tremor in Parkinson's disease has several features: it can be first a benign symptom of Parkinson's disease, its frequency can vary from low 4-5 Hz to high 8-10 Hz, can vary according to different circumstances, tremor may occur at rest, it can be seen in the hands, feet or other body parts. Parkinson's disease is a chronic disease with the need to adapt ongoing treatment in relation to a multitude of symptoms present. Each case has to be diagnosed and analyzed by a complex team (neurologist, family doctor, physiotherapist, psychologist) to initiate the most appropriate treatment and rehabilitation approaches. In this paper we present a proposed system for disease detection, screening and motor rehabilitation of Parkinson's patients for tremor symptom correction.

Key words: data mining, Parkinson's disease, graphic user interface, nonlinear signal processing, SVM.

2000 Mathematics Subject Classification: 92C55, 97R40.

top

Representations of the Qubit States

Iulian Petrila and Vasile ion Manta

Full text

In this article we present the relevant characteristics of the qubit and its various representations and descriptions. We give both the state vector and matrix density formulations and follow a proper graphic illustration of the qubit states and transformations. Besides the new Bloch Sphere representations, a new Cartesian Sphere representation is proposed for both state vector and matrix density formulations. In this representation the fundamental states are considered in the xOy plane and imaginary combinations of the fundamental states are placed on a direction orthogonal to this plane. This representation is useful for the qubits identified in quantum systems with certain symmetry or asymmetry.

Key words: Quantum logic, Quantum algorithms and complexity, Quantum computation.

2010 Mathematics Subject Classification: 03G12, 68Q12, 81P68.

top

A Study on Classifiers Accuracy for Hand Pose Recognition

Constantina Raluca Mihalache and Bogdan Apostol

Full text

This paper presents a comparative study between accuracy rates obtained by using different classification architectures for hand pose estimation in RGB-D data. The segmentation of a hand pose is optimized by using depth data in correlation with the grey scale image obtained from a Kinect sensor. We define an observation model composed of feature vectors obtained by calculating the histograms of oriented gradients on colour and depth data and also fingertip positions. A contour tracking algorithm is applied to track the contour of the hand and find the fingertip positions. The most relevant features from the observation model are selected and are served as input to all the classifiers. For this work we have considered Linear, Random Forest (RF), Support Vector Machine (SVM) and Decision Trees (DT) classifiers for posture classification. Experimental results show a 84.18% recognition accuracy is achieved by using the RF classifier, a 79.29% recognition accuracy is achieved using the DT classifier and a 78.27% recognition accuracy for SVM classifier. The multinomial regression is also used for classification purpose but shows a poor 44.26% recognition accuracy.

Key words: hand pose recognition, RGB-D, Kinect, histogram of oriented gradients, decision tree, random forest, support vector machines.

2010 Mathematics Subject Classification: 65D18, 68T05

top

Synthesis of Digital Systems Implemented with Programmable Logic Devices, using Decomposition Algorithms

Alexandru Valachi, Mihai Timis, Alexandru Barleanu and Andrei Stan

Full text

The paper consists in the use of some logical functions decomposition algorithms with application in the implementation of classical circuits like SSI, MSI and PLD. The decomposition methods use the Boolean matrices calculation. It is calculated the implementation costs emphasizing the most economical solutions. The decomposition problem is old, and well understood when the function to be decomposed is specified by a truth table, or has one output only. However, modern design tools handle functions with many outputs and represent them by cubes, for reasons of efficiency. We develop a comprehensive theory of serial decompositions for multiple-output, partially specified, Boolean functions. A function $f(x_1, \ldots, x_n)$ has a serial decomposition if it can be expressed as $h(u_1, \ldots, u_r, g(v_1, \ldots, v_s))$, where $U = \{u_1, \ldots, u_r\}$ and $V = \{v_1, \ldots, v_s\}$ are subsets of the set $X = \{x_1, \ldots, x_n\}$ of input variables, and g and h have fewer input variables than f.

Key words: decomposition algorithms, Boolean functions, programmable logic devices.

2010 Mathematics Subject Classification: 60G35, 94A12, 92C55

top

The Precision of Remaining Operating Time Estimates for Devices Powered by Li-Ion Batteries Using bq27541 Fuel Gauge

George Emil Vieriu

Full text

In this paper the author proposes a method for calculating the precision of the remaining operating time for systems powered by a single cell Lithium-Ion battery using the data provided by the bq27540 circuit. The bq27540 is a high-performance fuel gauge with more than 99% accuracy and low power consumption. By integrating the fuel-gauge function into systems powered by a single cell Li-Ion battery designers can use better power management solutions that offer increased reliability. The precision of the estimates depends, obviously, on the values and precision of the parameters used in calculating the remaining operating time. The precision is determined by a formula based on the simplified rules for error propagation. A test system using a 2500mAh Li-Ion battery monitored by a bq27540 and discharged at a constant was used in order to validate the results. The calculated theoretical error was compared with the measured error for the test system. The proposed method can be used to determine the precision of the remaining operating time estimates or it can be used to determine the optimum values for the input variables in order to achieve a desired precision for the estimates knowing the average power consumption of the system.

Key words: Lithium-Ion battery, fuel gauging, error propagation.

2010 Mathematics Subject Classification: 68M99, 94C99.

top