

E00-192931557

Miriam Zacksenhouse

Faculty of Mechanical Engineering Technion - Israel Institute of Technology Haifa Israel

23 24 25 40

Synergetic structure of manipulative hand movements facilitates their recognition

"Intrinsic hand movements, which involve the coordinated movement of the fingers, provide a rich and intuitive mean of communication that may facilitate interfacing with virtual environments or robots. These movements may be registered using a data-glove, such as the CyberGlove, which measures the angular position of 15 finger joints. However, the resulting high-dimensional time sequence is a challenge to interpret. Previous attempts at recognizing human hand movements include the Assembly Plan from Observation paradigm and gesture programming. The assembly plan from observation attempts to automate robotic task programming but considers only grasping and constant-grasp translation. Gesture programming has been developed for sign language understanding and for intuitive interfaces to robots or virtual environments. However, the large dimension of the resulting feature vector prevents efficient training and generalization. The large dimensionality of the problem stems from the large number of joints that are involved in producing hand movements. However, our previous investigation revealed that during simultaneous hand movements the different joints are tightly coordinated. Consequently, simultaneous hand movements are well characterized by the first eigen-vectors of their joint-space trajectories. The first eigen-vector captures the inherent synergy during the simultaneous hand movement and provides a concise feature vector for its recognition. This paper demonstrates how well the simultaneous hand movements can be recognized based on their first eigen-vectors using Fuzzy ARTMAP for classification. Fuzzy ARTMAP is adopted to facilitate extension to novel movements. The performance is evaluated using a database of six users, each conducting six versions during which the nine simultaneous hand movements are repeatedly executed. High recognition rates are achieved with a relatively small number of internal classes both for user-dependent and user-independent recognition systems. Keywords: Movement recognition, coordination, Manipulative hand movements, Gesture programming "

E00-204113195

Lixin Zhang

"Room 962, Building Xinzhai, Tsinghua University, Beijing, China. 100084 "

24 25 49

#### Classifier for Chinese Traditional Medicine

"Chinese traditional medicine is the treasure of China, but there is often pseudo medicine. Traditional identification method based on the morphologic or physical chemistry is time-consuming and subjective. In recent decades, computer pattern recognition and measurement by chromatogram and spectrum have gained remarkable development, which makes chemical pattern recognition a potential medicine identification method. The mainly existing chemical pattern recognition methods for medicine identification are PCA, neural network and fuzzy clustering etc. The main drawback of these methods is that extracted features are needed from original information to form the feature space. The sample set of medicine chromatogram is usually small, and the dimensions of the feature space are up to 1000. Furthermore different medicines have different component, therefore it is impossible to reduce the dimensions without losing important information for all medicines. So it is inadequate to use neural network method which is easy to be overfit on small train set or PCA method which is dependent much on the statistical information. In this paper, we take advantage of nearest neighbor (NN) characteristic for which the distance between samples is enough for classifying a sample. So we make efforts on calculating the distance between samples to avoid facing directly a discretized high-dimensional feature space which is necessary for other classifiers. A simple method named corresponding relative distance calculating is developed to calculate the distance between samples for NN classifier, and genetic algorithm is used to optimize the parameters in the method. With the proposed method, experiments are carried out on chromatogram data of Panax. The results indicate that the method can identify the medicine material of different harvest time or habitat, furthermore, this method which combines the pattern matching, genetic algorithm and NN classifier is robust, accurate and easy to be implemented. Key words: high performance liquid chromatogram (HPLC), High-Dimensional, pattern recognition, genetic algorithm, nearest neighbor classifier "

E00-1176245722

Lixin Zhang

"Room 962, Building Xinzhai, Tsinghua University, Beijing, China. 100084 "

24 25 49

#### Classifier for Chinese Traditional Medicine with High-Dimensional and Small Sample-Size Data

"The identification of Chinese traditional medicine is a difficult subject in pharmacology. Traditional identification method based on the morphologic or physical chemistry is time-consuming and subjective. In recent decades, The development of chemical measurement and pattern recognition make chemical pattern recognition a potential medicine identification method. The mainly existing chemical pattern recognition methods for medicine identification are PCA, neural network and fuzzy clustering etc. The main drawback of these methods is that extracted features are needed from original information to form the feature space. The sample set of medicine chromatogram is usually small, and the dimensions of the feature space are up to 1000. Furthermore different medicines have different component, therefore it is impossible to reduce the dimensions without losing important information for all medicines. So it is inadequate to use neural network method which is easy to be overfit on small train set or PCA method which is dependent much on the statistical information. In this paper, we take advantage of nearest neighbor (NN) characteristic for which the distance between samples is enough for classifying a sample. So we make efforts on calculating the distance between samples to avoid facing directly a discretized high-dimensional feature space which is necessary for other classifiers. A simple method named corresponding-peak distance calculating is developed to calculate the distance between samples for NN classifier, and genetic algorithm is used to optimize the parameters in the method. With the proposed method, experiments are carried out on chromatogram data of Panax. The results indicate that the method can identify the medicine material of different harvest time or habitat, furthermore, this method which combines the pattern matching, genetic algorithm and NN classifier is robust, accurate and easy to be implemented. Key words: high performance liquid chromatogram (HPLC), High-Dimensional, pattern recognition, genetic algorithm, nearest neighbor classifier "

E00-1967352769

Lixin Zhang

"Room 962, Building XinZhaiTsinghua University, Beijing, China Zhang Lixin "

24 49

#### Identification Classifier of Chinese Traditional Medicine with Combination of Corresponding Relative Distance Computation and Genetic Algorithm

"Abstract: Chinese traditional medicine is the treasure of China, but often there is pseudo medicine. Traditional identification method based on the morphologic or physical chemistry is time-consuming and subjective. In recent decades, the development of computer pattern recognition and measurement by chromatogram and spectrum make chemical pattern recognition a potential medicine identification method and have received significant attention. The mainly existing medicine chemical pattern recognition methods are PCA (Primary Component Analysis), Neural network, Fuzzy clustering et al. The main drawback of these methods is that extracted features are needed from original information to form the unified feature vector. The sample set of chromatogram is usually small because the needed chemical experiment is very time-consuming, so it is inappropriate to use neural network method which is easy to be overfitting on small train set and the PCA method which depends on the statistical information heavily. And the accuracy of clustering method is usually lower than supervised method. In this paper, a new and practical chemical pattern recognition method is proposed, in which a simple method named corresponding relative distance computing is developed to compute the distance between samples for Nearest-Neighbor (NN) classifier, and the genetic algorithm is used to optimize the parameters of NN classifier. With the proposed method in this paper, experiments are carried out on chromatogram data of Panax. The results indicate that the method can identify the medicine material of different harvest time or habitat, furthermore, this method which combines the pattern matching, genetic algorithm and NN classifier is robust, accurate and easy to be implemented. Key words: high performance liquid chromatogram; pattern recognition; corresponding relative distance computing; genetic algorithm; Nearest-Neighbor classifier "

E00-1986819551

Wen-Ran Zhang

"Department of Math and Computer Science Georgia Southern University P.O.Box 8093 Statesboro, Georgia 30460-8093 "

3 21 28 50

### Bipolar Concept Fusion and Bipolar Cognitive Mapping for OLAP and OLAM

" Abstract: Based on bipolar logic and relations, bipolar concept fusion and bipolar cognitive mapping are introduced for online analytical processing (OLAP) and online analytical mining (OLAM). As cognitive models cognitive maps (CMs) hold great potential for clustering and visualization. Due to the lack of formal mathematical basis, however, CM-based OLAP and OLAM has not gained popularity. Compared with existing approaches, bipolar CMs have a number of advantages. First, they are formal logical as well as cognitive models. Secondly, strict bipolarity leads to the notions of equilibrium (reflexivity, bipolar symmetry, and bipolar transitivity) that provides a theoretical basis for bipolar concept fusion, clustering, and coordination. Thirdly, an equilibrium relation or CM induces bipolar partitions that distinguish disjoint coalition subsets not involved in any conflict, disjoint coalition subsets involved in a conflict, disjoint conflict subsets, and disjoint harmony subsets. Fourthly, equilibrium energy analysis provides perspectives and support for strategic decision-making. This work bridges a gap for CM-based OLAP and OLAM. Basic ideas are illustrated with example CMs in international relations. Keywords: Bipolar Cognitive Map, Concept Fusion, Bipolar Clustering, International Relations, OLAP and OLAM "

E00-846334935

Wen-Ran Zhang

"Department of Math and Computer Science Georgia Southern University P.O.Box 8093 Statesboro, Georgia 30460-8093 "

3 12

### YIN-YANG BIPOLAR LOGIC AND BIPOLAR FUZZY LOGIC - A FUSION OF TWO INTERACTIVE SUBSYSTEMS

"Abstract: It is observed that Lukasiewicz's multiple valued logic is a finite valued extension of Boolean logic; Zadeh's fuzzy logic is a real-valued extension of Boolean logic; Boolean logic and its extensions are unipolar systems that cannot be used to represent and reason with the coexistence of bipolar truth. To circumvent the representational and reasoning limitations of unipolar systems, a crisp bipolar logic  $L_1$  is introduced in the bipolar space  $S_1 = \{-1, 0\} \times \{0, 1\}$ ; the bipolar logic is extended to a universal  $(n+1)$  square-valued crisp bipolar logic  $L_n$  in the space  $S_n = \{-n, \dots, -2, -1, 0\} \times \{0, 1, 2, \dots, n\}$ ; and a real-valued bipolar fuzzy logic  $L_f$  is proposed in the bipolar space  $S_f = [-1, 0] \times [0, 1]$ . It is proved that, for all  $(x, y)$  belong to  $S_1, S_n, S_f$ , the depolarization function  $D_{plr}(x, y) = (|x| \text{ OR } y)$  recovers  $L_1, L_n$ , and  $L_f$  to Boolean logic, Lukasiewicz's multiple valued logic, and Zadeh's fuzzy logic, respectively. Based on the recovery function  $D_{plr}(x, y) = (|x| \text{ OR } y)$ , it can be concluded that: (1) bipolar logic is a generalization of classical unipolar logical systems; and (2) a bipolar logic is a fusion of two interactive unipolar subsystems. Thus, the bipolar family provides a unique representation for bipolar data-knowledge fusion and bipolar reasoning. The semantics of the bipolar systems are established, justified, and compared with unipolar systems with examples. Keywords: Bipolar Crisp Logic, Bipolar Fuzzy Logic, Recovery to Classical Logic, Bipolar Knowledge Fusion, Bipolar Inference "

E00-1306324256

Lin Zheng

"School of Electronic and Information Engineering, Xi'an Jiaotong University, Xi'an 710049, P. R. China "

4 19 38

#### A Multi-modes Image-tracking Algorithm Based on Fuzzy Inference

" Abstract: In this paper, an image-tracking algorithm is proposed, which contains two tracking modes and a switch between them according to the fuzzy inference. The first mode is the feature-based tracking, and the second is the active contour-based tracking. These two kinds of modes are complementary each other. The feature-based tracking correlates the features in the previous images with those in current image. The advantage of this approach is that even in the presence of partial occlusion, some of the features remain visible. To use this method is not easy to determine the set of features. The active contour-based tracking can find the bounding contour of the target in the image sequence. This tracking method is rapid, and the segment result is fine when there is no occlusion. The disadvantages are the initiation problem and some mistake results if there is a serious occlusion. In this paper, above tracking modes are fused with the fuzzy inference. The key problem of the fusion is to determine whether the object is occluded. When the occlusion is serious, the feature-based tracking method is employed. As there is no occlusion or the occlusion is mild, the active contour-based method is used. The criterion to determine the occlusion is based on fuzzy inference. At every tracking stage, the segment-result of previous stage is placed at the predicted position in the current image, and then searches for the best match position. The corresponding maximum correlation coefficient is used as the universal of discourse for fuzzy inference. The experience results show that this algorithm performs well. Keywords: fuzzy inference, image tracking, multi-mode, feature-based, active contour-based "

E00-274552369

Yifeng Zhou

"Electronic Support Measures Section Defence Research Establishment Ottawa 3701 Carling Avenue,  
Ottawa, Ontario Canada K1A 0Z4 "

1 2 8 11 13 21 24 39

Neural Networks Classifier based Track Association Algorithm for Multiple ESM Sensor Fusion  
Applications

"Recently, there has been increasing interest in combining information from multiple ESM sensors to provide an enhanced target identification performance. In this paper, we study the problem of ESM sensor track association. A track association approach is proposed based on the application of pattern classification techniques. The classifier is built on a radial basis function (RBF) neural network. It is trained using pulse descriptive features from one of the sensor sites to approximate the posterior probability when the feature data is presented to the network input. The approach does not require any priori statistical information on the track data and is computationally efficient. Computer simulations are used to demonstrate its effectiveness. "

E00-749840883

Hongyan Zhu

"School of Electronic and Information Engineering, Xi'an Jiaotong University, Xi'an 710049, P. R. China "

19 21

#### A EM-Based Track Association Algorithm

" The information fusion in the distributed fusion system is just to combine the local tracks from different sensors to form best tracks according to some rules. To achieve it, it is necessary to determine whether some local tracks come from the same target, and this is usually called to be the track association problem. A number of approaches for the track association problem have been proposed, including statistic methods based on hypothesis test and fuzzy reasoning. But, when there are many crossing tracks with higher clutters in the surveillance region, the association errors by using the existing methods must be increasing. The aim of the paper is to maximize the probability density function of the association events of the known local tracks. But, it is not feasible due to the unknown real target states. It is a natural idea to utilize the expectation maximization (EM) algorithm in above situation, because it is one of the preferred methods for the so-called 'incomplete data problem'. In this paper, the parameters estimated are described to be the association events, the local tracks are treated as the 'incomplete data', and the real target states are formulated as the 'miss data', therefore, the so-called 'complete data' have been obtained. At the E-step, the cost function to maximize is obtained by means of calculating the expectation of the joint probability density function of the complete data and parameters. At the M-step, the maximization computation is efficiently implemented by using the dynamic programming. In this way, the maximum a posterior probability estimates of the association events are obtained by the iterative scheme. The advantage of the approach is that it provided a computationally efficient means and a better association performance. Finally, the simulation is made which illustrates the performance both EM-based track association and other competing schemes. "