
RECPAD–2002

12TH PORTUGUESE CONFERENCE ON PATTERN RECOGNITION

ABSTRACTS

JUNE 27–28, 2002

UNIVERSIDADE DE AVEIRO, PORTUGAL

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- 2 – Image Processing and Analysis
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- 4 – Image and Video Coding
- 5 – Computer Vision
- 6 – Neural Networks
- 7 – Biomedical Applications

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FOREWORD

The 12th Portuguese Conference on Pattern Recognition — RecPad2002, was organized by the Departamento de Electrónica e Telecomunicações and Instituto de Engenharia Electrónica e Telemática of the Universidade de Aveiro, on behalf of the APRP (Portuguese Association of Pattern Recognition). It is the third time that RecPad is held in Aveiro; the first one was in 1991 and the second in 1995.

RecPad is currently a biannual conference devoted to all areas of Pattern Recognition and covers theoretical aspects as well as applications. Submissions, in this edition, as in the previous ones, were encouraged in the following areas (among others): Pattern Recognition, Image and Signal Processing, Image and Video Coding and Compression, Computer Vision, Industrial and Medical Applications and Neural Networks.

The 79 received contributions were referred by, at least, two members of the Program Committee. Out of these, 26 were included in the program as long papers and 37 as short papers. These papers were included in the Proceedings (in CDROM) and their abstracts in the Book of Abstracts, and have been organized in 11 sessions. We are pleased to acknowledge a strong participation of authors from 13 different countries.

We thank all the members of the Program Committee and the invited speakers, Professors Maria Petrou (University of Surrey, U.K.), José Carlos Príncipe (University of Florida, USA) and Paulo Jorge Ferreira (University of Aveiro, Portugal), for their participation, ensuring the quality of RecPad2002 as a Scientific event.

We thank all the participants and wish them a fruitful work at the Conference and a pleasant sojourn in Aveiro.

We also thank the following institutions for their support:

UA — Universidade de Aveiro

IEETA — Instituto de Engenharia Electrónica e Telemática de Aveiro

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Aveiro, June 2002.

The Organizing Committee:

Francisco Vaz, Armando Pinho, Beatriz Sousa Santos, Carlos Bastos, José Vieira

PROGRAM OF RECPAD-2002

12TH PORTUGUESE CONFERENCE ON PATTERN RECOGNITION

UNIVERSIDADE DE AVEIRO, PORTUGAL

Thursday, June 27th

9:00–12:00	Registration	
9:15–9:30	Opening Session	
9:30–10:30	Invited Lecture: Prof. Maria Petrou	
10:30–11:00	Break	
11:00–12:00	Invited Lecture: Prof. José Principe	
12:00–14:00	Lunch	
14:00–15:00	Computer Vision (oral)	
15:10–16:30	Signal Processing (oral)	Biomedical Applications (poster)
16:30–16:50	Break	
16:50–18:10	Video Analysis (oral)	Signal Processing (poster)
18:10–19:00	Meeting of the APRP SIG's	
20:00	Conference Dinner	

Friday, June 28th

9:00–10:40	Applications (oral)	Pattern Recognition (poster)
10:40–11:00	Break	
11:00–12:00	Invited Lecture: Prof. Paulo Ferreira	
12:00–14:00	Lunch	
14:00–15:40	Pattern Recognition (oral)	Image and Video (poster)
15:40–16:00	Break	
16:00–17:30	Image Analysis (oral)	Computer Vision (poster)

Invited Lectures

Thu 27th, 9:30–10:30

3D texture analysis for medical applications

Maria Petrou

School of Electronics, Computing and Mathematics, University of Surrey, Guildford, U. K.

ABSTRACT — Volume data are very common in Medicine. However, they are difficult to visualise, yet alone to assess properties like volumetric isotropy or variation. Currently clinicians see such data slice by slice, they do not and they cannot take advantage of the full information conveyed by such data. This talk will present a way of assessing the texture of 3D volume data, a way of visualising such information, and some applications of the approach to schizophrenia and Alzheimer's disease.

Thu 27th, 11:00–12:00

Information Theoretic Learning: A Nonparametric Approach

José C. Principe

Computational NeuroEngineering Laboratory, University of Florida, Gainesville, FL, U.S.A.

ABSTRACT — This talk will present a new cost function for adaptation based on Renyi's entropy. In order to obtain a practical nonparametric cost function for supervised or unsupervised training of linear or nonlinear mappers, we integrate Renyi's definition with a Parzen estimator. This estimator of entropy does not require a data model, and resembles an interaction model for learning (the information potential). Properties of the information potential will be presented, and several learning algorithms (batch, stochastic gradient, and a recursive entropy estimator) will be derived. Results in feature extraction, unsupervised clustering, blind source separation and information filtering will be presented.

Fri 28th, 11:00–12:00**Handling impulsive noise***Paulo J. S. G. Ferreira*

Dep. de Electronica e Telecomunicações, Universidade de Aveiro, Portugal

ABSTRACT — Dealing with impulsive noise remains a challenge, despite the efforts of many people and the existence of several distinct approaches. This talk addresses the issue of impulsive noise removal. A few of the possible approaches will be considered, giving some attention to the two basic frameworks that must be faced when discussing the problem: the analog case, and the digital case. The techniques discussed are nonlinear, and under certain conditions lead to the total removal of the noise. The connections between the techniques discussed and other approaches (including error control coding) are also discussed.

Oral Sessions

Thu 27th, 14:00–15:00 Computer Vision

14:00 — A DCT-Based Feature Transformation Strategy for Fast Object Recognition

Qinghua Wang, Luis Seabra Lopes

Departamento de Electrónica e Telecomunicações/IEETA, Universidade de Aveiro, Portugal

ABSTRACT — In this paper, a feature transformation approach based on the Discrete Cosine Transform (DCT) is proposed for fast object recognition. The main contribution in this paper is the use of a blocked DCT to transform the image features for automatic classification into person and non-person images using MLP. The specific task is the detection of human beings by an intelligent service robot. The first step is dimensionality reduction through the application of blocked DCT. Then, a selection of the obtained DCT coefficients is fed to a three-layer MLP classifier. The experiments performed using BackPropagation with weight decay show the use of blocked DCT can greatly speed up the training procedure of the MLP classifier. The results obtained from 10-fold cross validation imply an acceptable performance with accuracy around 75% for objects having different scales, poses and positions. MLP training time for this accuracy level shows that the method can scale up well to on-line incremental learning.

14:20 — Model-Based Pose Estimation in Parabolic Catadioptric Images

António Paulino, Helder Araújo

Institute of Systems and Robotics, Dept. of Electrical and Computer Eng. — Polo II, University of Coimbra, Portugal

ABSTRACT — The applications for panoramic imaging systems are increasing. Among these are surveillance systems, commercial systems for web navigation and robot localization and navigation. The parabolic catadioptric mirror is one of such imaging systems. This paper describes an algorithm for pose estimation in images obtained with such a mirror. The algorithm is based on an analytical solution. The analytical solution is presented for two cases, depending on whether or not the mirror parameter is known. If the parameter is known, only four points are needed. These four points have to form a rectangle. If the parameter is not known it can be computed. However in that case we need an extra point.

14:40 — Robust Normalization of 3D Facial Meshes using Automatically Located Feature Points*Belén Moreno, Ángel Sánchez, José F. Vélez*

Dept. CC. Experimentales e Ingeniería of Universidad Rey Juan Carlos, Madrid, Spain

ABSTRACT — This paper presents an automatic method to carry out the task of pose normalisation in a database of frontal facial surfaces presenting facial expressions and light rotations for Face Recognition purposes. The database of facial meshes was acquired with a 3D laser digitizer, without considering colour information. In this approach, we use a set of nine feature points automatically extracted from the mesh surfaces. Local geometrical properties of the mesh surface have been used in the automatic feature point selection.

Thu 27th, 15:10–16:30 Signal Processing**15:10 — Modeling Intra and Inter Speaker Variability***Carla Lopes*¹, *Fernando Perdigão*²¹Instituto de Telecomunicações, Pólo de Coimbra / Escola Superior de Tecnologia e Gestão de Leiria, Portugal²Instituto de Telecomunicações, Pólo de Coimbra / Dept. Eng. Electrotécnica e Computadores, Pólo II da Universidade de Coimbra, Portugal

ABSTRACT — This paper describes three different procedures to reduce intra speaker, inter speaker and environment variability of speech signals. The environment variability is compensated by modeling explicitly some frequent noise phenomena. Intra speaker variability is reduced both at the phonetic level by modeling coarticulation events, and at the linguistic level as these units lead to alternative phonological rules. This communication also describes a speaker normalization procedure based on pitch, which uses frequency warping, as it is usually implemented in the vocal tract length normalization (VTLN) technique. The goal is to build robust models by the reduction of inter speaker variability. Previous work, in which normalization procedures were based on speaker specific features, namely on formant frequencies, pointed out as an obstacle for better results, the fact that is difficult to estimate formant frequencies. The proposed method, which is based on pitch, proved to be appropriate for the improvement of the performance of a 9 connected digit string task. The method overcomes the dependency of the system performance face to the reliability of formant estimation, and reached even better results.

15:30 — Average Error Bound for the Mixture of Experts MNN Architecture*Luís A. Alexandre*^{1,2}, *Aurélio C. Campilho*^{2,3}, *Mohamed Kamel*⁴¹Dept. Informática, Univ. Beira Interior, Covilhã, Portugal²INEB - Instituto de Engenharia Biomédica, Porto, Portugal³Fac. Engenharia, Univ. Porto, Portugal⁴Dept. Systems Design Engineering, Univ. Waterloo, Canada

ABSTRACT — In this paper we study the generalization error of modular neural network architectures (in particular the mixture of experts architecture) and compare its performance with a single neural network with the same number of weights, on separable problems. We propose a relation for the training error of the modular architecture versus the training error of the single neural net that, if verified, will guarantee, on average, better generalization results for the modular architecture. Experiments are presented to illustrate the results.

15:50 — Nonlinear Source Separation using a Genetic Algorithm*C.G.Puntonet¹, F. Rojas¹, I.Rojas¹, T.Westernhuber², E.W.Lang²*¹Dept. of Computer Architecture and Technology, University of Granada, Spain²Inst. of Biophysics, University of Regensburg

ABSTRACT — This paper shows the fusion of two important paradigms, Genetic Algorithms and the Blind Separation of Sources in Nonlinear Mixtures (GABSS). Although the topic of BSS, by means of various techniques, including ICA, PCA, and neural networks, has been amply discussed in the literature, to date the possibility of using genetic algorithms has not been explored. In Nonlinear Mixtures, optimization of the system parameters and the search of invertible functions is very difficult due to the existence of many local minima. From experimental results, this paper demonstrates the possible benefits offered by GAs in combination with BSS, such as robustness against local minima, the parallel search for various solutions, and a high degree of flexibility in the evaluation function.

16:10 — A Method for Constructing Nonlinear Discrete Wavelet Transforms*Lute Kamstra*

Centre for Mathematics and Computer Science, Amsterdam, The Netherlands

ABSTRACT — Sweldens' lifting scheme not only enables fast, in-place calculations of linear wavelet transforms, but can also be used to construct nonlinear wavelet transforms. This paper introduces a general framework for linear as well as nonlinear discrete wavelet transforms that work on finite valued signals and discusses how the lifting scheme can be used to construct these wavelets. It also introduces a new method, composition, that can be used to combine several discrete wavelet transforms with small supports into a wavelet transform with a larger support. It is demonstrated that this can be useful for binary image compression.

Thu 27th, 16:50–18:10 Video Analysis**16:50 — The Role of Middle Level Features for Robust Shape Tracking***Jacinto C. Nascimento¹, Arnaldo J. Abrantes², Jorge S. Marques¹*¹ISR/IST, Lisbon, Portugal²ISEL, Lisbon, Portugal

ABSTRACT — Shape trackers using low level features (e.g., edge points) often fail in complex environments (e.g. clutter, inner edges or multi-objects). Two alternatives are discussed in this paper. Both methods use middle level features: (data centroids, strokes), which are more informative and reliable than edge transitions used in most shape trackers. Furthermore, it is assumed that each middle level feature is either valid or an outlier. Therefore a confidence degree is assigned to each feature. Features with a high degree of confidence have a large influence on the shape estimate while features with low degree of confidence have a negligible influence on the final estimates. Both mechanisms (the use of middle level features and confidence degree) lead to a significant improvement of the tracker robustness. This is shown in the paper in the context of lip tracking problem.

17:10 — Radon-like Transforms of Log-polar Images for Affine Motion Estimation*V. Javier Traver, Filiberto Pla*

Dept. Llenguatges i Sistemes Informàtics, Universitat Jaume I, Castellón, Spain

ABSTRACT — The shift property of the Radon transform becomes useful for estimating translational motion in the image domain. But, how does a more general transform in the image domain affect the projection domain? This theoretical question was addressed in [1], and we now explore these results for their potential practical application for affine motion estimation using log-polar images, rather than uniformly sampled cartesian images, because of the advantages of foveal imaging in active vision tasks.

17:30 — Quasi-simultaneous Motion Segmentation and Estimation Using a Generalized Least Square Method*R. Montoliu, F. Pla*

Computer Vision Group, Universitat Jaume I, Castellón, Spain

ABSTRACT — This paper presents a quasi-simultaneous motion segmentation and estimation method based on a parametric model fitting algorithm. The method accurately estimates the affine motion parameters using a generalized least squares fitting process. It also classifies the pixels into the motion models present in a sequence of two consecutive frames. The classification of the pixels is based on a measure of their likelihood under each model. Experiments using synthetic and real sequences are shown in order to illustrate the results obtained using the proposed algorithm.

17:50 — Experimental Comparison of Existing Video Shot Detection Techniques in Compressed Video*Xiaoqiang Huang, Mark Fisher, Dan Smith*

University of East Anglia, Norwich, U.K.

ABSTRACT — Video shot detection is an important first step in video parsing that has been applied in many recent content-based video indexing and retrieval systems. A number of algorithms address the problem of detecting video shots automatically. Some algorithms work with decompressed digital video, while other more state-of-the-art approaches try to detect shots in MPEG-1,-2 compressed video streams directly in order to reduce the processing time. This paper reviews the main approaches to detecting shots in MPEG-1,-2 coded video and compares these using experimental results derived using extracts from the National Institute of Standards and Technology (NIST) video test data-set. These results show that the approach using DC images outperforms other more complex approaches based on macroblock coding reviewed in this paper in terms of precision and accuracy.

Fri 28th, 9:00–10:40 Applications**9:00 — Functional Trees: a Case Study on Cardiotocographic Data***João Gama¹, Marques de Sá²*¹LIACC, FEP University of Porto, Portugal²DEEC, FEUP University of Porto, Portugal

ABSTRACT — In this paper we study the behavior of Functional Trees on a medical domain: the Cardiotocographic data. Functional Trees are decision trees that can use decision nodes based on a combination of attributes and leaf nodes that make predictions using a combination of attributes. One of the advantages of tree models is the high degree of interpretability. In domains where this characteristic is relevant, as in medical domains, decision trees are a natural choice. The results on the Cardiotocographic data shows that the performance of Functional trees is one of the best results over a large set of classification algorithms.

9:20 — Automatic Analysis of Fetal Echographic Images*Sandra Vilas Boas Jardim¹, Mário A. T. Figueiredo²*¹Escola Superior de Tecnologia, Instituto Politécnico de Castelo Branco, Portugal²Instituto de Telecomunicações, Instituto Superior Técnico, Lisboa, Portugal

ABSTRACT — This paper describes a new method for the automatic extraction and measurement of fetal anatomic structures from echographic images. More specifically, we estimate and measure the contours of the femur and of cranial cross-sections of fetal bodies. Contour estimation is formulated as a statistical estimation problem, where both the contour and the observation model parameters are unknown. The observation model (or likelihood function) relates, in probabilistic terms the observed image with the underlying contour. This likelihood function is derived from a region-based image model. The contour and the parameters are estimated according to the *maximum likelihood* (ML) criterion, via unsupervised deterministic iterative algorithms. Experiments reported in the paper, using synthetic and real images, testify for the adequacy and good performance of the proposed approach.

9:40 — Some Results Regarding Applying ICA in Breast Cancer Microscopic Imagery*Ovidiu Grigore, Andre Puga*

INESC Porto, Portugal

ABSTRACT — The paper presents experimental results obtained by applying Independent Component Analysis (ICA) techniques in an image segmentation task. The angiogenesis process, which represents the appearance and the growing of cancer tumors, can be quantified through the level of the intratumoral microvessel density (MVD). An intelligent system designed to evaluate the MDV has to discover first, as accurate as possible, all the microvessel from the image. On this purpose, an image segmentation application based on Independent Component Analysis (ICA) techniques was implemented. The methodology applied in

this case consists of 3 steps: (i) preprocessing transform, based on ICA techniques, used to emphasize the microvessels areas perceptions; (ii) feature extraction using a 2D-DCT; (iii) segmentation of the image using unsupervised pattern recognition techniques applied to the features obtained before. Some practical solutions regarding the applying of ICA to this task are proposed and discussed in the second section. Also, in the last part of the paper, results and the conclusions are presented.

10:00 — Estimating Intramuscular Fat Content of Cured Iberian Loin Using Statistical Analysis of its Magnetic Resonance Images

E. Cernadas¹, M. L. Durán², P. G. Rodríguez², A. Caro², E. Muriel³, R. Palacios⁴

¹Dpto. de Informática, E.S.E Informática, Univ. de Vigo, Spain

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³Dpto. de Tecnología de los Alimentos, Fac. de Veterinaria, Universidad de Extremadura, Spain

⁴Servicio de Radiología, Hospital Universitario Infanta Cristina, Badajoz, Spain

ABSTRACT — The Iberian pig is an autochthonous breed from the South-western Iberian Peninsula. Its derived dry-cured products have high sensory quality and a first rate of consumer acceptance. Currently, chemical procedures are the only proved way to quantify fat content in Iberian products, which tedious and destroying the piece. So, meat industries have been shown a great interest in finding non-destructive methods. We describe a novel methodology to predict three level (low, medium and high) of fat content analysing magnetic resonance images (MRI) of cured Iberian loins. A statistical evaluation is also provided.

10:20 — Horse Recognition: A General Approach to Object Recognition

Merel Noorman¹, Kai Otto², Marten den Uyl², Rein van den Boomgaard³

¹Vicar Vision, Amsterdam, The Netherlands

²Sentient Machine Research B.V., Amsterdam, The Netherlands

³University of Amsterdam, Amsterdam, The Netherlands

ABSTRACT — The aim of the research described in this paper has been to take an investigative step towards the development of a general framework for object recognition. The algorithm that has been derived as a result of these explorations uses neural-network-based feature detectors to identify local characteristic features of a flexible object. Recognition is a result of finding a configuration of features detected in a given image that closely resembles the structure of one of a set of known instances of the object. The experiments show that the described approach applied to the object class horse produces good recognition results for instances that meet the requirements of the training set. Furthermore, the method proves to be able to generalise to a considerable extent over instances that do not meet these requirements.

Fri 28th, 14:00–15:40 Pattern Recognition**14:00 — Pattern Detection Using Cortical Cell Models***L. M. Santos, J. M. H. du Buf*

Vision Laboratory, University of Algarve, Faro, Portugal

ABSTRACT — In this paper we present methods for the detection of different patterns, such as snakes, disks and rings. We employ a set of Gestalt laws to define grouping rules for each type of pattern. These rules are applied to the output of an improved bar-cell model. Hence, we build a processing tree in which simple patterns are detected at a low level, whereas more complex ones are detected at a higher level. We also analyse a general grouping concept (Normalised Cut) that eliminates the need for specific grouping rules. This latter grouping is applied to the outputs of contour cells. Results obtained with synthetic images show an almost ideal performance of the cell models. In real-world scenes, most patterns can be detected, and even incomplete structures due to occlusion can be reconstructed.

14:20 — Context-Dependent Clustering based on Dissimilarity Increments*Ana L. N. Fred*

Instituto de Telecomunicações / Instituto Superior Técnico, Lisbon, Portugal

ABSTRACT — We explore the idea of context dependent clustering under a hierarchical agglomerative framework. Inter-pattern relationships (within a cluster) are modelled by the statistical distribution of dissimilarity increments between neighboring patterns. This distribution characterizes context, forming the basis of a new cluster isolation criterion. The integration of this criterion into a hierarchical agglomerative clustering framework produces a partitioning of the data, while exhibiting pattern structure in terms of a dendrogram-type graph. We further extend the applicability of the method to large data sets by proposing the integration of sampling techniques into the clustering process.

14:40 — Morphological Modelling in Features Space*Teresa Barata, Pedro Pina*

CVRM / Centro de Geo-Sistemas, Instituto Superior Técnico, Lisbon, Portugal

ABSTRACT — A mathematical morphology based methodology to construct decision region borders that geometrically models the training sets of points in features space is presented in this paper. The incorporation of the features of the training sets in the procedure allows defining more correct decision borders and, in consequence, higher classification rates are obtained. This methodology is illustrated with two indirect features (wetness' tasselled cap and NDVI's vegetation index) of seven land cover classes (forest (3), soil (2), vegetation and water) constructed from remotely sensed images of a region in centre Portugal.

15:00 — Comparison of Fuzzy Clustering and Quadtree Methods Applied to Color Segmentation*J. R. Caldas Pinto, João M. C. Sousa*

Technical University of Lisbon, Instituto Superior Técnico, Dept. Mech. Eng./GCAR ID-MEC, Portugal

ABSTRACT — Automatic marbles classification based on their visual appearance is an important industrial issue. However, there is no definitive solution to the problem mainly due to the presence of randomly distributed high number of different colors. In this paper we present a study of clustering algorithms for color segmentation based on fuzzy clustering. This method is compared to the quadtree method introduced recently. Both methods lead to a reduction in the number of colors, without important changes in the marbles visual appearance, simplifying the classification problem.

15:20 — Diatom Contour Classification by Curvature of Convex and Concave Segments*R. E. Loke, J. M. H. du Buf*

Vision Laboratory, University of Algarve, Faro, Portugal

ABSTRACT — In this paper we describe a new contour feature set. A contour is segmented into convex, concave and straight segments, after which length and curvature features are computed. A symmetry analysis allows the detection of the number of elementary segments. Results on two contour test sets were obtained: Using only four features, a simple nearest-mean classifier yielded a perfect identification (ID) rate of 100% on a small set consisting of shapes with minute differences, which are difficult to identify even for human experts. Using 10 features, it yielded 83.5% on a large set with very diverse shapes.

Fri 28th, 16:00–17:20 Image Analysis**16:00 — Toward the Characterization of Directional Texture Classes***Sébastien Mavromatis, Jean-Marc Boï, Rémy Bulot, Jean Sequeira*

ESIL - Equipe LXAO, Marseille, France

ABSTRACT — We propose a new and efficient characterization of directional textures and we show that this approach can be extended to directional texture classes. A texture class is defined as the association of a basic texture with a set of operators that can modify it. This definition enables the development of powerful tools for image segmentation when the relevant information within regions is made of a “slowly moving directional texture”.

16:20 — Scale-space Shape Comparison Suitable for Shape Based Retrieval*António M. G. Pinheiro¹, Mohammed Ghanbari²*¹Universidade da Beira Interior, Covilhã, Portugal²Department of Electronic Systems Engineering, University of Essex, Colchester, U.K.

ABSTRACT — In this paper a similarity measure between two shapes is introduced. This measure is computed in scale-space and is suitable for shape based image retrieval. A distance measure between the polygonal approximation of two smoothed contours is made in different scales. The lower scale that results in a smaller distance measure than a predefined threshold is selected for the final similarity measure computation. In this case the system indicates a match and computes the similarity between the two compared shapes. With this scale-space technique it is possible an efficient and reliable search and retrieve of the most similar shapes within a query shape. We have found that in most of the cases, the retrieved shapes reveal a good resemblance with the query shape.

16:40 — Optimal Intervals for Fuzzy Categories of Colour Temperature With Application to Image Browsing*Wladyslaw Skarbek^{1,2}, Grzegorz Kukielka^{2,3}*¹Institute of Radioelectronics, Warsaw University of Technology, Warsaw, Poland²AltKom Akademia S.A., Warsaw, Poland³Institute of Microelectronics and Optoelectronics, Warsaw University of Technology, Warsaw, Poland

ABSTRACT — This paper presents the results of experiments for colour temperature browsing descriptor. We consider the problem of the optimal objective value conversion (colour temperature) into the subjective category (Hot, Warm, Neutral, and Cold). The situation where the subjective categories are based on objective object attribute appears to be common while comparing interpretation of human sensors with physical sensors. The proposed optimal procedure of colour temperature partition segmentation into four disjoint intervals and the experimental results are described.

17:00 — MINN: A Multiple-Instance Learning Neural Network for Image Classification Problems

Y. Y. Xu¹, Hsin-Chia Fu¹, H. T. Pao²

¹Department of Computer Science and Information Engineering, National Chiao-Tung University, Hsinchu, Taiwan, ROC

²Department of Management Science, National Chiao-Tung University, Hsinchu, Taiwan, ROC

ABSTRACT — In this paper, we proposed a multiple-instance neural network (MINN) for ambiguous labeling problems, in which training items are labeled either imprecisely or incompletely. To train an image class model, a set of exemplar positive and negative labeled images are selected by a user. A positive image consists of at least one user interested object (instance), and a negative example should not contain any user interested object (instance). We first define a performance index E as a quantitative measure, which indicates how near the designated class is to the intersection of positive instances and how far the class is away from the negative instances. Based on these index E , a discriminant function is then proposed in each subnets of MINN to represent the closeness between input instances and the target class, which is modeled by a subnet. By using the proposed MINN learning scheme, an image classification system can learn the user's preferred image class from the given positive and negative examples. We have built a WWW based prototype system to retrieve user desired images and videos. Experimental results show that for only a few times of relearning, a user can use the prototype system to retrieve favor images over Internet.

Poster Sessions

Thu 27th, 15:10–16:30 Biomedical Applications

P.01 — Comparison of Two Neural Networks Models to Estimate Foetal Weight

F. Sereno, J.P. Marques de Sá, A. Matos, J. Bernardes

Faculdade de Engenharia da Universidade do Porto, Hospital de S. João, Dep. Ginecologia e Obstetrícia, Faculdade de Medicina da Universidade do Porto, Instituto de Engenharia Biomédica, Porto, Portugal

ABSTRACT — Foetal weight estimation based on echographic measurements has a paramount importance in delivery risk assessment. Four Portuguese hospitals participated in the collection of clinical and echographic data, according to a protocol. This paper reports the results of a complexity control experiment using two multilayer perceptrons (MLP) models that differ in their training optimization techniques. One uses the standard MSE minimization, and the other information-theoretic minimization of the Renyi's entropy of order two.

P.02 — A Recursive Filter for 3D MAP Reconstruction

João Sanches, Jorge S. Marques

Instituto Superior Técnico / Instituto de Sistemas e Robótica, Lisbon, Portugal

ABSTRACT — Three dimensional reconstruction aims at estimating a real function f defined on a subset of R^3 . The function f usually conveys information about the organs properties to be used for medical diagnosis. Bayesian methods (e.g. MAP) are often used to address this problem since they allow to incorporate the available knowledge about the data and function to be estimated. However they are usually slow and exhibit a bad performance at transitions. This paper addresses both difficulties by approximating the MAP solution by the output of a set of recursive filters which are fast and provide better results at transitions.

P.03 — User Interface Design and Evaluation of a DICOM Based Digital Mammography Workstation

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ABSTRACT — Digital mammography is opening a new age for breast imaging. The FDA has recently approved the use of digitally acquired images for primary diagnosis in mammography. However, the visualization of mammographic studies on CRT monitors remain a challenge nowadays due to the special nature of breast imaging. After a hard evaluation of our first system, an evolved display workstation has been designed. The new system incorporates whole DICOM functionality for acquiring, storing and printing images. The user interface has also been improved according to the evaluation and preferences of the radiologists. In this work we describe our efforts to address some unsolved problems concerning soft-copy diagnosis in digital mammography.

P.04 — Pollen Classification of Three Types of Plants of the Family Urticaceae

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ABSTRACT — The Urticaceae family is a kind of plants which grows especially on soils rich in nitrogen, e.g. like overgrowing weeds in cultivations. Due to human allergic reaction, clinical practice shows special interest in the differentiation of the genders. Currently, palinology experts do not achieve this differentiation in routine analysis of pollen preparations. We describe an automatic approach based on shape analysis to classify three types of pollen of the Urticaceae family and provide a statistical evaluation of the first experiments.

P.05 — Mitosis Detection Using the Hough Transform for Circles

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ABSTRACT — The study of cancer cell culture and the analysis of cell proliferating rates are of great interest for biologists and pharmacologists, for example to determine if some anti-cancer agents are able to reduce cell proliferation (i.e. cell division). In this context, the present study aims to provide Computer Vision tools able to detect two kinds of morphological cell patterns which can be observed during cell division in sequence images. On one hand, just before to division, (mother) cells become circular and very bright, and, on the other hand, at the end of division, the daughter cells are generally smaller than their mother cells, and also very bright. For these reasons, we consider appropriate to use the Hough Transform (HT) for circles to detect these two cell patterns, taking into account these peculiar characteristics. Therefore, our goal is the description of a novel method for the localisation and characterisation of cancer cells in division. For testing the results, a database of 40 images was created from the analysis of the pattern evolution of cancer cells in sequence images.

P.06 — Texture Attributes for Segmentation of Cells in Light Microscopy

E. Glory^{1,2}, I. Boudoux², F. Cloppet², V. Meas-Yedid¹, C. Zimmer¹

¹Laboratoire d'Analyse d'Images Quantitative, Institut Pasteur, Paris, France

²Laboratoire CRIP5-Sip, UFR Mathématiques et Informatique, Paris, France

ABSTRACT — This project aims at quantifying the motility and deformations of amoeba. This part of the project has been conceived to produce a region information which could improve segmentation by active contours. The methodology is based on computing locally texture attributes. A criterion of quality automatically estimates the ability of texture attributes to separate two different regions defined manually. The method has been applied in biological imaging to segment cells observed in phase contrast microscopy.

P.07 — Histological Image Analysis by Color Image Segmentation Based on Markov Random Field Clustering

Sorin Tilie, Vannary Meas-Yedid, Jean-Christophe Olivo-Marin

Laboratoire d'Analyse d'Images Quantitatives, Institut Pasteur, Paris, France

ABSTRACT — In order to characterise the virulence factors of different Mycobacterium tuberculosis strains responsible of tuberculosis disease, the quantification, by cell counting, of immune cell recruitment is necessary. However, this task by microscopic observations is very tedious and difficult to reproduce. Hence we propose an automatic counting approach, consisting in color image segmentation to discriminate three regions: cell nuclei, immune cells and background, followed by the extraction of each cell entity. For color segmentation, a Markov Random Field Clustering approach taking simultaneously into account both color and spatial information is chosen, in a specific color space. In the second step of biological entity counting, watershed is performed to separate cell aggregations. Our segmentation technique was successfully applied to several color images of different strains, and a preliminary evaluation of the results has been performed, showing the robustness of the method against noise, marker color changes, illumination changes and blurring. Automatic cells counting is an important issue for biologists and the results of this method is very encouraging.

P.08 — Preliminary Experimental Validation of the Absolute Coronary Blood Flow Measurement from Coronarographic Images Performed on the Artery Model

Hanna Goszczyńska¹, Leszek Kowalczyk¹, Piotr Bogorodzki², Tomasz Wolak², Robert Kurjata², Mateusz Orzechowski²

¹Institute of Biocybernetics and Biomedical Engineering PAS, Warsaw, Poland

²Nuclear and Medical Electronics Division, Warsaw University of Technology, Warsaw, Poland

ABSTRACT — The paper presents the experimental validation of the coronary blood flow measured from coronary images. Measurements of the image intensity along the same cross-section line of the artery was performed on two sequences of images: one with the bolus of the contrast and the second one with a small quantity of a slowly injected contrast. Experimental validation was performed using a simple artery model. The preliminary results of the flow calculation show that the error is below 20%.

P.09 — Objective Evaluation of Image Thresholding Techniques for Wounds*A. G. Deshpande¹, T. R. Sontakke²*¹Govt. Engg. College, Aurangabad, India²SGGSCE Tech, Nanded, India

ABSTRACT — Motivated by the need of computer-assisted analysis of wounds (Injuries), which is usually done by doctors, an attempt has been made for automatically segmenting the wounds from background. Segmentation techniques based on entropy or some pixel classification techniques are applied on images of wounds. Objective evaluation of all these methods is done using correlation factor, region uniformity, entropy, divergence and two new parameters Euclidian distance and Chi-square test are used for object evaluation.

Thu 27th, 16:50–18:10 Signal Processing**P.01 — A New Geometrical Method of Blind Source Separation Based on a Lattice of the Space of Observations**

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ABSTRACT — The techniques of Blind Separation of Sources (BSS) are used in many Signal Processing applications in which the data sampled by sensors are a mixture of signals from different sources, and the goal is to obtain an estimation of the sources from the mixtures. This work shows a new method for blind separation of sources, based on geometrical considerations concerning the observation space. This new method is applied to a mixture of two sources and it obtains the coefficients of the unknown mixture matrix A and separates the unknown sources, S . Following an introduction, we present a brief abstract of previous work by other authors, the principles of the method and a description of the algorithm, together with simulations.

P.02 — Gabor Filters Optimized by Simple Simulated Annealing

R. Oliveira, T. Candeias, L. Santos, H. Shahbazkia
Universidade do Algarve, Faro, Portugal

ABSTRACT — In this paper the Simulated Annealing algorithm will be applied to the Gabor filters parameters optimization. More precisely, we will show how the number of filters used in texture analysis can be reduced to almost half of the initial number. This is an innovative alternative to using a fixed Gabor filter bank. Comparisons with other search methods showed a better performance of our method. The computational cost is very low which makes the method suitable for cases where a fast estimation of the filter parameters is required.

P.03 — Blind Source Separation of Temporally Correlated Signals

Nuno Ferreira, Ana Maria Tomé
Dep. Electrónica e Telecomunicações / IEETA, Universidade de Aveiro, Portugal

ABSTRACT — This work presents a solution to the blind source separation problem based on the estimate of a matrix pencil computed at the input and at the output of a linear finite impulse response filter (FIR). The solution comprises the generalized eigendecomposition of the matrix pencil. It also presents an experimental study using different filters in order to achieve a distinct eigenvalue spread of the matrix pencil.

P.04 — Visualization of Articulatory and Acoustic Information on an Articulatory Synthesizer

Luís Nuno Silva, António Teixeira, Beatriz Sousa Santos

Departamento de Electrónica e Telecomunicações / IEETA, Universidade de Aveiro, Portugal

ABSTRACT — This work presents the viewer developed for University of Aveiro Articulatory Synthesizer to visualize the heterogeneous time varying information produced during the synthesis process: vocal tract configuration, flow at vocal folds, synthetic speech signal and related spectral information. This viewer has applications in speech research, teaching and speech therapy. Although it was implemented for Windows platforms the use of OpenGL and standard C++ will allow an easy migration to other platforms.

P.05 — Noise Power in PCM Image Transmission

J. Tavares, A. Navarro

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ABSTRACT — The quality of a pulse code modulation (PCM) transmission system is directly related to quantization noise introduced by quantizer. We derive a formula for the mean square quantization error of binary coded digital signals. Beyond quantization noise, the quantized samples are affected by the transmission noise, which leads to decoding errors at the receiver. Assuming that the above two types of noise are independent, this paper proves that PCM transmission noise power depends strongly on the signal probability density function (PDF) whenever the binary channel error probability is high. Therefore, we also present the precise mathematical expression of the decoding noise power. These expressions have some applications namely in the future PCM wireless contribution networks and in TV studios. Besides, the expressions presented in this paper are also valid for coefficients of any integer transform.

Fri 28th, 9:00–10:40 Pattern Recognition**P.01 — Clustering Techniques for Marbles Classification**

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¹IDMEC/IST, Technical University of Lisbon, Instituto Superior Técnico, Lisbon, Portugal

²CVRM/Centro de Geo-Sistemas, Instituto Superior Técnico, Lisbon, Portugal

ABSTRACT — Automatic marbles classification based on their visual appearance is an important industrial issue. However, there is no definitive solution to the problem mainly due to the presence of randomly distributed high number of different colours and its subjective evaluation by the human expert. In this paper we present a study of segmentation techniques, we evaluate their overall performance using a training set and standard quality measures and finally we apply different clustering techniques to automatically classify the marbles.

P.02 — A Classification Method for Ancient Hand-written Musical Symbols

Pedro Vieira, J. R. Caldas Pinto

IDMEC/IST, Technical University of Lisbon, Instituto Superior Técnico, Lisbon, Portugal

ABSTRACT — To solve the problem of binary pattern recognition several algorithms have been developed in the past, each one more complex than the previous. Also, the problem of finding features that clearly distinguish two different patterns is a key issue in the design of such algorithms. In this paper we present a graph-like recognition process which combines a number of different classifiers, to simplify the type of features and classifiers themselves used in each classification step. We present a method for the design of such graphs and the results achieved using that method applied to ancient music optical recognition.

P.03 — Spectrographic Color in Image Analysis and Classification

António F. Limas Serafim

Electronic Department of INETI, Lisbon, Portugal

ABSTRACT — RGB cameras are insufficient to capture all significant spectral features of the world objects. This fact has led to the adoption of a spectrometric approach in computer vision applications thus allowing an extended selection of the number of color channels. Actual spectrographs feature a physical resolution better than 5 nm, this meaning the availability of a number of tens of independent channels in the optical spectrum [400,700] nm that requires a multivariate image analysis. The goal is the pixel classifications based on an n-dimensional color space and training sets featuring a variable size thus leading most times to under or over determined systems whose solutions depend on different constraints. Over determined systems are analyzed and an optimized solution is sought based on a pseudoinverse algorithm. A case study, based on four classes with ten samples each, is taken to validate the classification model and the spectral channel selections. An n-dimensional color space

with $n=15$ was selected taking into account the samples reflectance spectrum. To stress the classification method, samples were selected from the contiguous blue colors of the Pantone Matching System catalogue, due to their similarity. Classification results showed a rate of success better than 90% for a testing set with 20 images.

P.04 — Weighted Morphometric Shape Analysis of Diatoms

H. Shahbazkia, T. Candeias, R. Oliveira, L. Santos, F. Tomaz

Universidade do Algarve – UCEH, BIF Laboratory, Faro, Portugal

ABSTRACT — In this paper we present an approach for diatom classification on the basis of contour information. First an initial feature set is analysed. Then we present a method to reduce this initial feature space while preserving its discriminative power. Both results based on the initial feature space and the reduced one are compared and the classification method is discussed.

P.05 — Applying Local Features when Identifying Text in Documents

José Eduardo B. dos Santos^{1,2}, B. Dubuisson¹, Flávio Bortolozzi²

¹HEUDIASYC, Université de Technologie de Compiègne, Compiègne, France

²LUCI²A, Pontifícia Universidade Católica do Paraná, Curitiba, Brasil

ABSTRACT — In this paper we present a process of identification and extraction of textual elements based on their local features. Using local features allows a document-independent process, thus making the process more generic and free of heuristic based decisions, as in the use of contextual information. The observed features supply a classifier charged with distinguishing hand-written and machine printed elements. We detail some shape and content based features and present a set of such features elected to perform the textual element classification. Bank cheque images from several different institutions and writers were used to evaluate the process performance. Preliminary results demonstrate the approach's efficiency and promise.

P.06 — On Computational Complexity of Non-Reducible Descriptors

Ventzeslav Valev, Asai Asaithambi

Department of Computer Science, Parks College of Engineering and Aviation, Saint Louis University, St. Louis, MO, USA

ABSTRACT — We present a supervised pattern recognition model that uses Boolean formulas for Non-Reducible Descriptors. This model leads to computational problem which is shown to be NP-complete. In the paper, we identify two open combinatorial problems in the construction of Non-Reducible Descriptors.

P.07 — Image Texture Segmentation Using Linear Filter Based Features and Network of Synchronised Oscillators*Michal Strzelecki*

Institute of Electronics, Technical University of Lodz, Lodz, Poland

ABSTRACT — This paper presents recently emerged temporal correlation based method for image texture segmentation. It uses locally connected network of oscillators, which are able to synchronise while given image object is detected, and desynchronise for other objects. Texture features, necessary for appropriate oscillator weight setting, are obtained using linear filtering technique. The mathematical oscillator model is described. Example of numerical simulation of an oscillator network for segmentation of natural textures is also included and discussed.

P.08 — Use of Logistic Discrimination to Classify Remotely-Sensed Digital Images*Hélio Radke Bittencourt¹, Robin Thomas Clarke²*¹Laboratório de Estatística - ULBRA, Canoas, Brasil²Centro de Sensoriamento Remoto - UFRGS, Porto Alegre, Brasil

ABSTRACT — Although statistical methods for pattern recognition are used widely, one statistical method that is less widely known is logistic discrimination, which can be regarded as a partially parametric approach to pattern recognition. The method is quite general and robust; since it assumes nothing about the probability distribution of variables, it therefore has the advantage over better-known procedures, such as the Gaussian maximum likelihood discriminator, that the number of parameters to be estimated is relatively small. This paper describes the statistical approach to pattern recognition, the logistic discrimination model and gives some results obtained when using it to classify Landsat-TM images.

Fri 28th, 14:00–15:40 Image and Video**P.01 — Video Coding by Applying the Extension of EZW to 3D and the Lifting Scheme***José Salvado¹, Leonel Sousa²*¹Electronics Depart., EST/IPCB, Castelo Branco, Portugal²DEEC-IST / INESC-ID, Lisbon, Portugal

ABSTRACT — This paper proposes a video codec based on the discrete wavelet transform (DWT). The video sequences are first splitted in groups of frames (GOF). Each GOF is then decomposed in the time domain, and in the spatial domain (for each frame) by applying the DWT. We use the lifting scheme to compute the DWT coefficients. The coefficients of the 3D structure resulting from both DWT (in time and space domain) are then coded through the extension of EZW coding to 3D and the bitstream is finally passed through a Huffman coder, to achieve better compression ratios. The structure of the video codec and some experimental results are presented. Experimental results evaluate the quality of the coded images and the compression ratio achieved with the proposed codec.

P.02 — Generic Framework for Video Analysis*Luís Filipe Tavares¹, Luís Teixeira^{1,2}, Luís Corte-Real^{1,3}*¹Instituto de Engenharia de Sistemas e Computadores do Porto, Portugal²Universidade Católica Portuguesa, Porto, Portugal³Faculdade de Engenharia da Universidade do Porto, Portugal

ABSTRACT — In this paper we propose a framework for development of video analysis and description systems, in an easy and interactive way. Due to the architecture design the developed software can run on different operating systems and on distributed environments.

P.03 — MPEG-4 Natural Video Parallel Implementation on a Cluster*Miguel Ribeiro, Oliver Sinnen, Leonel Sousa*

IST/INESC-ID, Lisbon, Portugal

ABSTRACT — This paper describes a parallel encoder for the natural video section of the MPEG-4 specification, based on the MomuSys Verification Model. Several different scheduling approaches are considered in order to balance the computational load. The system is built upon a cluster of computers running Linux connected in a local network. The communication relies on the MPI specification. The results show that it is possible to speed up considerably the encoding process using the proposed system.

P.04 — Improving the JPEG-LS Compression of Images With Locally Sparse Histograms

António J. R. Neves, Armando J. Pinho

Dept. of Electronics and Telecommunications / IEETA University of Aveiro, Portugal

ABSTRACT — In this paper, we propose a preprocessing technique that is capable of improving the compression of images that have locally sparse intensity histograms. In this case, (global) off-line histogram packing may be unsuitable. However, by reducing the size of the symbol-set used by the packing procedure, we are able to attain globally better results, being some of them quite dramatic.

P.05 — Constrained Waterfall Method on Image Segmentation

Fernando J. A. Pina Soares

Departamento de Matemática, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal

ABSTRACT — Morphological image segmentation tasks, for the development of particular element extraction techniques such as roads, buildings, forest, etc., are referenced in several work-studies, concerning image-processing field. Frequently, the main objective wanted in image extraction studies, using grey level remote sensed images is the increasing of the automation degree in developed segmentation algorithms, considering specific image features. This paper presents a morphologic marker characterisation, based on a hierarchical segmentation approach. The method, based on the concept of waterfall transformation, shows a strategy for a hierarchical constraint, in order to slow down the standard evolution of that known algorithm, so that smaller middle objects can be revealed. Further, an unclassified-segmented image emerges, distinguishing every relevant objects/areas of the main image. At the end, each object/area will be isolated from the others and, over it, will be performed a task of its partition into the most relevant sub-features inside it, according to the initial grey level image.

P.06 — A Fully Automatic Method for Image Rectification of AVHRR Satellite Data

André R. S. Marçal, Janete Borges

Faculdade de Ciências, Universidade do Porto, Porto, Portugal

ABSTRACT — Most remote sensing applications require the geometric distortions present on satellite images to be corrected. The geometric correction methods usually need the identification of ground control points, which is a time consuming task and requires human intervention. The method proposed here intends to automate this stage by using image matching techniques. The satellite images are first segmented into water, land and cloud. The matching is performed using a library of search points alongside the coastline. The matching is done 5 times for each search point, using target matrices of various dimensions. The method was tested on 10 AVHRR images and the results are presented and discussed.

P.07 — Cadastral Map Analysis: Simple Methods, Good Results*R. Oliveira, T. Candeias, F. Tomaz, H. Shahbazkia*

Universidade do Algarve, Faro, Portugal

ABSTRACT — This paper introduces the project ACID (Automatic Cadastral Information Digitalization), which started in February 2000 and is financed by the Portuguese FCT (Fundação para a Ciência e Tecnologia). The main goal is to develop a system for automatic digitalization of Portuguese cadastral maps by using simple image processing algorithms. This paper presents the goals of the project as well as first results obtained.

P.08 — A Region Merging Method for Watershed Oversegmentation Using Quadrees*Antonio S. Montemayor, Ángel Sánchez*

Dept. Ciencias Experimentales e Ingeniería, ESCET, Universidad Rey Juan Carlos, Madrid, Spain

ABSTRACT — In this paper, a novel prototype of region merging scheme to reduce watershed oversegmentation is proposed. Our approach uses an initial high level quadtree decomposition of the images to be segmented. To avoid the unpleasant drawback of square-region shape corresponding to quadtree segmentation, watershed is applied. Then, an intuitive merging criterion based on the size of the parent quadtree region is used. The proposed method is very intuitive, flexible to be extended and gives reasonable results when applied to highly oversegmented images.

P.09 — Mathematical Morphology: Features Extraction from Orbital Images*E. A. da Silva, T. Statella*

São Paulo State University, Department of Cartography, São Paulo, Brazil

ABSTRACT — In Brazil, regions with poor cartographic covering still exist, mainly those where difficult access and weather conditions lead conventional procedures to be costly. Besides, even in regions with total cartographic covering, this is most of the times outdated due to man action in the environment. Several techniques can be used to aid the task of updating cartographic products. Among these we can point out the techniques of Digital Image Processing and Remote Sensing. Orbital images are important sources of data to identify terrestrial targets and are obtained through remote sensing. The use of orbital images can also be justified by its speed, efficiency, quality and lower financial cost if compared to conventional processes. The digital processing tool used in this research was Mathematical Morphology, which aims at quantitatively describe geometric structures and, besides, works as a technique when conceiving algorithms in the processing area, displaying basic tools such as edge detectors and morphologic filters. Today Mathematical Morphology is widely used and researched in universities and research centres worldwide. By using it we are able to extract and treat cartographic features of interest, which will be used to update

cartographic products. The manipulation of images in this research was performed with the use of the mathematical morphology toolbox developed by SDC Information Systems linked to MATLAB software. We applied skeletonization and pruning routines on the test image, which is a sub-image depicting the tracks of the International Airport Antonio Carlos Jobim in Rio de Janeiro. Through skeletonization and pruning operators we detected the cartographic features of interest, which can be used in updating cartographic processes of the test area. The results achieved were promising and confirmed positively the contribution of the use of the Morphologic Theory in extracting and treating cartographic features of orbital images aiming at cartographic products updating.

Fri 28th, 16:00–17:30 Computer Vision**P.01 — Tele-3D — Developing a Handheld Scanner Using Structured Light Projection***João Filipe Ferreira, Jorge Lobo, Jorge Dias*

Institute of Systems and Robotics, Departamento de Engenharia Electrotécnica, Universidade Coimbra, Portugal

ABSTRACT — Three-dimensional surface reconstruction using a handheld scanner is a process with great potential for use on different fields of research, commerce and industrial production. In this article we will describe the evolution of a project comprising the study and development of a system that implements the aforementioned process based on two-dimensional images. We will present our current work on the development of a fully portable, handheld system using cameras, projected structured light and attitude and positioning measuring sensors — the Tele-3D scanner.

P.02 — Multiresolution Scheme for Stereo Correspondence Using Correlation Techniques*Rosana Satorre, Patricia Compañ, Antonio Botía, Ramón Rizo*

Grupo VGIA: Visión, Gráficos e Inteligencia Artificial, Departamento de Ciencia de la Computación e Inteligencia Artificial, Universidad de Alicante, Spain

ABSTRACT — A stereo algorithm that reduces cost is presented. In robot navigation getting a short execution time near to real time is very important. Our algorithm uses classical correlation techniques under a multiresolution scheme. What is new in our paper is that information about edges and previous level correspondences are incorporated. The proposed cost function provides robust disparity maps that allow the system to reduce the search range in the following levels. The main goal of our algorithm is reducing the cost and increasing quality in the final map, that is, decreasing the error margin.

P.03 — Location of Eyes in Face Images*Nuno Valentim^{1,2}, André Melo², Aurélio Campilho^{1,2}*

¹ INEB - Instituto de Engenharia Biomédica, Porto, Portugal

² Departamento de Engenharia Electrotécnica e de Computadores, Universidade do Porto, Faculdade de Engenharia, Portugal

ABSTRACT — This paper describes a method for detection of irises in face images. The approach follows the work described in [1] with new procedures introduced by the authors in order to improve the detection results. The global approach has the following main steps: image cropping; image cleaning; selection of possible eye locations; costs computation for each candidate pre-detected eye; determination of the best pair of eyes. The innovation introduced is mainly in the first two phases: the image cropping process and the image

cleaning. Completely new code was written in Matlab, providing a user friendly graphical interface which paves the way for the making, testing and debugging of the algorithm. This work was developed within a Digital Image Processing course at the Electrical and Computer Engineering degree in the Faculty of Engineering, University of Porto.

P.04 — Segmentation of Moving Images

Pedro Quelhas, Miguel Correia, Aurélio Campilho

INEB - Instituto de Engenharia Biomédica / Faculdade de Engenharia Departamento de Engenharia Electrotécnica e de Computadores, Universidade do Porto, Portugal

ABSTRACT — The segmentation and detection of objects in a scene is one of the most frequent tasks in digital image processing, being also one of the most important. Normally it involves separating the object from a statistically distinct background. When the background and object in the scene have the same statistical properties, problems arise. The method presented uses temporal information about the scene to aid in the detection of moving objects. This work tries to bring an object with the exact same statistical characteristics of the background, from its camouflaged position, by the use of motion analysis instead of static picture analysis.

P.05 — Adaptive Tracking of Moving Objects in Colour Video Sequences

Ayoub Al-Hamadi, Bernd Michaelis

Institute for Electronics, Signal Processing and Communications (IESK), Otto-von-Guericke-University Magdeburg, Magdeburg, Germany

ABSTRACT — In this paper, we propose an adaptive technique for the automatic detection and tracking of objects in colour video sequences. For this technique, we apply the colour information to the improvement of the matching quality when disturbances (e.g. shadow) occur. This approach includes a neural recognition system and is adaptive and robust in comparison with conventional methods.

P.06 — A Principle Component Based BDNN for Face Recognition

H. T. Pao

Department of Management Science, National Chiao-Tung University, Hsinchu, Taiwan, ROC

ABSTRACT — In this paper we propose a high performance two-stage recognizer for face recognition. The first stage is a PCA based eigenface recognizer which serves as a similar faces selector, and the second stage is a paired-Bayesian-decision neural network (pBDNN) which identify the target from the similar faces. By applying the small orientation ($-22.5^\circ \sim 22.5^\circ$) facial images as the training set, and the larger orientation facial images ($-45^\circ \sim 45^\circ$) as the testing faces, our experiment results show that the pBDNN system can improve the recognition rate for 17% better than the PCA systems alone (65%).

P.07 — Design of Face Recognition System (Implementing Face Detection & Various Face Recognition Algorithms)

S. K. Singh, Mayank Vatsa, Richa Singh

Department of Computer Sc. & Engg., Institute of Engg. & Tech., Purvanchal University, Jaunpur, India

ABSTRACT — Automatic face recognition is the application part of pattern recognition techniques. It has got significant attention of researchers and work is still going on. In this paper we try to implement the algorithm of face detection, which is based on image processing techniques and got 95% success. For recognition we have implemented three algorithms feature based, eigen based, and neural network based method. In our experiment we have found that neural network method for face recognition is the best of all other algorithms.