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Computer Analysis of Images and Patterns

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Preface

Computer analysis of images and patterns is a scientific field of longstanding tradition, with roots in the early years of the computer era when *electronic brains* inspired scientists. Moreover, the design of vision machines is a part of humanity's dream of the artificial person.

I remember the 2nd CAIP, held in Wismar in 1987. Lectures were read in German, English and Russian, and proceedings were also only partially written in English. The conference took place under a different political system and proved that ideas are independent of political *walls*. A few years later the Berlin Wall collapsed, and Professors Sommer and Klette proposed a new formula for the CAIP: let it be held in Central and Eastern Europe every second year. There was a sense of solidarity with scientific communities in those countries that found themselves in a state of transition to a new economy. A well-implemented idea resulted in a chain of successful events in Dresden (1991), Budapest (1993), Prague (1995), Kiel (1997), and Ljubljana (1999).

This year the conference was welcomed at Warsaw. There are three invited lectures and about 90 contributions written by more than 200 authors from 27 countries. Besides Poland (60 authors), the largest representation comes from France (23), followed by England (16), Czech Republic (11), Spain (10), Germany (9), and Belarus (9). Regrettably, in spite of free registration fees and free accommodation for authors from former Soviet Union countries, we received only one accepted paper from Russia.

Contributions are organized into sessions corresponding to the scope of the conference: image analysis (20 papers), computer vision (12), pattern recognition (12), medical imaging (10), motion analysis (8), augmented reality (4), image indexing (7), image compression (8), and industrial applications (6). Several brilliant results are presented and in my opinion the average level of quality of the contributions is high. New trends in these disciplines are well represented.

The 9th conference on *Computer Analysis of Images and Patterns* was organized at Warsaw University of Technology, in September 2001, under the auspices of its Rector, Professor Jerzy Woznicki. We appreciate the kind patronage of the International Association for Pattern Recognition (IAPR) and the Polish Association for Image Processing, the Polish Section of Institute of Electrical and Electronics Engineers, and of the Institute of Radioelectronics in the Department of Electronics and Information Technology.

Major sponsorship was received from Altkom Akademia S.A., a private educational institution in Poland. We also thank The Foundation for the Development of Radiocommunication and Multimedia Technologies for support.

Władysław Skarbek
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J. Kittler, United Kingdom

Table of Contents

Image Indexing (MPEG-7)

MPEG-7: Evolution or Revolution? 1
M. Bober

The MPEG-7 Visual Description Framework - Concepts, Accuracy, and Applications 2
J.-R. Ohm

MPEG-7 Color Descriptors and Their Applications 11
L. Cieplinski

Texture Descriptors in MPEG-7 21
P. Wu, Y.M. Ro, C.S. Won, Y. Choi

An Overview of MPEG-7 Motion Descriptors and Their Applications 29
A. Divakaran

MPEG-7 MDS Content Description Tools and Applications 41
A.B. Benitez, D. Zhong, S.-F. Chang, J.R. Smith

Image Retrieval Using Spatial Color Information 53
K. Walczak

Image Compression

Lifting-Based Reversible Transforms for Lossy-to-Lossless Wavelet Codecs . 61
A. Przelaskowski

Coding of Irregular Image Regions by SA DFT 71
R. Stasiński

Fast PNN Using Partial Distortion Search 77
O. Virmajoki, P. Fränti, T. Kaukoranta

Near-Lossless Color Image Compression with No Error Accumulation in Multiple Coding Cycles 85
M. Domański, K. Rakowski

Hybrid Lossless Coder of Medical Images with Statistical Data Modelling . 92
A. Przelaskowski

A Simple Algorithm for Ordering and Compression of Vector Codebooks .. 102
M. Bartkowiak, A. Łuczak

MPEG 2-Based Video Coding with Three-Layer Mixed Scalability 110
M. Domański, S. Maćkowiak

The Coefficient Based Rate Distortion Model for the Low Bit Rate Video Coding 118
G. Siemek

Shape-Adaptive DCT Algorithm - Hardware Optimized Redesign 125
K. Mroczek

Pattern Recognition

Superquadric-Based Object Recognition 134
J. Krivic, F. Solina

Weighted Graph-Matching Using Modal Clusters 142
M. Carcassoni, E.R. Hancock

Discovering Shape Categories by Clustering Shock Trees 152
B. Luo, A. Robles-Kelly, A. Torsello, R.C. Wilson, E.R. Hancock

Feature Selection for Classification Using Genetic Algorithms with a Novel Encoding 161
F. Pernkopf, P. O'Leary

A Contribution to the Schlesinger's Algorithm Separating Mixtures of Gaussians 169
V. Franc, V. Hlaváč

Diophantine Approximations of Algebraic Irrationalities and Stability Theorems for Polynomial Decision Rules 177
V.M. Chernov

Features Invariant Simultaneously to Convolution and Affine Transformation 183
T. Suk, J. Flusser

A Technique for Segmentation of Gurmukhi Text 191
G.S. Lehal, C. Singh

Efficient Computation of Body Moments 201
A.V. Tuzikov, S.A. Sheynin, P.V. Vasiliev

Genetic Programming with Local Improvement for Visual Learning from Examples 209
K. Krawiec

Improved Recognition of Spectrally Mixed Land Cover Classes Using Spatial Textures and Voting Classifications 217
J.C.-W. Chan, R.S. DeFries, J.R.G. Townshend

Texture Feature Extraction and Classification 228
B. Verma, S. Kulkarni

Medical Imaging

Today's and Tomorrow's Medical Imaging 236
A. Przelaskowski

A New Approach for Model-Based Adaptive Region Growing in Medical Image Analysis 238
R. Pohle, K.D. Toennies

Attempts to Bronchial Tumor Motion Tracking in Portal Images during Conformal Radiotherapy Treatment 247
M. Orkisz, A. Frery, O. Chapet, F. Mornex, I.E. Magnin

Color Thinning with Applications to Biomedical Images 256
A. Nedzved, Y. Ilyich, S. Ablameyko, S. Kamata

Dynamic Active Contour Model for Size Independent Blood Vessel Lumen Segmentation and Quantification in High-Resolution Magnetic Resonance Images 264
C. Desbleds-Mansard, A. Anwander, L. Chaabane, M. Orkisz, B. Neyran, P.C. Douek, I.E. Magnin

Medical Active Thermography - A New Image Reconstruction Method 274
J. Rumiński, M. Kaczmarek, A. Nowakowski

3-D Modeling and Parametrisation of Pelvis and Hip Joint 282
C. Jędrzejek, A. Łempicki, R. Renk, J. Radziulis

Cardiac Rhythm Analysis Using Spatial ECG Parameters and SPART Method 290
H.A. Kowalski, A. Skorupski, Z. Szymański, W. Ziembla, D. Wojciechowski, P. Sionek, P. Jędrasik

Deformable Contour Based Algorithm for Segmentation of the Hippocampus from MRI 298
J. Klemenčič, V. Valenčič, N. Pečarič

Edge-Based Robust Image Registration for Incomplete and Partly Erroneous Data 309
P. Gut, L. Chmielewski, P. Kukołowicz, A. Dąbrowski

Motion Analysis

Real Time Segmentation of Lip Pixels for Lip Tracker Initialization 317
M. Sadeghi, J. Kittler, K. Messer

Particle Image Velocimetry by Feature Tracking 325
D. Chetverikov

Estimation of Motion through Inverse Finite Element Methods with Triangular Meshes 333
J.V. Condell, B.W. Scotney, P.J. Morrow

Face Tracking Using the Dynamic Grey World Algorithm 341
J.M. Buenaposada, D. Sopeña, L. Baumela

Fast Local Estimation of Optical Flow Using Variational and Wavelet Methods 349
K. Neckels

A Method to Analyse the Motion of Solid Particle in Oscillatory Stream of a Viscous Liquid 357
W. Suchecki, K. Urbaniec

An Optimization Approach for Translational Motion Estimation in Log-Polar Domain 365
V.J. Traver, F. Pla

Tracking People in Sport: Making Use of Partially Controlled Environment 374
J. Perš, S. Kovačič

Augmented Reality

Linear Augmented Reality Registration 383
A. Ansar, K. Daniilidis

Shape and Position Determination Based on Combination of Photogrammetry with Phase Analysis of Fringe Patterns 391
M. Pawłowski, M. Kujawińska

Automated Acquisition of Lifelike 3D Human Models from Multiple Posture Data 400
J. Wingbermühle, C.-E. Liedtke, J. Solodenko

Augmented Reality and Semi-automated Landmarking of Cephalometric Radiographs 410
B. Romaniuk, M. Desvignes, J. Robiaille, M. Revenu, M.J. Deshayes

Industrial Applications

On Restoration of Degraded Cinematic Sequences by Means of Digital Image Processing 419
S. Skoneczny, M. Iwanowski

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Vision Based Measurement System to Quantify Straightness Defect in Steel Sheets 427
R.C. González, R. Valdés, J.A. Cancelas

Positioning of Flexible Boom Structure Using Neural Networks 435
J. Mielikäinen, I. Koskinen, H. Handroos, P. Toivanen, H. Kälviäinen

Material Identification Using Laser Spectroscopy and Pattern Recognition Algorithms 443
O. Samek, V. Krzyžánek, D.C.S. Beddows, H.H. Telle, J. Kaiser, M. Liška

Scanner Sequence Compensation 451
T. Toczyski, S. Skoneczny

The Industrial Application of the Irregular 3D-Objects Image Processing in the Compact Reverse Engineering System 457
D. Svirsky, Y. Polozkov

Image Analysis

A Local Algorithm for Real-Time Junction Detection in Contour Images .. 465
A. Śluzek

A New Algorithm for Super-Resolution from Image Sequences 473
F. Dekeyser, P. Bouthemy, P. Pérez

Flatness Analysis of Three-Dimensional Images for Global Polyhedrization 482
Y. Kenmochi, L. Chunyan, K. Kotani

Generalized Morphological Mosaic Interpolation and Its Application to Computer-Aided Animations 493
M. Iwanowski

Openings and Closings by Reconstruction Using Propagation Criteria 502
I.R. Terol-Villalobos, D. Vargas-Vázquez

Multiscale Segmentation of Document Images Using M-Band Wavelets 510
M. Acharyya, M.K. Kundu

Length Estimation for Curves with ϵ-Uniform Sampling 518
L. Noakes, R. Kozera, R. Klette

Random Walk Approach to Noise Reduction in Color Images 527
B. Smolka, M. Szczepanski, K.N. Plataniotis, A.N. Venetsanopoulos

Wigner Distributions and Ambiguity Functions in Image Analysis 537
S.L. Hahn, K.M. Snopek

A Markov Random Field Image Segmentation Model Using Combined Color and Texture Features 547
Z. Kato, T.-C. Pong

Application of Adaptive Hypergraph Model to Impulsive Noise Detection . 555
S. Rital, A. Bretto, D. Aboutajdine, H. Cherifi

Estimation of Fusarium Head Blight of Triticale Using Digital Image Analysis of Grain 563
M. Wiwart, I. Koczowska, A. Borusiewicz

Fast Modified Vector Median Filter 570
B. Smolka, M. Szczepanski, K.N. Plataniotis, A.N. Venetsanopoulos

Hierarchical Method of Digital Image Segmentation Using Multidimensional Mathematical Morphology 581
G. Kukiełka, J. Woźnicki

Images of Imperfectly Ordered Motifs: Properties, Analysis, and Reconstruction 589
V. Krzyžánek, O. Samek, R. Reichelt

Implementation and Advanced Results on the Non-interrupted Skeletonization Algorithm 601
K. Saeed, M. Rybnik, M. Tabedzki

Object Segmentation of Color Video Sequences 610
F.M. Porikli

Thresholding Image Segmentation Based on the Volume Analysis of Spatial Regions 620
D. Sankowski, V. Mosorov

Topographic Feature Identification Based on Triangular Meshes 621
H. Pedrini, W.R. Schwartz

Visual Attention Guided Seed Selection for Color Image Segmentation 630
N. Ouerhani, N. Archip, H. Hügli, P.-J. Erard

Computer Vision

Theoretical Analysis of Finite Difference Algorithms for Linear Shape from Shading 638
T. Wei, R. Klette

Relational Constraints for Point Distribution Models 646
B. Luo, E.R. Hancock

Shape-from-Shading Using Darboux Smoothing 657
H. Ragheb, E.R. Hancock

A Novel Robust Statistical Design of the Repeated Genetic Algorithm 668
S.Y. Yuen, H.S. Lam, C.K. Fong

Binocular Stereo Matching by Local Attraction 676
H. Jahn

Characterizations of Image Acquisition and Epipolar Geometry of Multiple Panoramas 684
S.-K. Wei, F. Huang, R. Klette

Interclass Fuzzy Rule Generation for Road Scene Recognition from Colour Images 692
M. Wilson

Unsupervised Learning of Part-Based Representations 700
D. Guillamet, J. Vitrià

A Comparative Study of Performance and Implementation of Some Area-Based Stereo Algorithms 709
B. Cyganek, J. Borgosz

A New Autocalibration Algorithm: Experimental Evaluation 717
A. Fusiello

An Iconic Classification Scheme for Video-Based Traffic Sensor Tasks 725
W. Kasprzak

Matching in Catadioptric Images with Appropriate Windows, and Outliers Removal 733
T. Svoboda, T. Pajdla

Author Index 741

MPEG-7: Evolution or Revolution?

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Abstract. The ISO MPEG-7 Standard, also known as a Multimedia Content Description Interface, will be soon finalized. After several years of intensive work on technology development, implementation and testing by almost all major players in the digital multimedia arena, the results of this international project will be assessed by the most cruel and demanding judge: the market. Will it meet all the high expectations of the developers and, above all, future users? Will it result in a revolution, evolution or will it just simply pass unnoticed?

In this invited lecture, I will review the components of the MPEG-7 Standard in the context of some novel applications. I will go beyond the classical image/video retrieval scenarios, and look into more generic image/object recognition framework relying on the MPEG-7 technology. Such a framework is applicable to a wide range of new applications. The benefits of using standardized technology, over other state-of-the art techniques from computer vision, image processing, and database retrieval, will be investigated. Demonstrations of the generic object recognition system will be presented, followed by some other examples of emerging applications made possible by the Standard. In conclusion, I will assess the potential impact of this new standard on emerging services, products and future technology developments.

Keywords: MPEG-7, multimedia database retrieval, multimedia object recognition

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The MPEG-7 Visual Description Framework – Concepts, Accuracy, and Applications

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Abstract. This paper gives a brief introduction into the Visual part of the forthcoming new standard MPEG-7, the "Multimedia Content Description Interface". It then emphasizes on the aspects how the Visual Descriptors of MPEG-7 were optimized for efficiency, compactness and behavior similar to human visual characteristics. The MPEG-7 descriptors were mainly designed for signal identification and recognition in the context of multimedia applications ; however, they are applicable wherever interoperability between distributed systems designed for the task of visual information recognition need a standardized interface. I this sense, MPEG-7 may become a key element in the process of convergence of multimedia related applications with computer vision systems.

Keywords: MPEG-7, visual descriptor, application scenario

1 Introduction

Recently, ISO's Moving Pictures Experts Group (MPEG) has finalized the standardization of the "Multimedia Content Description Interface", called MPEG-7, which shall provide standardized feature description tools for audiovisual data [1][2]. Part 3 of the standard is handling Visual feature description. Even though database retrieval is foreseen as one of the first and most illustrative applications of MPEG-7, the general applicability of this description framework is much broader, installing a link between image/video coding and visual-signal recognition techniques. MPEG-7 is not a competitor with previous MPEG standards (MPEG-1, MPEG-2, MPEG-4), which were mainly designed for encoding of audiovisual signals with the goal of *reconstruction and rendering* with highest quality. Moreover, it is a step towards the next-higher level of signal representation, describing *signal features*, not *signal samples*. This is highly valuable in the context of systems dealing with the *content* of audiovisual signals, such as automatic identification and recognition systems. The need for a standard arises when interoperability between distributed systems on visual information is necessary, or communication between a human user and a machine about visual information is

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required. This paper gives a coarse overview about the Visual elements of the MPEG-7 standard (section 2), explain how the MPEG-7 Visual Descriptors were designed taking into account the characteristics of human perception (section 3), and point out possible applications from different areas as indicated above (section 4).

2 The MPEG-7 Standard and Its Visual Part

The meaning of "content features" to be described by MPEG-7 is widespread, and can consist of elements for

- high-level description (e.g. manually-generated metadata like authoring information, scripting and editing information) ;
- mid-level description (e.g. rule-based semantic categories of objects or subjects present within a scene) ;
- low-level description (e.g. basic visual features like color, texture, shape, geometry, motion within a scene or of a camera).

The work reported in this contribution concentrates on the low-level visual feature description aspects, in which case automatic extraction of features from the data is usually possible, and definition of matching criteria for the similarity using a specific feature type is more or less unique. Even though, it is not the intention that MPEG-7 standardizes the feature extraction, nor the search/retrieval algorithms, which may be differently optimized for specific applications. However, for some features at a very low level, the feature extraction process must be more or less unique, and had to be specified as the semantic meaning of a description element. This is of high importance for interoperability between different systems, or an automatic system and a human, where the "common understanding" about what a specific feature description means must be clear.

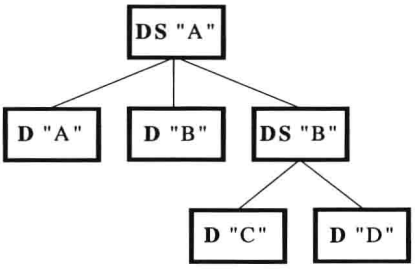

Fig. 1. Example of a simple hierarchical MPEG-7 description scheme structure.

An MPEG-7 description is structured in terms of *Description Schemes* (**DS**) and *Descriptors* (**D**), the latter ones instantiated as *Descriptor Values* (**DV**). A description scheme can contain one or more descriptor(s) and/or subordinate description scheme(s). An example is illustrated in Fig.1, where the **DS** "A" is the top-level DS, containing the **D**s "A" and "B", and **DS** "B", which again is containing **D**s "C" and

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