

*Commenced Publication in 1973*

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

## Editorial Board

David Hutchison

*Lancaster University, UK*

Takeo Kanade

*Carnegie Mellon University, Pittsburgh, PA, USA*

Josef Kittler

*University of Surrey, Guildford, UK*

Jon M. Kleinberg

*Cornell University, Ithaca, NY, USA*

Alfred Kobsa

*University of California, Irvine, CA, USA*

Friedemann Mattern

*ETH Zurich, Switzerland*

John C. Mitchell

*Stanford University, CA, USA*

Moni Naor

*Weizmann Institute of Science, Rehovot, Israel*

Oscar Nierstrasz

*University of Bern, Switzerland*

C. Pandu Rangan

*Indian Institute of Technology, Madras, India*

Bernhard Steffen

*TU Dortmund University, Germany*

Madhu Sudan

*Microsoft Research, Cambridge, MA, USA*

Demetri Terzopoulos

*University of California, Los Angeles, CA, USA*

Doug Tygar

*University of California, Berkeley, CA, USA*

Gerhard Weikum

*Max Planck Institute for Informatics, Saarbruecken, Germany*

Hayit Greenspan Henning Müller  
Tanveer Syeda-Mahmood (Eds.)

# Medical Content-Based Retrieval for Clinical Decision Support

Third MICCAI International Workshop, MCBR-CDS 2012  
Nice, France, October 1, 2012  
Revised Selected Papers



Springer

## Volume Editors

Hayit Greenspan  
Tel Aviv University  
The Iby and Aladar Fleischmann Faculty of Engineering  
Ramat Aviv, Israel  
E-mail: hayit@eng.tau.ac.il

Henning Müller  
University of Applied Sciences Western Switzerland (HES-SO)  
Business Information Systems  
TechnoArk 3, 3960 Sierre, Switzerland  
E-mail: henning.mueller@hevs.ch

Tanveer Syeda-Mahmood  
IBM Almaden Research Center  
Multi-modal Mining for Healthcare  
650 Harry Road  
San Jose, CA 95120, USA  
E-mail: stf@almaden.ibm.com

ISSN 0302-9743 e-ISSN 1611-3349  
ISBN 978-3-642-36677-2 e-ISBN 978-3-642-36678-9  
DOI 10.1007/978-3-642-36678-9  
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2013931221

CR Subject Classification (1998): J.3, I.5, H.2.8, I.4, H.3-5, I.2

LNCS Sublibrary: SL 6 – Image Processing, Computer Vision, Pattern Recognition,  
and Graphics

© Springer-Verlag Berlin Heidelberg 2013

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

*Typesetting:* Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

# Preface

This document contains articles from the Third Workshop on Medical Content-Based Retrieval for Clinical Decision Support (MCBR-CDS) that took place at the MICCAI (Medical Image Computing for Computer Assisted Intervention) 2012 conference in Nice, France, on October 1, 2012. The first workshop on this topic took place at MICCAI 2009 in London, UK. The second one was held in Toronto, Canada, in 2011. An earlier workshop on medical image retrieval was conducted at MICCAI 2007, in Brisbane, Australia.

The workshop obtained 15 high-quality submissions of which 10 were selected for presentation. Three external reviewers and one workshop organizer reviewed each of the papers. The review process was double blind.

In addition to the oral presentations, two invited presentations were given. Gwenole Quéléec, the first invited speaker, presented a talk on heterogeneous information retrieval from medical databases. His talk developed several ideas about medical image and video retrieval applications from a theoretical and an application perspective. Georg Langs presented his invited presentation on the VISCERAL project that aims at creating a benchmark for medical imaging on extremely large data sets using a cloud-based infrastructure that is shared by the participants. A panel at the end discussed the role of content-based image retrieval in clinical decision support. In general, the workshop resulted in many lively discussions and showed well the current trends and tendencies in content-based medical retrieval and how this can support decisions in clinical work.

These proceedings contain the ten accepted papers of the workshop as well as the two invited presentations. An overview of the workshop initiates the proceedings, summarizing the papers and the discussions that took place at the workshop itself.

We would like to thank all the reviewers that helped make a selection of high-quality papers for the workshop. We hope to have a similar workshop at next year's MICCAI conference.

December 2012

Hayit Greenspan  
Henning Müller  
Tanveer Syeda-Mahmood

# Organization

General Co-chairs                      Hayit Greenspan, Israel  
   Henning Müller, Switzerland  
   Tanveer Syeda-Mahmood, USA

Publication Chair                      Hayit Greenspan, Israel

## International Program Committee

Burak Acar	Bogazici University, Turkey
Sameer Anatani	National Library of Medicine (NLM), USA
Rahul Bhotika	GE Global Research Center, NY, USA
Albert Chung	Hong Kong University of Science and Technology, Hong Kong
Adrien Depeursinge	University of Applied Sciences Western Switzerland (HES-SO), Switzerland
Thomas M. Deserno	Aachen University of Technology (RWTH), Germany
Gerhard Engelbrecht	University Pompeu Fabra (UPF), Spain
Bram van Ginneken	Radboud University Nijmegen Medical Centre, The Netherlands
Allan Hanbury	Vienna University of Technology, Austria
Jayashree Kalpathy-Cramer	Harvard University, USA
Nico Karssemeijer	Radboud University Nijmegen, The Netherlands
Rodney Long	National Library of Medicine, USA
Kazunori Okada	San Francisco State University, USA
Daniel Racoceanu	French National Center for Scientific Research (CNRS), France
Daniel Rubin	Stanford University, USA
Linda Shapiro	University of Washington, US
Ron Summers	National Institutes of Health, USA
Agma Traina	University of Sao Paulo, Brazil
S. Kevin Zhou	Siemens Corporate Research, USA

## Sponsors

European Commission 7<sup>th</sup> Framework Programme, project Khresmoi (257528)

# Table of Contents

## Workshop Overview

Overview of the Third Workshop on Medical Content-Based Retrieval for Clinical Decision Support (MCBR-CDS 2012) . . . . .	1
<i>Henning Müller and Hayit Greenspan</i>	

## Invited Talk

A Polynomial Model of Surgical Gestures for Real-Time Retrieval of Surgery Videos . . . . .	10
<i>Gwénoél Quellec, Mathieu Lamard, Zakarya Droueche, Béatrice Cochener, Christian Roux, and Guy Cazuguel</i>	

## Methods

Exploiting 3D Part-Based Analysis, Description and Indexing to Support Medical Applications . . . . .	21
<i>Chiara Eva Catalano, Francesco Robbiano, Patrizia Parascandolo, Lorenzo Cesario, Loris Vosilla, Francesca Barbieri, Michela Spagnuolo, Gianni Viano, and Marco Amedeo Cimmino</i>	

Skull Retrieval for Craniosynostosis Using Sparse Logistic Regression Models . . . . .	33
<i>Shulin Yang, Linda Shapiro, Michael Cunningham, Matthew Speltz, Craig Birgfeld, Indriyati Atmosukarto, and Su-In Lee</i>	

## 3D/4D Data Retrieval

Retrieval of 4D Dual Energy CT for Pulmonary Embolism Diagnosis . . .	45
<i>Antonio Foncubierta-Rodríguez, Alejandro Vargas, Alexandra Platon, Pierre-Alexandre Poletti, Henning Müller, and Adrien Depeursinge</i>	

Immediate ROI Search for 3-D Medical Images . . . . .	56
<i>Karen Simonyan, Marc Modat, Sebastien Ourselin, David Cash, Antonio Criminisi, and Andrew Zisserman</i>	

The Synergy of 3D SIFT and Sparse Codes for Classification of Viewpoints from Echocardiogram Videos . . . . .	68
<i>Yu Qian, Lianyi Wang, Chunyan Wang, and Xiaohong Gao</i>	

Assessing the Classification of Liver Focal Lesions by Using Multi-phase Computer Tomography Scans . . . . .	80
<i>Auréline Quatrehomme, Ingrid Millet, Denis Hoa, G�rard Subsol, and William Puech</i>	

## Invited Talk

VISCERAL: Towards Large Data in Medical Imaging — Challenges and Directions . . . . .	92
<i>Georg Langs, Allan Hanbury, Bjoern Menze, and Henning M�ller</i>	

## Visual Features

Customised Frequency Pre-filtering in a Local Binary Pattern-Based Classification of Gastrointestinal Images . . . . .	99
<i>Sebastian Hegenbart, Stefan Maimone, Andreas Uhl, Andreas V�csei, and Georg Wimmer</i>	
Bag-of-Colors for Biomedical Document Image Classification . . . . .	110
<i>Alba Garc�a Seco de Herrera, Dimitrios Markonis, and Henning M�ller</i>	

## Multimodal Retrieval

An SVD-Bypass Latent Semantic Analysis for Image Retrieval . . . . .	122
<i>Spyridon Stathopoulos and Theodore Kalamboukis</i>	
Multimedia Retrieval in a Medical Image Collection: Results Using Modality Classes . . . . .	133
<i>Angel Castellanos, Xaro Benavent, Ana Garc�a-Serrano, and J. Cigarr�n</i>	

<b>Author Index</b> . . . . .	145
-------------------------------	-----