

Martin Welk, Martin Urschler, and Peter M. Roth (eds.)

**Proceedings of the
OAGM Workshop 2018
Medical Image Analysis**

May 15-16, 2018

Private University for Health Sciences, Medical Informatics
and Technology (UMIT)
Hall/Tyrol, Austria

Austrian Association of Pattern Recognition (OAGM)



OESTERREICHISCHE
COMPUTER GESELLSCHAFT[®]
AUSTRIAN
COMPUTER SOCIETY



Editors

Martin Welk, Martin Urschler, and Peter M. Roth

Layout

Austrian Association of Pattern Recognition
<http://aapr.at/>

Cover

Verlag der Technischen Universität Graz

© 2018 Verlag der Technischen Universität Graz
www.ub.tugraz.at/Verlag

DOI 10.3217/978-3-85125-603-1



*This work is licensed under a Creative Commons Attribution 4.0 International License.

<https://creativecommons.org/licenses/by/4.0/deed.en>

Contents

Preface	iv
Workshop Organization	v
Program Committee	vi
Awards 2017	vii
Index of Authors	1
Keynote Talks	1
Machine learning imaging biomarkers <i>Marleen de Bruijne</i>	2
Extracting and modeling information from medical images <i>Bjoern Menze</i>	3
Contributed Session 1	4
Image Retrieval with BIER: Boosting Independent Embeddings Robustly <i>Michael Opitz, Georg Waltner, Horst Possegger and Horst Bischof</i>	5
Multi-label Whole Heart Segmentation using Anatomical Label Configurations and CNNs <i>Christian Payer, Darko Štern, Horst Bischof and Martin Urschler</i>	6
Contributed Session 2	7
Multivariate Manifold Modelling of Functional Connectivity in Developing Language Networks <i>Ernst Schwartz, Karl-Heinz Nenning, Gregor Kasprian, Anna-Lisa Schuller, Lisa Bartha-Doering and Georg Langs</i>	8
Early Predictors of Bone Infiltration in Multiple Myeloma Patients from T2 weighted MRI Images <i>Roxane Licandro, Johannes Hofmanninger, Marc-André Weber, Bjoern Menze and Georg Langs</i>	9

Volumetric Reconstruction from a Limited Number of Digitally Reconstructed Radiographs Using CNNs <i>Franz Thaler, Christian Payer and Darko Stern</i>	13
Unsupervised Identification of Clinically Relevant Clusters in Routine Imaging Data <i>Johannes Hofmanninger, Markus Krenn, Markus Holzer, Thomas Schlegl, Helmut Prosch and Georg Langs</i>	20
Poster Session	21
Generative Adversarial Networks to Synthetically Augment Data for Deep Learning based Image Segmentation <i>Thomas Neff, Christian Payer, Darko Stern and Martin Urschler</i>	22
Multi-camera Array Calibration for Light Field Depth Estimation <i>Bernhard Blaschitz, Svorad Štolc and Doris Antensteiner</i>	30
CNN training using additionally training data extracted from frames of endoscopic videos <i>Georg Wimmer, Michael Häfner and Andreas Uhl</i>	34
Bridging the gap between classical Robot Vision and Deep Learning <i>Jean-Baptiste Weibel, Timothy Patten and Michael Zillich</i>	41
Towards ScalableFusion: Feasibility Analysis of a Mesh Based 3D Reconstruction <i>Simon Schreiberhuber, Johann Prankl and Markus Vincze</i>	47
Page Segmentation and Region Classification Based on Region Bounding Boxes <i>Thomas Lang</i>	53
The Convex-Concave Ambiguity in Perspective Shape from Shading <i>Michael Breuß, Ashkan Mansouri and Douglas Cunningham</i>	57
Contributed Session 3	64
Fast Solvers for Solving Shape Matching by Time Integration <i>Martin Bähr, Michael Breuß and Robert Dachsel</i>	65
A Study of Spectral Expansion for Shape Correspondence <i>Michael Breuß, Robert Dachsel and Laurent Hoeltgen</i>	73
Image texture classification with morphological amoeba descriptors <i>Franz Schwanninger and Martin Welk</i>	80
Depreciating Motivation and Empirical Security Analysis of Chaos-based Image and Video Encryption <i>Mario Prieshuber, Thomas Hütter, Stefan Katzenbeisser and Andreas Uhl</i>	87
Contributed Session 4	88

A Network Traffic and Player Movement Model to Improve Networking for Competitive Online Games <i>Philipp Moll, Mathias Lux, Sebastian Theuermann and Hermann Hellwagner</i>	89
Reliably Decoding Autoencoders' Latent Spaces for One-Class Learning Image Inspection Scenarios <i>Daniel Soukup and Thomas Pinetz</i>	90
Detection of bomb craters in WWII aerial images <i>Simon Brenner, Sebastian Zambanini and Robert Sablatnig</i>	94
Semi-Automatic Retrieval of Toolmark Images <i>Manuel Keglevic and Robert Sablatnig</i>	98
Contributed Session 5	102
Large Area 3D Human Pose Detection Via Stereo Reconstruction in Panoramic Cameras <i>Christoph Heindl, Thomas Pönitz, Andreas Pichler and Josef Scharinger</i>	103
Vision-based Autonomous Feeding Robot <i>Matthias Schörghuber, Marco Wallner, Roland Jung, Martin Humenberger and Margrit Gelautz</i>	111
A workflow for 3D model reconstruction from multi-view depth acquisitions of dynamic scenes <i>Christian Kapeller, Braulio Sespede, Matej Nezveda, Matthias Labschütz, Simon Flöry, Florian Seitner and Margrit Gelautz</i>	116
Globally Consistent Dense Real-Time 3D Reconstruction from RGBD Data <i>Rafael Weilharter, Fabian Schenk and Friedrich Fraundorfer</i>	120
Contributed Session 6	128
Efficient 3D Pose Estimation and 3D Model Retrieval <i>Alexander Grabner, Peter M. Roth and Vincent Lepetit</i>	129
Being lazy at labelling for pose estimation <i>Georg Poier, David Schinagl and Horst Bischof</i>	130

Preface

The Private University for Health Sciences, Medical Informatics and Technology (UMIT) and the Austrian Association for Pattern Recognition (AAPR/OAGM) welcome you at Hall/Tyrol for the 42nd Annual Workshop of the AAPR that takes place on May 15/16 at the UMIT campus.

The workshop provides a platform for presentation and discussion of research progress as well as current projects within the AAPR community. In this year's edition of the workshop, OAGM2018, we additionally focus on the theme of medical image analysis and applications of computer vision, image processing and pattern recognition in the medical context, with the aim to bring together Austrian and nearby located groups working on this topic for discussion and establishing potential collaborations.

From the vivid Austrian and international community in the field, a total of 24 full papers and application spotlight papers were submitted to the workshop. Prior to the workshop, the program committee has carefully reviewed all submissions. From the submitted papers, 19 papers were finally included in the conference program as oral or poster presentations. Two invited speakers, Prof. Marleen de Bruijne (Rotterdam/Copenhagen) and Prof. Bjoern Menze (Munich), will present keynote lectures on their research in Medical Image Analysis. The conference program is complemented by 8 featured presentations in which scientists from the AAPR community will showcase outstanding recent contributions accepted by leading international conferences and journals.

Combining all these, the final program represents an impressive cross-section of current research in the medical image analysis, pattern recognition and vision field in and around Austria. We look forward to lively discussions and scientific exchange during the conference.

Martin Welk, Martin Urschler, Peter M. Roth
Hall/Tyrol, May 2018

Workshop Chair

Martin Welk, UMIT Hall/Tyrol

Workshop Co-Chairs

Martin Urschler, Ludwig Boltzmann Institute for Clinical Forensic Imaging
Peter M. Roth, Graz University of Technology

Program Committee

Helmut Ahammer, Medical University of Graz
Reinhard Beichel, University of Iowa
Csaba Beleznai, Austrian Institute of Technology
Horst Bischof, Graz University of Technology
Kristian Bredies, Karl Franzens University of Graz
Katja Bühler, VRVis Vienna
Wilhelm Burger, FH Hagenberg
Gernot Stübl, Profactor GmbH and JKU Linz
Cornelia Fermüller, University of Maryland
Friedrich Fraundorfer, Graz University of Technology
Karl Fritscher, UMIT Hall/Tyrol
Harald Ganster, Joanneum Research Graz
Margrit Gelautz, Vienna University of Technology
Sasa Grbic, Siemens Corporate Res. Princeton
Martin Hirzer, Graz University of Technology
Bernhard Kainz, Imperial College London
Walter G. Kropatsch, Vienna Univ. of Technology
Roland Kwitt, University of Salzburg
Christoph Lampert, IST Austria
Georg Langs, Medical University of Vienna
Mathias Lux, Alpen-Adria University Klagenfurt
Klaus Maier-Hein, DKFZ Heidelberg
Hubert Mara, Heidelberg University
Bernhard Moser, SCC Hagenberg
Thomas Pock, Graz University of Technology
Hayko Riemenschneider, ETH Zürich
Robert Sablatnig, Vienna University of Technology
Josef Scharinger, JKU Linz
Konrad Schindler, ETH Zürich
Veronika Schöpf, Karl Franzens University of Graz
Rainer Schubert, UMIT Hall/Tyrol
Andreas Uhl, University of Salzburg
Markus Vincze, Vienna University of Technology
Tomaz Vrtovec, University of Ljubljana
Christian Wachinger, LMU Munich
Christopher Zach, Toshiba Research Cambridge

Awards 2017

The

OAGM Best Paper Award 2017

was awarded to the papers

Generative Adversarial Network based Synthesis for Supervised Medical Image Segmentation

by

Thomas Neff, Christian Payer, Darko Štern, and Martin Urschler

and

Using a U-Shaped Neural Network for minutiae extraction trained from refined, synthetic fingerprints

by

Thomas Pinetz, Daniel Soukup, Reinhold Huber-Mörk, and Robert Sablatnig.

The

IEEE RAS Austria Best Student Award 2017

was awarded to the paper

A Model-Based Fault Detection, Diagnosis and Repair for Autonomous Robotics systems

by

Stefan Loigge, Clemens Mühlbacher, Gerald Steinbauer, Stephan Gspandl, and Michael Reip.

Keynote Talks

Machine learning imaging biomarkers

Marleen de Bruijne¹

marleen.debruijne@erasmusmc.nl

Abstract

Quantitative analysis of medical imaging data is increasingly important in clinical studies as well as in the diagnosis, monitoring, and prognosis of disease in individual patients. Traditional techniques measure factors that are well-known to indicate disease, such as for instance the density of lung tissue, which relates to lung function, or the size of certain brain structures, which may help to predict the development of dementia. Advances in machine learning together with increased computational power now allow a new, more data-driven approach: image characteristics related to disease outcome can be learned directly from databases that combine medical imaging data with other patient data. This talk will cover different approaches to learning disease-specific models from imaging data, including techniques to address common issues in (medical) image analysis: varying scan protocols, weakly annotated data, and missing data.

¹University of Copenhagen, Denmark

Extracting and modeling information from medical images

Bjoern Menze¹

bjoern.menze@tum.de

Abstract

The computer based extraction of biomarkers that support the evaluation of clinical image data is an established field in diagnostic radiology. Recently, approaches and ideas that are described by terms, such as 'image phenotyping', 'imaging genetics', or 'radiomics', gained significant interest in the field. They all share a similar technical approach and aim at the direct inference of properties of the underlying disease grade and process using image information, replacing or complementing genetic and clinical descriptors in diagnostic decisions. Of particular relevance in their design and application is the identification of patient subgroups that may be susceptible to new targeted treatments. It is widely believed that this new generation of computational decision support tools has the potential to transform the quantitative analysis of clinical imaging data and the implementation of empirical diagnostic rules in the clinical workflow. Following the pipeline for a 'radiomics'-like information extraction, I will present recent work on medical image quantification, benchmarking of algorithms, and data-driven as well as physical-inspired modeling of the underlying disease process. A focus will be on applications from the field of oncological imaging.

¹TUM Computer Science