Lecture Notes in Computer Science 13001

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Ahmed Abdulkadir · Seyed Mostafa Kia ·
Mohamad Habes · Vinod Kumar ·
Jane Maryam Rondina · Chantal Tax ·
Thomas Wolfers (Eds.)

Machine Learning in Clinical Neuroimaging

4th International Workshop, MLCN 2021
Held in Conjunction with MICCAI 2021
Strasbourg, France, September 27, 2021
Proceedings

Springer

Editors
Ahmed Abdulkadir
University of Pennsylvania
Philadelphia, PA, USA

Mohamad Habes
The University of Texas Health Science Center at San Antonio
San Antonio, TX, USA

Jane Maryam Rondina
University College London
London, UK

Thomas Wolfers
University of Oslo
Oslo, Norway

Seyed Mostafa Kia
Donders Institute
Nijmegen, The Netherlands

Vinod Kumar
Max Planck Institute for Biological Cybernetics
Tübingen, Germany

Chantal Tax
University Medical Center Utrecht
Utrecht, The Netherlands

Cardiff University Brain Research Imaging Centre (CUBRIC)
Cardiff, UK

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-030-87585-5 ISBN 978-3-030-87586-2 (eBook)
https://doi.org/10.1007/978-3-030-87586-2

LNCS Sublibrary: SL6 – Image Processing, Computer Vision, Pattern Recognition, and Graphics

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

Methodological developments in neuroimaging analysis contribute to the progress in clinical neurosciences. In specific domains of academic image analysis, impressive strides were made thanks to modern machine learning and data analysis methods such as deep artificial neural networks. The initial success in academic applications of complex neural networks started a wave of studies through the neuroimaging research field. Deep learning is now complementing more traditional machine learning as a tool for image and data analysis. It is our view that incorporating interdisciplinary domain knowledge into the machine learning models is critical to answer challenging clinically relevant research questions in the field of clinical neuroscience that eventually will translate to clinical routine. With this workshop, we aimed at creating an intellectual playing field for clinicians and machine learning experts alike to share and discuss knowledge at the interface between machine learning and clinical application.

The 4th International Workshop on Machine Learning in Clinical Neuroimaging (MLCN 2021) was held as a satellite event of the 24th International Conference on Medical Imaging Computing and Computer-Assisted Intervention (MICCAI 2021) to foster a scientific dialog between experts in machine learning and clinical neuroimaging. The call for papers was published on April 30, 2021, and the submission window closed on July 5, 2021. Each submitted manuscript was reviewed by three members of the Program Committee in a double-blindd review process. The accepted manuscripts contained in this proceedings presented a methodologically sound, novel, and thematically fitting contribution to the field of clinical neuroimaging, and were presented and discussed by the authors at the virtual MLCN workshop. The contributions studied *in vivo* structural and functional magnetic resonance imaging data. Several accepted submissions were concerned with computational anatomy involving a wide range of methods including supervised image segmentation, registration, classification, anomaly detection, and generative modeling. Network analysis and time series were other topical branches of the workshop contributions in which a wide variety of methods were employed and developed including dictionary learning, graph neural networks, and space-time convolutional neural networks. The fields of applications were as diverse as the methods. They included detection and modeling of abnormal cortical folding patterns and simulation of brain atrophy, mapping histology to ex vivo imaging, mapping functional cortical regions, and mapping structural with functional connectivity graphs. The methodological developments pushed the boundaries of clinical neuroscience image analysis with fast algorithms for complex and accurate descriptors of structure, function, or the combination of multiple modalities.

This workshop was made possible by a devoted community of authors, Program Committee, Steering Committee, and workshop participants. We thank all creators and attendees for their valuable contributions.

September 2021

Ahmed Abdulkadir
Mohamad Habes
Seyed Mostafa Kia
Vinod Kumar
Jane Maryam Rondina
Chantal Tax
Thomas Wolfers

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